MANAV RACHNA UNIVERSITY

FACULTY OF EDUCATION & HUMANITIES

DEPARTMENT OF EDUCATION & HUMANITIES

PROGRAM STRUCTURE

&

DETAILED SYLLABUS

B.Sc. B.Ed

BATCH: 2017-2021

MANAV RACHNA UNIVERSITY

DEPARTMENT OF EDUCATION

B.Sc B.Ed (2017-2021)

SEMESTER - 1

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/Workshop/	COURSE TYPE(Core/Elective	L	T	P	O	NO. OF CONTACT HOURS PER	NO. OF CREDITS
CHH135-T	Atomic Structure and Bonding	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH135-P	Atomic Structure and Bonding Lab				0	0	2	0		
PHH121-T	Physics-I	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH121-P	Physics-I Lab				0	0	2	0		
EDH113-T	Diversity of Microbes and Thallophytes	EDU			3	0	0	0	5	
EDH113-P	Diversity of Microbes and Thallophytes Lab				0	0	2	0		
MAH145-T	Differential Calculus and Analytical Geometry (Paper - I)	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH145-P	Differential Calculus and Analytical Geometry (Paper - I) Lab				0	0	2	0		
MAH146-T	Number Theory, Theory of Equations and Matrices	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH146-P	Number Theory, Theory of Equations and Matrices Lab				0	0	2	0		
EDH114-T	Animal Diversity-I	EDU			3	0	0	0	5	
EDH114-P	Animal Diversity-I Lab				0	0	2	0		
EDH102-T	Foundation of Education	EDU	HARD	CORE	3	0	0	0	5	4
EDH102-P	Foundation of Education Lab				0	0	2	0		
EDS116	Communicative English- I	EDU	SOFT	CORE	1	0	2	0	3	2
EDW105	Critical Understanding of ICT in Education-I	EDU	WORKSHOP	CORE	0	0	3	0	3	2
CHH 137	Education for conserving Environment	CH	NTCC	UNIVERSITY COMPULSORY	3	0	0	1	3	4
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				(PCM)/16(ZE	0	13	1	33(PCM)/30(ZBC	(PCM)/24(ZE

SEMESTER - 2

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/	COURSE TYPE (Core/Elective /	L	T	P	O	NO. OF CONTACT	O. OF CREDIT
CHH136-T	States of Matter and Nuclear Chemistry	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH136-P	States of Matter and Nuclear Chemistry Lab				0	0	2	0		
PHH122-T	Elasticity, Waves, Heat and Thermodynamics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH122-P	Elasticity, Waves, Heat and Thermodynamics Lab				0	0	2	0		
EDH132-T	Bryophytes and Pteridophytes	EDU			3	0	0	0	5	
EDH132-P	Bryophytes and Pteridophytes Lab				0	0	2	0		
MAH147-T	Partial Differentiations and Integral Calculus	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH147-P	Partial Differentiations and Integral Calculus Lab				0	0	2	0		
EDH131-T	Animal Diversity-II	EDU			3	0	0	0	5	
EDH131-P	Animal Diversity-II Lab				0	0	2	0		
EDH133-T	Learner and Learning Process	EDU	HARD	CORE	3	0	0	0	5	4
EDH133-P	Learner and Learning Process Lab				0	0	2	0		
EDS134	Communicative English-II	EDU	SOFT	CORE	1	0	2	0	3	2

EDW125	Drama and Art Education	EDU	WORKSHOP	CORE	0	0	3	0	3	2
EDN 136	Project Report on Field Trip	EDU	NTCC	UNIVERSITY COMPULSORY	0	0	0	0	0	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				13	0	13	0	26	22 (PCM/ZBC)

SEMESTER - 3

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/	COURSE TYPE (Core/Elective /	L	T	P	O	NO. OF CONTACT HOURS PER	NO. OF CREDITS
CHH237-T	Organic Chemistry I	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH237-P	Organic Chemistry I Lab				0	0	2	0		
PHH226-T	Electricity and Electromagnetism	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH226-P	Electricity and Electromagnetism Lab				0	0	2	0		
EDH204-T	Gymnosperms and Reproduction in Angiosperms	EDU			3	0	0	0	5	
EDH204-P	Gymnosperms and Reproduction in Angiosperms Lab				0	0	2	0		
MAH248-T	Real Analysis	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH248-T	Real Analysis Lab				0	0	2	0		
EDH205-T	Animal Diversity-III and Comparitive Anatomy of Vertebrates	EDU			3	0	0	0	5	
EDH205-P	Animal Diversity-III and Comparitive Anatomy of Vertebrates Lab				0	0	2	0		
EDH221-T	Basics of Biophysics	EDU	HARD	CORE	3	0	0	0	5	4
EDH221-P	Basics of Biophysics Lab				0	0	2	0		
EDH206-T	Knowledge and Curriculum	EDU	HARD	CORE	3	0	0	0	5	4
EDH206-P	Knowledge and Curriculum Lab				0	0	2	0		
EDS207	Gender, school and society	EDU	SOFT	CORE	1	0	2	0	3	2
EDW208	Craft and visual arts	EDU	WORKSHOP	CORE	0	0	3	0	3	2
FLS101	Spanish-I	MRCFL	ELECTIVE	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS102	German-I									
FLS103	French-I									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				17	(PCM)/ 2 (ZB	15	0	36(PCM)/34(ZBC	24

Under Choice based Credit system, a basket of electives will b offered from which one electives will taken by the student

SEMESTER - 4

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/	COURSE TYPE (Core/Elective /	L	T	P	O	NO. OF CONTACT HOURS PER	NO. OF CREDITS
CHH238-T	Thermodynamics, Equilibrium and Solutions	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH238-P	Thermodynamics, Equilibrium and Solutions Lab				0	0	2	0		
CHH313-T	Organic Chemistry II	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH313-P	Organic Chemistry II Lab				0	0	2	0		
PHH227-T	Optics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH227-P	Optics Lab				0	0	2	0		
EDH224-T	Angiosperm Anatomy, Evolution and economic Botany	EDU			3	0	0	0	5	
EDH224-P	Angiosperm Anatomy, Evolution and economic Botany Lab				0	0	2	0		
MAH249 T	Differential Equation	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH249 T	Differential Equation Lab				0	0	2	0		

EDH225	Animal Physiology and Endocrinology	EDU	HARD	CORE	3	0	0	0	5	4
EDH225	Animal Physiology and Endocrinology Lab				0	0	2	0		
EDH122-T	Assessment For Learning	EDU	HARD	CORE	3	0	0	0	5	4
EDH122-P	Assessment For Learning Lab				0	0	2	0		
EDS227	School Organization & Management	EDU	SOFT	CORE	1	0	2	0	3	2
EDW228	Skill Lab, Robotics-Project Based Learning	EDU	WORKSHOP	CORE	0	0	3	0	3	2
MOOC-18E-EDN-205	Design Thinking- A Primer	EDU	MOOC	CORE	0	0	0	3	3	2
EDN 229	Street Play/ Skit/ Mime		Elective Workshop	CORE	1	0	2	0	3	
MOOC-18E-EDS-204	Principles of Human Resource Management	EDU	MOOC	CORE	0	0	0	3	3	2
FLS105	Spanish-II	MRCFL	ELECTIVE	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS106	German-II									
FLS107	French-II									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				18	(PCM)/3(ZBC	17	6	46(PCM)/44(ZBC	28

(EDO239) Two weeks Community Connect internship (1.5 credits)

SEMESTER - 5

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/	COURSE TYPE (Core/Elective /	L	T	P	O	NO. OF CONTACT HOURS PER	NO. OF CREDIT
CHH312-T	Transition Elements, Coordination Compounds and Chemical Kinetics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH312-P	Transition Elements, Coordination Compounds and Chemical Kinetics Lab				0	0	2	0		
PHH330-T	Basic Electronics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH330-P	Basic Electronics Lab				0	0	2	0		
EDH301-T	Plant Systematics and Angiosperm Phylogeny	EDU			3	0	0	0	5	
EDH301-P	Plant Systematics and Angiosperm Phylogeny Lab				0	0	2	0		
MAH350-T	Multivariate Calculus and Vector Calculus	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH350-P	Multivariate Calculus and Vector Calculus Lab				0	0	2	0		
EDH302-T	Ecology and Animal Behaviour	EDU			3	0	0	0	5	
EDH302	Ecology and Animal Behaviour Lab				0	0	2	0		
EDH303-T	Cell Biology and Genetics	EDU	HARD	CORE	3	0	0	0	5	4
EDH303-P	Cell Biology and Genetics Lab				0	0	2	0		
EDH214-T	Education in Contemporary India	EDU	HARD	CORE	3	0	0	0	5	4
EDH214-P	Education in Contemporary India Lab				0	0	2	0		
EDH109-T	Pedagogy of Biological Sciences	EDU	HARD	CORE ELECTIVE	3	0	0	0	5	4
EDH109-P	Pedagogy of Biological Sciences Lab				0	0	2	0		
EDH110-T	Pedagogy of Mathematics				3	0	0	0		
EDH110-P	Pedagogy of Mathematics Lab				0	0	2	0		
EDW304	Yoga & Health Education	EDU	WORKSHOP	CORE	0	0	3	0	3	1.5
EDN305	Colloquium	EDU	NTCC	CORE	0	0	0	0	0	2
EDO209	Phase I (Field Engagement)	EDU	OUTCOME	CORE	0	0	0	0	0	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				(PCM)/18(ZB	(PCM)/1(ZBC	PCM)/12(ZBC)		31 (PCM)/34 (ZBC)	(PCM)/28 (ZB

Under Choice based Credit system, a basket of electives will b offered from which two electives will taken by the student

SEMESTER - 6

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/	COURSE TYPE (Core/Elective /	L	T	P	O	NO. OF CONTACT HOURS PER	NO. OF CREDITS
CHH314-T	Electrochemistry and Photochemistry	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH314-P	Electrochemistry and Photochemistry Lab				0	0	2	0		
PHH331-T	Relativity and Quantum Mechanics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH331-P	Relativity and Quantum Mechanics Lab				0	0	2	0		
EDH310-T	Plant Physiology and Metabolism	EDU			3	0	0	0	5	
EDH310-P	Plant Physiology and Metabolism Lab				0	0	2	0		
MAH351-T	Group Theory	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH351-P	Group Theory Lab				0	0	2	0		
EDH311-T	Developmental Biology and Applied Zoology	EDU			3	0	0	0	5	
EDH311-P	Developmental Biology and Applied Zoology Lab				0	0	2	0		
PHH432-T	Atomic and Molecular Physics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH432-P	Atomic and Molecular Physics Lab				0	0	2	0		
EDH128-T	Pedagogy of Physical Sciences	EDU	HARD	CORE	3	0	0	0	5	4
EDH128-P	Pedagogy of Physical Sciences Lab				0	0	2	0		
EDS103	Creating An Inclusive Classroom	EDU	SOFT	CORE	1	0	2	0	3	2
EDW218	Critical Understanding of ICT-II	EDU	WORKSHOP	CORE	0	0	3	0	3	2
EDW104	Reading And Reflection On Texts	EDU	WORKSHOP	CORE	0	0	3	0	3	2
EDO314	Phase-II Field Engagement	EDU	OUTCOME	CORE	0	0	0	2	0	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				(PCM)/13(ZB	(PCM)/1(ZBC	PCM)/16(Z	2	40(PCM)/32(ZBC)	(PCM)/24 (ZB

SEMESTER - 7

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/	COURSE TYPE (Core/Elective /	L	T	P	O	NO. OF CONTACT HOURS PER	NO. OF CREDITS
CHH315-T	Spectroscopy, Natural Products and Heterocyclics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH315-P	Spectroscopy, Natural Products and Heterocyclics Lab				0	0	2	0		
PHH433-T	Nuclear and Solid State Physics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH433-P	Nuclear and Solid State Physics Lab				0	0	2	0		
EDH410-T	Biochemistry , Plant Tissue culture and Biotechnology	EDU	HARD	CORE	3	0	0	0	5	
EDH410-P	Biochemistry , Plant Tissue culture and Biotechnology Lab				0	0	2	0		
MAH455-T	Numerical Analysis	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH455-P	Numerical Analysis Lab				0	0	2	0		
EDH411-T	Genetics and Palentology	EDU	HARD	CORE	3	0	0	0	5	
EDH411-P	Genetics and Palentology Lab				0	0	2	0		
MAH453-T	Linear Algebra	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH453-P	Linear Algebra Lab				0	0	2	0		
EDH402-T	Molecular Biology and Immunology	EDU	HARD	CORE	3	0	0	0	5	
EDH402-P	Molecular Biology and Immunology Lab				0	0	2	0		

EDN412	Seminar	EDU	NTCC	CORE	0	0	0	2	0	2
EDS236	School leadership and Management	EDU	SOFT	ELECTIVE	1	0	2	0	3	2
MOOC-21O-EDS-402	Educational Leadership									
EDS220	Peace and Value Education									
EDS221	Guidance and Counseling									
EDS222	Human Rights in Education									
EDS 223	Environment and Education									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				13	PCM)/1(ZB	10	2	42	20

SEMESTER - 8

EDN403	Reflective Journal	EDU	NTCC	CORE	0	0	0	2	0	2
EDO404	Phase-III School Internship-Pedagogy-I	EDU	OUTCOME	CORE	0	0	0	8	0	8
EDO405	Phase-III School Internship-Pedagogy-II	EDU	OUTCOME	CORE	0	0	0	8	0	8
EDO415	Action Research	EDU	OUTCOME	CORE	0	0	0	2	0	2
EDO416	Case Study	EDU	OUTCOME	CORE	0	0	0	2	0	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				#REF!	#REF!	#REF!	22	#REF!	22

Career Development Centre Modules will be offered

**OFFERING DEPARTMENT NAMES		A course shall be assigned credits as under:
EDU	DEPARTMENT OF EDUCATION	One credit for each lecture hour; One credit for each tutorial hour ; One credit for each Outcome hour; Two credits for each workshop/ Laboratory/practical/project session of 3 hours; One credit for each Laboratory or practical or project session of 2 hours
MRCFL	MANAV RACHNA CENTRE OF FOREIGN LANGUAGES	
CH	CHEMISTRY	
	MANAGEMENT	
CS	COMPUTER SCIENCE	

*** Electives are subject to change according to expertise avaiLable/ required.

PROGRAMME BOOKLET

Bachelor of Education (B.Sc. B.Ed.) (EDU02)
(Academic Session: 2017-2021)

MANAV RACHNA UNIVERSITY

Vision

To educate students in frontier areas of knowledge enabling them to take up challenges as ethical and responsible global citizens

Mission

- To impart outcome based holistic education
- To disseminate education in frontier areas
- To produce globally competitive, ethical and socially responsible human resources
- To produce human resources sensitive to issues of Environment and Sustainable Development
- To develop Environment and Sustainable development as a thrust area of research and development.

Quality Policy

To continuously learn from the best practices, study role models and develop transparent procedures for empowerment of stakeholders.

Strategic Objectives

- To facilitate, enhance & promote innovation in curriculum design and delivery and have Outcome-oriented Learning Culture.
- To promote Research Environment and Management Practices.
- To enhance the quality of the student learning experience.
- To provide Resources and Infrastructure for Academic Excellence.

DEPARTMENT OF EDUCATION AND HUMANITIES

Vision

To nurture professionals in frontier areas of knowledge enabling them to take up challenges as ethical and responsible global citizens.

Mission

- To integrate contemporary pedagogies and skills in the teaching learning process.
- To formulate and transact research-based teacher education curriculum.
- To create a culture of grooming reflective practitioners.
- To demonstrate inclusion in deeds and action.

Vision

To nurture professionals in frontier areas of knowledge enabling them to take up challenges as ethical and responsible global citizens.

Mission

- To integrate contemporary pedagogies and skills in the teaching learning process.
- To formulate and transact research-based teacher education curriculum.
- To create a culture of grooming reflective practitioners.
- To demonstrate inclusion in deeds and action.

Bachelor of Education (B.Sc. B.Ed.) (EDU02)

Programme Educational Objectives (PEOs)

- To groom professional and humane teachers with key competencies pertinent to local and global scenario.
- To educate students to succeed in higher studies and thrust areas of research in the field of Education and other related fields.

Programme Outcomes (POs)

- Demonstrate core values: Commitment to profession; honour diversity and ensure inclusion; ethical integrity.
- Demonstrate competencies such as; Communication skills; working effectively with students and parents; drive for achieving improved student learning outcome.
- Demonstrate professional/technical knowledge of the physical, social and intellectual development of students.
- Demonstrate knowledge and understanding of: differentiating teaching to meet specific learning needs of students; both school education and teacher education-related subjects.
- Demonstrate knowledge required to design lesson plan learning sequences, implement teaching strategies using ICT, set explicit, challenging and achievable learning goals for all students.
- Demonstrate professional competencies/practice that are required to manage classroom activities by establishing and maintaining orderly and workable routines.
- Demonstrate professional competencies required to select, use and develop informal and formal, diagnostic, formative and summative assessment strategies to assess student learning, provide timely feedback to students, and participate in assessment moderation activities.
- Demonstrate competencies and actions required for keeping oneself professionally engaged independently and participate in learning to update knowledge and practice.
- Demonstrate the ability to conduct research in related thrust areas.
- Demonstrate an ability to connect with the community and provide solutions at educational, environmental, and social level.
- Demonstrate an attitude of reflection, social entrepreneurship and innovation.

PROGRAM SPECIFIC OUTCOMES

- Demonstrate the practical and theoretical understanding of core science courses: Botany/zoology/physics/chemistry/mathematics.

- Demonstrate an ability to develop inter and trans disciplinary approaches to connect with community and to provide solutions to emerging problems.
- Demonstrate bridging of the gap between academia, industry and society through field based projects and social engagements

DEPARTMENT OF EDUCATION

B.Sc. B.Ed. (2021-2025)

MANAV RACHNA UNIVERSITY

DEPARTMENT OF EDUCATION

B.Sc B.Ed (2017-2021)

SEMESTER - 1											
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/ Workshop/ NTCC)**	**COURSE TYPE(Core/Elective /University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH135-T	**Atomic Structure and Bonding**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
CHH135-P	**Atomic Structure and Bonding Lab**				**0**	**0**	**2**	**0**		
PHH121-T	**Physics-I**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
PHH121-P	**Physics-I Lab**				**0**	**0**	**2**	**0**		
EDH113-T	**Diversity of Microbes and Thallophytes**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH113-P	**Diversity of Microbes and Thallophytes Lab**				**0**	**0**	**2**	**0**		
MAH145-T	**Differential Calculus and Analytical Geometry (Paper - I)**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
MAH145-P	**Differential Calculus and Analytical Geometry (Paper - I) Lab**				**0**	**0**	**2**	**0**		
MAH146-T	**Number Theory, Theory of Equations and Matrices**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
MAH146-P	**Number Theory, Theory of Equations and Matrices Lab**				**0**	**0**	**2**	**0**		
EDH114-T	**Animal Diversity-I**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH114-P	**Animal Diversity-I Lab**				**0**	**0**	**2**	**0**		
EDH102-T	**Foundation of Education**	**EDU**	**HARD**	**CORE**	**3**	**0**	**0**	**0**	**5**	**4**

EDH102-P	**Foundation of Education Lab**				**0**	**0**	**2**	**0**		
EDS116	**Communicative English- I**	**EDU**	**SOFT**	**CORE**	**1**	**0**	**2**	**0**	**3**	**2**
EDW105	**Critical Understanding of ICT in Education-I**	**EDU**	**WORKSHOP**	**CORE**	**0**	**0**	**3**	**0**	**3**	**2**
CHH 137	**Education for Conserving Environment**	**CH**	**NTCC**	**UNIVERSITY COMPULSORY**	**3**	**0**	**0**	**1**	**3**	**4**
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**19(PCM)/ 16(ZBC)**	**0**	**13**	**1**	**33(PCM)/ 30(ZBC)**	**28 (PCM)/24 (ZBC)**

	SEMESTER - 2									
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/ Workshop/ NTCC)**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH136-T	**States of Matter and Nuclear Chemistry**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
CHH136-P	**States of Matter and Nuclear Chemistry Lab**				**0**	**0**	**2**	**0**		
PHH122-T	**Elasticity, Waves, Heat and Thermodynamics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
PHH122-P	**Elasticity, Waves, Heat and Thermodynamics Lab**				**0**	**0**	**2**	**0**		
EDH132-T	**Bryophytes and Pteridophytes**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH132-P	**Bryophytes and Pteridophytes Lab**				**0**	**0**	**2**	**0**		
MAH147-T	**Partial Differentiations and Integral Calculus**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
MAH147-P	**Partial Differentiations and Integral Calculus Lab**				**0**	**0**	**2**	**0**		
EDH131-T	**Animal Diversity-II**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH131-P	**Animal Diversity-II Lab**				**0**	**0**	**2**	**0**		
EDH133-T	**Learner and Learning Process**	**EDU**	**HARD**	**CORE**	**3**	**0**	**0**	**0**	**5**	**4**
EDH133-P	**Learner and Learning Process Lab**				**0**	**0**	**2**	**0**		
EDS134	**Communicative English-II**	**EDU**	**SOFT**	**CORE**	**1**	**0**	**2**	**0**	**3**	**2**
EDW125	**Drama and Art Education**	**EDU**	**WORKSHOP**	**CORE**	**0**	**0**	**3**	**0**	**3**	**2**

EDN 136	**Project Report on Field Trip**	**EDU**	**NTCC**	**UNIVERSITY COMPULSORY**	**0**	**0**	**0**	**0**	**0**	**2**
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**13**	**0**	**13**	**0**	**26**	**22 (PCM/ZBC)**

SEMESTER - 3										
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/ Workshop/ NTCC)**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH237-T	Organic Chemistry I	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH237-P	Organic Chemistry I Lab				0	0	2	0		
PHH226-T	Electricity and Electromagnetism	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH226-P	Electricity and Electromagnetism Lab				0	0	2	0		
EDH204-T	Gymnosperms and Reproduction in Angiosperms	EDU			3	0	0	0	5	
EDH204-P	Gymnosperms and Reproduction in Angiosperms Lab				0	0	2	0		
MAH248-T	Real Analysis	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH248-P	Real Analysis Lab				0	0	2	0		
EDH205-T	Animal Diversity-III and Comparative Anatomy of Vertebrates	EDU			3	0	0	0	5	
EDH205-P	Animal Diversity-III and Comparative Anatomy of Vertebrates Lab				0	0	2	0		
EDH221-T	Basics of Biophysics	EDU	HARD	CORE	3	0	0	0	5	4
EDH221-P	Basics of Biophysics Lab				0	0	2	0		

EDH206-T	Knowledge and Curriculum	EDU	HARD	CORE	3	0	0	0	5	4
EDH206-P	Knowledge and Curriculum Lab				0	0	2	0		
EDS207	Gender, School and Society	EDU	SOFT	CORE	1	0	2	0	3	2
EDW208	Craft and Visual arts	EDU	WORK SHOP	CORE	0	0	3	0	3	2
FLS101	Spanish-I	MRCFL	ELECTIVE	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS102	German-I									
FLS103	French-I									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				17	4(PCM)/ 2 (ZBC)	15	0	36(PCM)/ 34(ZBC)	24
	SEMESTER - 4									
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/ Workshop/ NTCC)	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH238-T	Thermodynamics, Equilibrium and Solutions	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH238-P	Thermodynamics, Equilibrium and Solutions Lab				0	0	2	0		
CHH313-T	Organic Chemistry II	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH313-P	Organic Chemistry II Lab				0	0	2	0		
PHH227-T	Optics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH227-P	Optics Lab				0	0	2	0		

EDH224-T	**Angiosperm Anatomy, Evolution and Economic Botany**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH224-P	**Angiosperm Anatomy, Evolution and Economic Botany Lab**				**0**	**0**	**2**	**0**		
MAH249 T	**Differential Equation**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
MAH249 P	**Differential Equation Lab**				**0**	**0**	**2**	**0**		
EDH225-T	**Animal Physiology and Endocrinology**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH225-P	**Animal Physiology and Endocrinology Lab**				**0**	**0**	**2**	**0**		
EDH122-T	**Assessment For Learning**	**EDU**	**HARD**	**CORE**	**3**	**0**	**0**	**0**	**5**	**4**
EDH122-P	**Assessment For Learning Lab**				**0**	**0**	**2**	**0**		
EDS227	**School Organization & Management**	**EDU**	**SOFT**	**CORE**	**1**	**0**	**2**	**0**	**3**	**2**
EDW228	**Skill Lab, Robotics-Project Based Learning**	**EDU**	**WORK SHOP**	**CORE**	**0**	**0**	**3**	**0**	**3**	**2**
MOOC-18E-EDN-205	**Design Thinking- A Primer**	**EDU**	**MOOC**	**CORE**	**0**	**0**	**0**	**3**	**3**	**2**
EDN229	**Street Play/ Skit/ Mime**		**Elective Worksh op**	**CORE**	**1**	**0**	**2**	**0**	**3**	
MOOC-18E-EDS-204	**Principles of Human Resource Management**	**EDU**	**MOOC**	**CORE**	**0**	**0**	**0**	**3**	**3**	**2**
FLS105	**Spanish-II**	**MRCFL**	**ELECTIVE**	**UNIVERSITY COMPULSORY**	**1**	**1**	**0**	**0**	**2**	**0**
FLS106	**German-II**									
FLS10	**French-II**									

7											
TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)					**18**	**5(PCM)/3 (ZBC)**	**17**	**6**	**46(PCM)/ 44(ZBC)**		**28**

(EDO239) Two weeks Community Connect internship (1.5 credits)										
SEMESTER - 5										
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard /Soft/ Workshop/ NTCC)**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH312-T	**Transition Elements, Coordination Compounds and Chemical Kinetics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
CHH312-P	**Transition Elements, Coordination Compounds and Chemical Kinetics Lab**				**0**	**0**	**2**	**0**		
PHH330-T	**Basic Electronics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
PHH330-P	**Basic Electronics Lab**				**0**	**0**	**2**	**0**		
EDH301-T	**Plant Systematics and Angiosperm Phylogeny**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH301-P	**Plant Systematics and Angiosperm Phylogeny Lab**				**0**	**0**	**2**	**0**		
MAH350-T	**Multivariate Calculus and Vector Calculus**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
MAH350-P	**Multivariate Calculus and Vector Calculus Lab**				**0**	**0**	**2**	**0**		

EDH 302-T	Ecology and Animal Behaviour	EDU			3	0	0	0	5	
EDH 302	Ecology and Animal Behaviour Lab				0	0	2	0		
EDH 303-T	Cell Biology and Genetics	EDU	HARD	CORE	3	0	0	0	5	4
EDH 303-P	Cell Biology and Genetics Lab				0	0	2	0		
EDH 214-T	Education in Contemporary India	EDU	HARD	CORE	3	0	0	0	5	4
EDH 214-P	Education in Contemporary India Lab				0	0	2	0		
EDH 109-T	Pedagogy of Biological Sciences	EDU	HARD	CORE ELECTIVE	3	0	0	0	5	4
EDH 109-P	Pedagogy of Biological Sciences Lab				0	0	2	0		
EDH 110-T	Pedagogy of Mathematics				3	0	0	0		
EDH 110-P	Pedagogy of Mathematics Lab				0	0	2	0		
EDW304	Yoga & Health Education	EDU	WORKSHOP	CORE	0	0	3	0	3	1.5
EDN 305	Colloquium	EDU	NTCC	CORE	0	0	0	0	0	2
EDO 209	Phase I (Field Engagement)	EDU	OUTCOME	CORE	0	0	0	0	0	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				15(PCM	3(PCM	10(PCM		31	24

					)/18(ZBC)	)/1(ZBC)	)/12(ZBC)		(PCM)/34 (ZBC)	(PCM)/28 (ZBC)
SEMESTER - 6										
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/Workshop/NTCC)**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH314-T	Electrochemistry and Photochemistry	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH314-P	Electrochemistry and Photochemistry Lab				0	0	2	0		
PHH331-T	Relativity and Quantum Mechanics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH331-P	Relativity and Quantum Mechanics Lab				0	0	2	0		
EDH310-T	Plant Physiology and Metabolism	EDU			3	0	0	0	5	
EDH310-P	Plant Physiology and Metabolism Lab				0	0	2	0		
MAH351-T	Group Theory	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH351-P	Group Theory Lab				0	0	2	0		
EDH	Developmental Biology and	EDU			3	0	0	0	5	

311-T	Applied Zoology									
EDH 311-P	Developmental Biology and Applied Zoology Lab				0	0	2	0		
PHH 432-T	Atomic and Molecular Physics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH 432-P	Atomic and Molecular Physics Lab				0	0	2	0		
EDH 128-T	Pedagogy of Physical Sciences	EDU	HARD	CORE	3	0	0	0	5	4
EDH 128-P	Pedagogy of Physical Sciences Lab				0	0	2	0		
EDS 103	Creating An Inclusive Classroom	EDU	SOFT	CORE	1	0	2	0	3	2
EDW218	Critical Understanding of ICT-II	EDU	WORKSHOP	CORE	0	0	3	0	3	2
EDW104	Reading And Reflection on Texts	EDU	WORKSHOP	CORE	0	0	3	0	3	2
EDO 314	Phase-II Field Engagement	EDU	OUTCOME	CORE	0	0	0	2	0	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				16(PCM)/13(ZBC)	4(PCM)/1(ZBC)	18(PCM)/16(ZBC)	2	40(PCM)/32(ZBC)	28 (PCM)/24 (ZBC)

SEMESTER - 7										
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/ Soft/ Workshop/ NTCC)**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH315-T	Spectroscopy, Natural Products and Heterocyclics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH315-P	Spectroscopy, Natural Products and Heterocyclics Lab				0	0	2	0		
PHH433-T	Nuclear and Solid-State Physics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH433-P	Nuclear and Solid-State Physics Lab				0	0	2	0		
EDH410-T	Biochemistry, Plant Tissue culture and Biotechnology	EDU	HARD	CORE	3	0	0	0	5	
EDH410-P	Biochemistry, Plant Tissue culture and Biotechnology Lab				0	0	2	0		
MAH455-T	Numerical Analysis	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH455-P	Numerical Analysis Lab				0	0	2	0		
EDH411-T	Genetics and Palentology	EDU	HARD	CORE	3	0	0	0	5	
EDH411-P	Genetics and Palentology Lab				0	0	2	0		
MAH453-T	Linear Algebra	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH453-P	Linear Algebra Lab				0	0	2	0		
EDH402-T	Molecular Biology and Immunology	EDU	HARD	CORE	3	0	0	0	5	

EDH402-P	**Molecular Biology and Immunology Lab**				**0**	**0**	**2**	**0**		
EDN412	**Seminar**	**EDU**	**NTCC**	**CORE**	**0**	**0**	**0**	**2**	**0**	**2**
EDS236	**School leadership and Management**	**EDU**	**SOFT**	**ELECTIVE**	**1**	**0**	**2**	**0**	**3**	**2**
MOOC-21O-EDS-402	**Educational Leadership**									
EDS220	**Peace and Value Education**									
EDS221	**Guidance and Counselling**									
EDS222	**Human Rights in Education**									
EDS 223	**Environment and Education**									
TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)					**13**	**4(PCM)/1(ZBC)**	**10**	**2**	**42**	**20**

SEMESTER - 8			
EDN403	**Reflective Journal**	**EDU**	**NTCC**
EDO404	**Phase-III School Internship-Pedagogy-I**	**EDU**	**OUTCOME**
EDO405	**Phase-III School Internship-Pedagogy-II**	**EDU**	**OUTCOME**
EDO415	**Action Research**	**EDU**	**OUTCOME**
EDO416	**Case Study**	**EDU**	**OUTCOME**
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)		

Total Credit Scheme

S. No.	Semester	Contact Hours	Credits
1	I	**30-33**	**24**
2	II	**26**	**22**
3	Summer Training (Post II Sem)	**26**	**22**
4	III	**34-36**	**24**
5	IV	**31-34**	**28**
6	Community Connect (Post IV Sem)	**0**	**1.5**
7	V	**29-34**	**27- 31**
8	VI	**32-40**	**24**
9	VII	**42**	**20**
10	VIII (School Internship)	**0**	**22**
Total		**203**	**191**

SEMESTER I
Detailed Syllabus
B.Sc. B.Ed. Batch (2021-25)
Semester I

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	*COURSE NATURE (Hard/Soft/ Workshop/ NTCC)	COURSE TYPE(Core/Elective /University Compulsory)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH135-T	Atomic Structure and Bonding	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH135-P	Atomic Structure and Bonding Lab				0	0	2	0		
PHH121-T	Physics-I	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH121-P	Physics-I Lab				0	0	2	0		
EDH113-T	Diversity of Microbes and Thallophytes	EDU			3	0	0	0	5	
EDH113-P	Diversity of Microbes and Thallophytes Lab				0	0	2	0		
MAH145-T	Differential Calculus and Analytical Geometry (Paper - I)	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH145-P	Differential Calculus and Analytical Geometry (Paper - I) Lab				0	0	2	0		
MAH146-T	Number Theory, Theory of Equations and Matrices	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH146-P	Number Theory, Theory of Equations and Matrices Lab				0	0	2	0		
EDH114-T	Animal Diversity-I	EDU			3	0	0	0	5	
EDH1	Animal Diversity-I Lab				0	0	2	0		

14-P										
EDH102-T	**Foundation of Education**	**EDU**	**HARD**	**CORE**	**3**	**0**	**0**	**0**	**5**	**4**
EDH102-P	**Foundation of Education Lab**				**0**	**0**	**2**	**0**		
EDS116	**Communicative English- I**	**EDU**	**SOFT**	**CORE**	**1**	**0**	**2**	**0**	**3**	**2**
EDW105	**Critical Understanding of ICT in Education-I**	**EDU**	**WORKSHOP**	**CORE**	**0**	**0**	**3**	**0**	**3**	**2**
CHH137	**Education for conserving Environment**	**CH**	**NTCC**	**UNIVERSITY COMPULSORY**	**3**	**0**	**0**	**1**	**3**	**4**
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**19(PCM)/ 16(ZBC)**	**0**	**13**	**1**	**33(PCM)/ 30(ZBC)**	**28 (PCM)/24(ZBC)**

Course Title/Code	Atomic Structure & Bonding (CHH135-T)
Course Type	Core
Course Nature	Hard
L-T-P-0 Structure	3-1-0-0
Credits	3
Course Objective	To develop an understanding of principles of atomic structure and Chemical Bonding.
Course Outcomes (COs)	
CO1	Will be able to skilled in critical thinking and reasoning for different phenomenon related to structure of atom.
CO2	Will be able to use various periodic trends having a firm foundation in the fundamentals and application of current chemical and scientific theories.
CO3	Able to develop confidence for self-education and long learning w.r.t. properties of elements
CO4	Able to evaluate and solve chemical problems involving the features of chemical bonding.
CO5	Able to analyze concept and application of MOT and participate and succeed in competitive exams.
Prerequisites	Intermediate Chemistry

SECTION A

ATOMIC STRUCTURE

Discuss the processes on an atomic scale and show how the familiar concepts of classical mechanics have their basis in quantum theory. List the Characteristics of Black-body radiation, heat capacity of solids, Compton effect and explain how quantum theory accounts for them. Bohr's model of hydrogen atom and its limitations, significance of Ψ and Ψ^2, postulates of quantum mechanics, particle in one dimensional box. Radial wave functions, angular wave functions. Quantum numbers and their importance, atomic orbitals and shapes of s, p, d orbitals , Multi-electron atoms , Aufbau and Pauli exclusion principles and Hund's multiplicity rule- Electronic configurations of the elements, effective nuclear charge. Slaters' rule, Energy level diagram for multi –electron atoms.

SECTION B

PERIODIC PROPERTIES AND S AND P-BLOCK ELEMENTS

Periodic table as an expression of regularity as a basis for organising information. Atomic radius, Covalent, ionic and Vander waal radii-explanation

with examples. 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.Factors influencing ionization energy in a group and a period. Electronegativity – Variation in a group and a period, Relationship between Electronegativity, Ionisation Energy and Electron Affinity. Pauling Scale of Electronegativity.

Comparative study of s-Block Elements, diagonal relationships, an introduction to alkyls and aryls –salient features of hydrides, Action of Liquid Ammonia , Properties of solutions of alkali metals in Liquid Ammonia, Anomalous properties of Lithium and Beryllium,.

To appreciate the wide variety in Physical and Chemical characteristics of p-Block elements and their compounds. Comparative study (including diagonal relationships) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16

SECTION C

CHEMICAL BONDING I

Chemical bond as a basis for predicting the properties which should be expected for a given chemical substance. Ionic Solids – Ionic structures, radius ratio effect 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, valence bond and band theories. Weak interactions – Hydrogen bonding, van der Waals forces. 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. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3, ICl_2, and H_2O.

SECTION D

MOLECULAR ORBITAL THEORY, BORANES AND XENON COMPOUNDS

Approaches to understand the properties and stabilities of molecules as viewed by different theories of bonding. Molecular orbital theory, basic ideas – criteria for forming M.O. from A.O., construction of M.O's by LCAO – H^+_2 ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ^*, Π, Π^* orbitals and their characteristics. Hybrid orbitals – sp, sp^2, sp^3; calculation of coefficients of A.O.s used in these hybrid orbitals. Introduction to valence bond model of H_2, comparison of M.O. and V.B. 3

Discussion about homonuclear (He_2, N_2, O_2, F_2, C_2) and heteronuclear (CO and NO) diatomic molecules, bond Order and bond energy, percentage ionic character from dipole moment and electronegativity difference.

References

University Chemistry: Bruce Mahan
Concise Inorganic Chemistry: J D Lee
An Introduction to Inorganic Chemistry: Mackay and Macka

Course Title/Code	Atomic Structure & Bonding Lab (CHH135-P)
Course Type	Core
Course Nature	Hard
L-T-P-0 Structure	0-0-2-0
Credits	1
Course Objective	To enable students to analyze water samples, perform acid-base titrations and learn concepts of organic synthesis along with their determination using some spectroscopic techniques.
Course Outcomes (COs)	
CO1	Learn to run simulation experiment to understand the physical and chemical parameters determination for water
CO2	To develop understanding of Acid Base titration
CO3	To analyze the concept behind the formation of some organic compounds.
CO4	To familiarize students with various spectroscopic instruments, their principle and applications like UV-VIS, IR, NMR and fluoresecence spectroscopy.
Prerequisites	Intermediate Chemistry

TITRATIONS

1. Estimation of Sodium Carbonate and Sodium Bicarbonate in a mixture.
2. Estimation of Ammonia in Ammonium Salt by Back Titration.
3. Estimation of Ferrous ions using Potassium Permanganate
4. Estimation of Oxalic acid using Potassium Permanganate
5. Estimation of Ferrous ions Using Potassium Dichromate with Internal & External Indicators.
6. Standardisation of Sodium Thiosulphate using Potassium Dichromate and estimation of Iodine.
7. Estimation of Copper in a Copper salt by Iodimetry

8. Standardisation of EDTA solution using Zinc Sulphate and determination of Mg or Ca

9. Standardization of EDTA and estimating the hardness of water.

10. Determination of Alkali content of antacids.

Reference :

1.A Text Book of Quantitative Inorganic Analysis, A I Vogel

Course Title/Code	Physics-1 (PHH121-T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	**3-1-0-0**
Credits	**3**
Course Objective	To enable students to understand Newtonian mechanics and apply Newton's laws to explain natural physical phenomena
Course Outcomes (COs)	
CO1	Students would be able to understand, explain and demonstrate fundamentals of dynamics of a particle/system of particles and apply work and energy concepts to daily life problems
CO2	Students would be able to understand, analyze concept of collisions and hence would be able to evaluate and apply conservation laws on various physical systems
CO3	Students would be able to explain and analyze the concepts of central force motion and gravitation and hence apply them on planetary problems and solve and hypothesize problems related to central forces
CO4	Students would be able to explain and analyze rotational dynamics. They would also be able to formulate and construct a solution pertaining to it
Prerequisites (if any)	

SECTION A

Particle dynamics, work and energy

Particle dynamics (review), Newton's First, Second and Third Law of Motion, Newton's I Law as a basic kinematical law defining a frame of reference, Newton's II Law as a basic dynamical law of mechanics and Newton's III law as an interaction law, Frames of reference, inertial and non-inertial, pseudo forces, Force laws, weight and mass, static procedure for measuring forces, Application of Newton's law, free body diagrams representing forces on the body and frictional forces. Discussion of importance of friction in daily life.

Work and Energy: Work done by a constant force and by a variable force–one and two dimensional cases. Kinetic energy and work-

energy theorem and its Significance, The importance of language in Physics to be highlighted by differentiating the meaning of 'work', 'power', 'energy' as defined in Physics and in daily life.

SECTION B

Conservation Laws and collisions

Conservation Laws: Introduction, conservative forces, potential energy, complete solution for one, two and three dimensional systems, non-conservative forces, conservation of energy, conservation of energy to be seen as a spreading out and appearing in different forms, mass and energy.

Conservation of Linear Momentum: Centre of mass, motion of the center of mass, linear momentum of a particle, linear momentum of a system of particles, conservation of linear momentum, some applications of momentum principle, systems having variable mass – Rocket equation.

Collisions: Definition and types of collisions. Impulse and momentum, conservation of momentum during collisions, collision in one and two dimensions. Illustration with examples of collisions during accidents and collisions at atomic and sub-atomic level.

SECTION C

Gravitation and central forces

Gravitation*:* Historical Introduction, Newton's law of Universal Gravitation, inertial and gravitational mass, variation in acceleration due to gravity with altitude and depth, motion of planets and satellites, gravitational field and potential, gravitational potential energy, potential energy for many particle systems, calculations of field and potential for (a) a spherical shell, (b) a sphere, energy consideration in the motion of planets and satellites.

Central Force: Kepler's laws of planetary motion, the inverse square law, Derivation of Kepler's Law from Universal law of Gravitation.

SECTION D

Rotational Kinematics

Rotational variables, angular velocity, angular acceleration. Rotation with constant angular acceleration, Linear and angular variables, kinetic energy of rotation, rotational inertia, calculation of rotational inertia – of a rod, sphere and cylinder, torque, Newton's laws of

rotation, work, power and work – kinetic energy theorem.

References

Fundamentals of Physics, 6th Edition, David Halliday, Robert Resnick and Jearl Walker, John Wiley and Sons Inc.
University Physics, Revised Edition, Harris Benson, John Wiley and Sons, Inc.

Course Title/Code	Physics-1 (PHH121-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	**0-0-2-0**
Credits	**1**
Course Objective	To provide training in the broad methodology of science through investigatory type and open-ended Laboratory exercises.
Course Outcomes (COs)	
CO1	Students would be able to demonstrate an ability to conduct investigations of practical/technical issues consistent with their level of knowledge and understanding
CO2	Demonstrate an ability to analyze data and reach a valid conclusion.
CO3	Designing/performing/resolving the experiments to develop their individual capabilities and representing the collective team work.
Prerequisites (if any)	

A minimum of TEN experiments out of the following:

1. Study of the rate of flow of water through a capillary tube under different pressure heads.
2. Study of the motion of an air bubble.
3. To study the relation between force and extension produced in a stretched spring.
4. To study the relation between length and time period of a simple pendulum.
5. Study of the motion of a freely falling body.
6. Study of the dependence of the period of oscillation of a spring-mass system on mass.
7. Study of the acceleration of a body subjected to different unbalanced forces.
8. Study of accelerations of different masses under a constant unbalanced force.
9. Study of conservation of energy and momentum in head-on-collision between two spheres of equal mass.
10. Study of conservation of momentum and energy of a collision in a plane.
11. Conservation of momentum in an explosion.
12. Study of the relation between pressure and volume of a gas at constant temperature.

References

1. PSSC Physics Laboratory Guide.
2.Practical Physics, E Armitage, John Murray.

Course Title/Code	**Diversity of Microbes and Thallophytes (EDH113-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	**(3-0-0-0)**
Credits	**3**
Course Objective	After going through this course, the learner will be able to develop an understanding of the diversity and classification of living organisms
Course Outcomes (COs)	
CO1	Understand the basis and principles of classification of living organisms
CO2	Understand the diversity that exists in microorganisms
CO3	Understand the organization, morphological features and various modes of reproduction in Viruses,Bacteria, Algae and Fungi
CO4	Understand the structural diversity in Lichens and their ecological and economic importance
CO5	Understand the various role played by microorganisms in human welfare and would be able to identify some of the diseases caused by microorganisms and study their symptoms
Prerequisites (if any)	----------

SECTION A

Classification of living organisms ,Brief history, discovery, characteristics, structure, mode of nutrition, reproduction: Bacteriophages, Viruses, Prions (Special mention: Chronic Wasting Disease, Bovine Spongiform Encephalopathy, Yellow Mosaic of Bean, Human Immunodeficiency Virus) ,Brief history, discovery, characteristics, structure, classification based on morphology and flagellation, mode of nutrition and reproduction: Bacteria, Mycoplasma, Cyanobacterium (Special mention:*Xanthomonascitri*, *Clostridium botulinum, Rickettsiae, Sandal spike phytoplasma, Spirullina, Nostoc, Oscillatoria*)

SECTION B

Brief classification of Thallophytes General account, classification (Fritsch), occurrence,thallus organisation, reproduction and life cycle: Algae- Chlorophyceae (*Oedogonium, Chara*), Xanthophyceae (*Vaucharia*), Phaeophyceae (*Sargassam*), Rhodhophyceae (*Polysiphonia*), Bacillariophyceae (Pinnate diatoms)

SECTION C

General account, classification (Alexopoulos and Mims), occurrence, thallus organisation, reproduction and life cycle: Fungi-Myxomycetes (*Stemonites*),

Phycomycetes (*Albugo*), Ascomycetes (Yeast, *Penicillium*), Basidiomycetes (*Puccinia, Agaricus*), Deuteromycetes (*Cercospora, Collectotrichum*)

SECTION D

a) General account, distribution, types, structure, reproduction, ecological and economic importance: Lichens (Crustose, Foliose, Fruticose)

b) Role of microorganisms in human welfare with respect to Environment, Agriculture, Pharmaceuticals and Industry.

References Books and Readings:

1. Alexopoulos.C.J. *Introductory Mycology.*
2. Chopra.*A Class book of Fungi*. Jullandar: S.Nagin& Co.
3. Dubey H.D. *A Text book of Fungi, Bacteria and Viruses.*
4. Kumar, H.D., *A Textbook of Algae.*
5. Pandey, B.P.*A Text book of Algae*.New Delhi:Sultanchand& Co.
6. Sharma, P.D. (2005).*The Fungi*.Meerut: Rastogi Publications.
7. Sharma, O.P. (1992).*Text book of Thallophytes*, New Delhi: TMH Publishing House.
8. Singh,V., Pande,P.C. &Jain,D.K.(2006). *A Text book of Botany*. Meerut:Rastogi Publications.
9. Singh,V., Pande,P.C. &Jain,D.K. (2007). *Diversity of Microbes and Cryptogams*. Meerut:.Rastogi Publications.
10. Smith, G.M.(1971). *Cryptogamic Botany Vol.I, Algae & Fungi*. New Delhi: TMH Publishing Co.

Course Title/Code	Diversity of Microbes and Thallophytes Lab (EDH113-P)
Course Type	Core
Course Nature	Hard
L-T-P Structure	(0-0-2-0)
Credits	1
Course Objective	To develop the skill of preparing bacterial cultures and identifying diseases caused by microorganisms based on their symptoms.
Course Outcomes (COs)	
CO1	To enable students to develop the skills of staining and mounting microbes.
CO2	To enable students to develop the skill of preparing bacterial cultures
CO3	To develop in the students skill of identifying diseases caused by microorganisms based on their symptoms.
CO4	To develop the skill of observing and identifying microbes using temporary and permanent slides.
Prerequisites (if any)	------

- Observation of disease symptoms in hosts infected by virus, mycoplasma and bacteria.
- Gram staining of bacteria.
- Preparation of bacterial media and culture of bacteria.

- Study of genera included in theory under Cyanobacteria, algae and fungi by making temporary micropreparations and using permanent slides.

Course Title/Code	**DIFFERENTIAL CALCULUS AND ANALYTICAL GEOMETRY (MAH 145 T)**
Course Type	Core
Course Nature	Hard
L-T-P Structure	(1-0-2-0)
Credits	1
Course Objective	To develop the skill of preparing bacterial cultures and identifying diseases caused by microorganisms based on their symptoms.
Course Outcomes (COs)	
CO1	To enable students to develop the skills of staining and mounting microbes.
CO2	To enable students to develop the skill of preparing bacterial cultures
CO3	To develop in the student's skill of identifying diseases caused by microorganisms based on their symptoms.
CO4	To develop the skill of observing and identifying microbes using temporary and permanent slides.
Prerequisites (if any)	------

Unit I: Continuity and Differentiation – I: Limits, one-sided limits, Infinite limits and limits at infinity, Continuous functions, Discontinuous functions, Continuity theorems, Uniform continuity. Differentiation, Linear approximation theorem, Higher derivatives, Leibnitz's theorem. Monotone functions, Maxima and Minima, Concavity, Convexity and Points of inflection.

Unit II: Differentiation – II: Polar coordinates, angle between the radius vector and the tangent at a point on a curve, angle of intersection between two curves. Differentiability theorems, Rolle's theorem, Lagrange's Mean Value theorem, Cauchy's Mean Value Theorem, Taylor's theorem, Maclaurin's theorem, Generalised Mean Value theorem, Taylor's Infinite series and power series expansions, Maclaurin's infinite series, Indeterminate forms.

Unit III: Analytical Geometry – I

Cartesian coordinates in three dimensional spaces, Relation between Cartesian coordinates and position vector, Distance formula (Cartesian and Vector form), Direction cosines, Direction ratios, Projection on a Straight line, angle between two lines, Area of Triangle, Volume of a tetrahedron. Straight line, equations and straight lines (Cartesian and Vector form.

Unit IV: Analytical Geometry – II

Planes, Equations of Planes (Cartesian and Vector form), Normal form, Angle between planes, Coaxial planes, Parallel and Perpendicular planes, Length of a Perpendicular from a point to a plane, Bisectors of angles between two planes, Mutual, Position of lines and planes, shortest distance between two skew lines.

Translation and Rotation of Cartesian axes in plane, Curves of second degree, Discriminant and Trace, Theorem on Discriminant and trace, Generalisation of second degree in two variables represents either empty set or a point or a line or a pair of lines or a parabola or an ellipse or a hyperbola.

References :

1. Calculus by Anton, Addison-Wiley.
2. Calculus with Analytical Geometry by S K Stein, McGraw Hill.
3. Calculus and Analytical Geometry, Thomas and Finney, S.Chand and Co. Ltd.
4. First Course in Calculus, Serge Lang, Addison-Wiley
5. Calculus by LipmanBers, Vols. 1 and 2, IBH.
6. Advanced Calculus, Frank Ayres, Schaum Publishing Co.
7. Higher Algebra by Bamard and Child, MacMillan India Ltd.
8. Integral Calculus by Shanthinarayan, S.Chand and Co.Ltd.
9. Differential Calculus by Gorakhprasad, Pothishala Ltd.
10. Elements of Analytical Solid Geometry by Shanthinarayan

11. Calculus and Analytical Geometry by Thomas – Finney, Narosa Publishing House.
12. Introduction to Calculus and Analytical Geometry by Courant and John.
13. The Calculus with Analytical Geometry (5^{th} Edition) by Louis Leithold, Harper International.
14. Analytical Geometry (Three Dimensions) by T K ManicavachagamPillay and T Natarajan, S.Vishwanath and Co.
15. Elements of Vector Algebra and Analytical Geometry by Kanthi Kumar Varma.
16. Analytical Geometry by P K Mittal.
17. Analytical Geometry of two and Three Dimensions and Vector Analysis by R M Khan.
18. Solid Geometry by M L Khanna, Jaic

Course Title/Code	Differential Calculus and Analytical Geometry Lab (MAH145-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	0-0-2-0
Credits	1
Course Objective	To develop the practical skills to apply the concept of application derivatives to find solution of related Problems
Course Outcomes (COs)	
CO1	Understand & apply the concept of application derivatives to find solution of related Problems
CO2	Explain and solve problem based on differentiability theorems and their applications
Prerequisites (if any)	N.A

1) Introduction to Octave /Matlab
2) Introduction to Graphs(2D graphs)
3) Introduction to Graphs(3D graphs)
4) Differential Calculus using Octave
5) Differential Calculus :Eulers Theorem & derivative of Composite Function
6) To get the condition for general equation to represent a pair of lines

7) To get the condition for general equation to represent parabola, Ellipse & Hyperbola

8) Area of triangle, Volume of tetrahedral

9) Length of the perpendicular from a point to the plane.

10) To find the angle between pair of lines represented by generalized second degree equations

Reference Books:

1. Calculus by Anton, Addison-Wiley.
2. Calculus with Analytical Geometry by S K Stein, McGraw Hill.
3. Calculus and Analytical Geometry, Thomas and Finney, S.Chand and Co. Ltd.
4. First Course in Calculus, Serge Lang, Addison-Wiley

Course Title/Code	NUMBER THEORY, THEORY OF EQUATIONS AND MATRICES Lab (MAH 146-T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	3-0-2-0
Credits	4
Course Objective	To analyze the concept of Eigen value's and eigen vectors and their properties.
Course Outcomes (COs)	.
CO1	To apply the concept of numbers system for higher level
CO2	To prove results involving divisibility and greatest common divisors;
Prerequisites (if any)	N.A

Unit I: Theory of Numbers

Division Algorithm – Prime and Composite Numbers – proving the existence and uniqueness of GCD and the Euclidean Algorithm – fundamental theorem of Arithmetic - the least common multiple – congruences – linear congruences – Wilson's theorem – Simultaneous congruences – Theorem of Euler – Fermat and Lagrange.

Unit II : Theory of Equations

Relation between roots and coefficients, Symmetric functions, Transformations,

Reciprocal equations, Descarte's rule of signs, Multiple roots, Solving cubicequations by Cardon's method, Solving quartic equations by Descarte's method and Ferrari's method.

Unit III: Matrices – I

Matrices of order mXn, Algebra of matrices, Symmetric and Skew Symmetric, Hermitian and Skew Hermitian matrices and their standard properties, Determinants Adjoint of a square matrix, Singular and non-singular matrices, Rank of a matrix, Elementary row / column operations, Invariance of rank under elementary operations, Inverse of a non-singular matrix by elementary operations.

Unit IV : Matrices - II

System of m-linear equations in n-unknowns, Matrices associated with linear equations, Trivial and non-trivial solutions, Criterion for existence of non-trivial solution of homogeneous and non-homogeneous systems, Criterion for uniqueness of solutions.

Eigen values and Eigen vectors of a square matrix, Characteristic equation of a square matrix, Eigen values and Eigen vectors of a real symmetric matrix properties, Diagonalisation of a real symmetric matrix, Cayley – Hamilton theorem, Applications to determine the powers of square matrices and Inverse of non-singular matrices.

References :

Elementary Number Theory by David M. Burton.
Algebra by Natarajan, Manicavachagon Pillay and Ganapathy, S. Vishwanath Pvt. Ltd.
Theory of Equations by Uspensky, McGraw Hill Book Co. Ltd.
Matrices by Frank Ayres, Schaum Publishing Co.
Textbook of Matrix Algebra by Suddhendu Biswas.

Course Title/Code	NUMBER THEORY, THEORY OF EQUATIONS AND MATRICES Lab (MAH 146-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	2-0-1-0
Credits	4
Course Objective	To analyze the concept of Eigen value's and eigen vectors and their properties.
Course Outcomes (COs)	
CO1	To apply the concept of rank to solve system of equation.
CO2	To analyze the concept of Eigen value's and eigen vectors and their properties.
Prerequisites (if any)	N.A

LAB EXERCISES

1. To study the divisibility of integers.

2. Operate on prime numbers, check and prove primality.

3. Factorization of integers, verification of factorization algorithms.

4. To find Quotients and remainders, primitive roots, orders of residue classes, Euler's quotient function.

5. Solve linear congruences, compute modular roots.

6. To develop and study Bernoulli, Fibonacci, Mersenne, and other sequences of numbers.

7. To verify Euler phi, Carmichael, Moebius, and other number theoretic functions.

8. ASCII encoding and decoding, continued fraction expansion.

9. To find the Rank of a matrix, Inverse of a Square matrix and to reduce a matrix into Normal Form.

10 To solve the system of simultaneous linear equations.

11 To find the Eigen values and Eigenvectors of a square matrix.

RECOMMENDED BOOKS

1. Elementary Number Theory and its applications, 5th edition, by Kenneth H. Rosen.

2. Elementary Number Theory by D. Burton

Course Title/Code	**Animal Diversity-I (EDH114-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	To enable students to understand invertebrates, the organizational hierarchies and complexities; the evolutionary trends in external morphology and internal structure; identification and classification with examples; to enable them to understand various modes of adaptations in animals.
Course Outcomes (COs)	
CO1	Explain the basis and principles of classification of living organisms
CO2	Evaluate and understand the diversity that exists in Protozoa and Porifera
CO3	Remember the organization, morphological features and various modes of reproduction in Cnidaria and Acnidaria
CO4	Explain the morphology and various mode of reproduction in Helminthes.
CO5	Able to identify some of the diseases caused by Helminthes and study their symptoms
CO6	Analyse and understand the diversity of phylum Annelida
Prerequisites (if any)	Basic knowledge of animal kingdom

SECTION A

ANIMAL CLASSIFICATION, PROTOZOA AND PORIFERA

Principles of classification: Binomial nomenclature and outline classification of animal kingdom.
Protozoa: General characters and classification of Phylum Protozoa up to orders with examples; Type study: Plasmodium– External morphology, lifecycle and pathogenicity; Nutrition in Protozoa – Holozoic, holophytic, saprozoic and parasitic nutrition; Locomotion in Protozoa – Locomotor organelles and types of movement; Reproduction in Protozoa: Asexual – fission, budding, sporulation; Sexual – conjugation (amphimixis), syngamy and autogamy.Porifera: General characters affinities and classification of Phylum Porifera up to orders with examples; Type study: Sycon – External morphology and cellular organization; Skeletal system in sponges; Canal system – Ascon, sycon and leucon types; Reproduction in sponges: Budding and gemmule formation, lifecycle with reference to Amphiblastula and Parenchymal larvae.

SECTION B

CNIDARIA AND ACNIDARIA

Cnidaria: General characters and classification of Phylum Cnidaria up to orders with examples; Type study: Obelia– External morphology, metagenesis and lifecycle Mesenteries in Metridium; Polymorphism in Cnidaria ; Corals andcoral reefs, their types, formation, theories and importance.
Acnidaria (Ctenophora): General characters and classification of Phylum Acnidaria up to orders with examples ; Type study – Pleurobrachia, Affinities of Acnidaria.

SECTION C

HELMINTHES – PLATYHELMINTHES AND NEMATHELMINTHES

Platyhelminthes: General characters and classification of Phylum Platyhelminthes up to orders with examples; Type study: Fasciola hepatica– External morphology, digestive system, excretory system and reproductive system – asexual, sexual and regeneration .
Nemathelminthes: General characters and classification of Phylum Nemathelminthes up to orders with examples; Type study: Ascaris– External morphology, digestive system, excretory system, reproductive system and life-cycle.
Mode of infection and pathogenicity of i) Fasciola hepatica, ii) Taeniasolium,iii) Ancylostomaduodenale, iv) Trichinellaspirallis (2); Host parasite relationship and parasitic adaptation in Helminthes

SECTION D

ANNELIDA

General characters and classification of Phylum Annelida up to orders with examples; Type study: Pheretima– External morphology, coelom, locomotion, digestive system, blood vascular system, excretory system, reproductive system, life-history and regeneration; Comparative study of a) digestive system, b) coelomoduct and nephredia in Pheretima, Nereisand Hirudinaria); Trochopore larva; metamerism in Annelida.

References Books and Readings:

1. Modern Textbook of Zoology Invertebrates by R.L. Kotpal – (Rastogi Publications, Meerut, 10th Revised Edition).
2. Invertebrate Zoology series (Protozoa to Echinodermata) by R.L. Kotpal –(Rastogi Publications, Meerut).
3. Invertebrate Zoology by E.L.Jordon and P.S. Verma – S. Chand & Co., Delhi).
4. Invertebrate Zoology by J.K. Dhami and P.S. Dhami – S. Chand & Co., Delhi).
5. A Textbook of Invertebrate Zoology by S.N. Prasad – (Kitab Mahal, Allahabad).
6. Life of Invertebrates by Russel and Hunter – (Macmillan)
7. The invertebrate series of L.H.Hyman – (McGraw Hill)
8. A student's textbook of Zoology by Adam Sedgwick Vol. I, II & III – (Central Book Depot, Allahabad).
9. A Text book of Zoology vol.1 by Parkar and Haswell – (Macmillan)

Course Title/Code	ANIMAL DIVERSITY -I Lab (EDH114-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To develop in students the skills; of staining and mounting of materials (temporary and permanent); of dissection, display and Labelling; of preparation of cultures of invertebrates by using common culture methods; of Laboratory observation of animals
Course Outcomes (COs)	
CO1	To familiarize the students with the basic knowledge and working of microscope
CO2	To develop in the students the ability to spot the specimens of various organisms belonging to different phyla
CO3	To study the permanent slides of the lower invertebrate phyla
CO4	To prepare the temporary mount slides of amoeba and paramecium
Prerequisites (if any)	-----

1. Study of microscopes: Simple and compound, handling of microscopes.
2. Study of permanent slides of Protozoa, Amoeba, Entamoeba, Euglena, Paramecium, Giardia and Plasmodium
3. Study of specimens and permanent slides of Porifera: Sycon, Spongilla, Euplectella, Sponge spicules of various types and Spongin fibres. Sponge gemmule h) T.S. Sycon i) L.S. of Sycon.
4. Preparation of permanent and stained slides:a) Sponge spicules b) Sponge gemmules.

5. Study of specimens of Cnidaria: Physalis, Porpita, Valella, Pennatula, Alcyonium , Madrepora, Meandrina, Astreaj and Gorgonia.
6. Study of permanent slides of Cnidaria: Hydra, Obeliacolony, Obeliamedusa, Tubulariae, Pennaria, Metridium(T.S. of Meridiam) Aurelia, Ephyra larva.
7. Preparation of permanent and stained slide of Obeliacolony.
8. Study of specimens of Helminthes: Dugesiab) Fasciolac) Taeniasoliumd) Ascarise) Enterobiusf) Ancylostomag) Trichinella.
9. Study of permanent slides of Helminthes- a) Cercaria of fasciola b) Redia of Fasciola c) Miracidium of Fasciola.
10. Dissection of Pheretima (Study of dissected specimens)a) Digestive system b) Nervous system c) Reproductive system.
11. Study of specimens of Annelida: a) Pheretimab) Nereisc) Heteronereisd) Hirudinariae) Aphroditef) Sipunculus
12. Study of permanent slides of Annelida: a) T.S. of Pheretima b) T.S. of Nereis c) T.S. of Hirudinaria d) Parapodium of Nereis. E) trochophore larva of leech.
13. Preparation of permanent and stained slides:*a) Nereis*parapodia b) Jaws of Leech c) Nephredia of Leech

Field Visit- Any national park/ sanctuary/ biosphere reserve / botanical garden.

Course Title/Code	Foundations of Education (EDH102-T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-OStructure	**3-0-2-0**
Credits	**3**
Course Objective	To orient the students about the philosophical and sociological foundation of Education
Course Outcomes (COs)	
CO1	Assimilate the concept of Education and Its philosophical aspects
CO2	Comprehend the Socio-Cultural aspect of Education
CO3	Discuss the Inter-disciplinary nature of Education
CO4	Analyze the contribution of various Indian and western Educationists to Indian Education System
CO5	Reflect on the Educational concerns and Issues in the Indian context
Prerequisites (if any)	NA

SECTION A

BASICS OF EDUCATION AND PHILOSOPHY

Education: Concept, meaning, aims and functions of education, Critical understanding of various related terms: Training, Instruction, Teaching and Indoctrination, Education as a discipline and its interdisciplinary nature, Role of Education in promotion of Culture and value inculcation.Introduction to philosophy with special reference to its branches, Relation between
Education and Philosophy, Nature and Scope of Educational Philosophy

SECTION B

EDUCATIONAL THOUGHTS AND THEIR IMPLICATIONS

Contribution of following thinkers with respect to meaning of education, aims, curriculum development and techniques of maintaining discipline in present scenario. Indian Educationists: Mahatma Gandhi, Rabindranath Tagore, Swami Vivekananda, Jiddu Krishnamurthy and Dr. B.R Ambedkar. Western Educationists: Plato, Rousseau, John Dewey, and Paulo Frieri

SECTION C

EDUCATION AND SOCIETY

Relation between Education and Society, Education as an agent of Social Change, Education and Culture, Socio-cultural influences of Globalization on Education, Socialization of child and social agencies of education, Constitutional values and Education

SECTION D

NATIONAL CONCERNS IN EDUCATION

Equalization of Education Opportunities- Accessibility, Affordability and Equality to all. Constitutional Provisions for ensuring equity and equality in Education-with special reference to Right to Education (RTE).Education and Gender Equality, Nature of Democracy and its implications, Secularism and Religious Pluralism, National and Emotional Integration in Indian context.

Reference Book and Readings

1. Anand, C L and et al (1993). *Teacher and Education in the Emerging Indian Society*. New Delhi: NCERT.
2. Bhatia, K. & Bhatia, B.(1974) *The Philosophical and Sociological Foundations of Education*. Delhi: Doaba House.
3. Delors, Jacques (1996). *Learning the Treasure Within*. Report to UNESCO of the International Commission on Education for the Twenty-first Century. UNESCO.
4. Dewey J (1966). *Democracy in Education*, New York: Macmillan.
5. Gandhi M K (1956). *Basic Education*. Ahmedabad, Navajivan.

6. Goel, A. & Goel S.L. (2005). *Human values and Education*. New Delhi: Deep and Deep Publications Pvt. Ltd.
7. Govt. of India (1952). *Report of the Secondary Education Commission*. New Delhi.
1. Govt. of India. MHRD (1986, Revised 1992) *National Policy of Education*, New Delhi.
2. NCERT (2014*). Basics of Education*. NCERT: Publication Division.
3. R. S. Peters (Ed.) (1967) *The concept of education*. London: Routledge & Kegan Paul.
4. Rajput, J.S. (2006). *Human Values and Education*. New Delhi: Pragun Publications.
5. Saraswathi T S (1999). *Culture, Socialization and Human Development*. Sage Publication.
6. Sharma, A. P. (2010). *Indian and Western Educational Philosophy*. New Delhi: Unicorn Books.
7. Walia, J.S. (2011). *Philosophical, Sociological and Economic Bases of Education.*
8. Jalandhar: Ahim Paul Publishers.

Course Title/Code	Foundations of Education Lab (EDH102-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To orient the students about the philosophical and sociological foundation of Education
Course Outcomes (COs)	
CO1	Apply the philosophical understanding of Education into the real classroom situation
CO2	Reflect upon the Socio Cultural aspect of Education through practical activities
CO3	Appreciate the contribution of various Indian and western Educationists in shaping the Indian Education System with reference to the present scenario
Prerequisites (if any)	NA

1. Report writing based on visits made to schools practicing innovative philosophies in areas of education like inclusive education, gender sensitization, secularism and any other crucial area.
2. A Survey regarding ground realities of implementation of the provisions of RTE in any one school in the neighbourhood.

3. Group discussions on any suitable topics concerning contemporary society like aggression among youth, misuse of democracy, implications of secularism etc. and to reflect upon different viewpoints.
4. Organization of and participation in street plays /dramas/ declamation/ debates/ any other suitable activity on any theme of Philosophical perspectives of Socio-Political scenario in India.
5. Preparation of quotation boards to display quotes of great philosophers in the college premises.
6. Any other suitable activity

Reference Book and Readings

1. Govt. of India. MHRD (1986, Revised 1992) *National Policy of Education,* New Delhi.
2. NCERT (2014*). Basics of Education*. NCERT: Publication Division.
3. R. S. Peters (Ed.) (1967) *The concept of education*. London: Routledge & Kegan Paul.
4. Rajput, J.S. (2006). *Human Values and Education*. New Delhi: Pragun Publications.
5. Saraswathi T S (1999). *Culture, Socialization and Human Development*. Sage Publication.
6. Sharma, A. P. (2010). *Indian and Western Educational Philosophy*. New Delhi: Unicorn Books.
7. Walia, J.S. (2011). *Philosophical, Sociological and Economic Bases of Education.* Jalandhar: Ahim Paul Publishers.

Course Title/Code	Communicative English I (EDS116)
Course Nature	Soft
Course Type	Core
L-T-P-O Structure	1-0-2-0
Credits	2
Course Objective	The Course aims at developing communication skills among learners
Course Outcomes (COs)	
CO1	Demonstrate accuracy in the usage of grammar in their communication
CO2	Showcase skills while communicating verbally
CO3	Display proficiency while using morphology and syntax of English language
CO4	Express themselves accurately in writing
CO5	Use different techniques while reading for comprehension
Prerequisites (if any)	

SECTION A

GRAMMAR

GRAMMAR AND USAGE –, Parts of Speech, Sentence (Declarative, Affirmative, Negative, and Interrogative, Simple), concept of Clause and Phrase, Transformation of sentences.

Word order and concord, Verbs (Finite, Nonfinite, linking verbs, auxiliary verbs, modals,) Tenses Some common errors in English.

SECTION B

ORAL COMMUNICATION

Features of oral communication- word stress-intonation- falling and rising tones.

CONVERSATIONS: Introducing yourself, Body Language, Public speaking, Debates, Group Discussion Skills, Interview skills and

Etiquette, Meetings, Voice and delivery, Dress code, Class seminar presentation

SECTION C

READING COMPREHENSION

COMPREHENSION SKILLS: Reasons for Poor Comprehension, Techniques for Good Comprehension (Skimming and Scanning), Non-verbal signals, Structure of the text, Author's Viewpoint, Reader's Anticipation, Summarizing

SECTION D

ACADEMIC WRITING

NOTE MAKING: Methods of preparing notes.

PRÉCIS: Summary, Abstract, Synopsis,

LETTER: Letter structure and element, types of letter (Application, Cover, Acknowledgement, Recommendation, Appreciation, Acceptance, Apology, Complaint, Inquiry, Order)

Reference Books and Readings:

1. Cholis, M. (2007). *Towards Academic English. New* Delhi :Cambridge University Press
2. Cohen, F. R. & Miller L. J. (2003). *Reasons to Write: Strategies for Success in Academic Writing.* New York: Oxford University Press.
3. Kohli, A. L. (1993). *English Grammar, Reading and Writing Skills.* Chandigragh: Kohli Publishers
4. Kumar,S. & Lata, P. (2012). *Communication Skill in English*. New Delhi: Oxford University Press.
5. Mohan, K. & Banerji, M. (1990). *Developing Communication Skills*. New Delhi: MacMillan India Ltd.
6. Washburn, P. (2010). *The Vocabulary of Critical Thinking*. New York: OUP.
7. Eastwood, J. (1999). *Oxford Practice Grammar*. India: Oxford University Press.

Communicative English-I Practical

1. Developing Telephonic skills by Handling calls, leaving messages, Making enquiries, Placing an order, Booking and arrangements, Change of plan, Handling complaints.
2. Combating stage fright by Classroom Presentations, Power Point Slides presentation, Debate, Discussions, Extempore, Public Speaking.
3. Paraphrase and reflect on any one of the editorial article from any National Level English News paper

Course Title/Code	Critical Understanding of ICT in Education-I (CSW114B)
Course Type	Workshop
Course Nature	Soft
L-T-P Structure	(0-0-3)
Credits	1.5
Objective	To assist students in developing the fundamental information and skills they need to function successfully in their daily lives.
Course Outcomes	
CO1	To demonstrate the understanding of the main components of the computer hardware and software in use. Entrepreneurship
CO2	To integrate technology tools for teaching learning and material development
CO3	To integrate use of ICT to simplify record keeping, information management in education administration.
CO4	To implement various ICT's for project / problem based constructivist learning environments.
CO5	To reflect critically on application of ICT in teaching-learning process.
CO6	To provide the hands on experience on ICT

SECTION A

Introduction to Computer Systems

Characteristics and Components of a computer system, Memory – Primary & Secondary, Input Devices, Output Devices, Hardware and Software

Operating System

Microsoft Windows - Versions of Windows, Basic Windows elements, Folder and File management, using essential accessories: Calculator, Notepad, Paint, WordPad. Utility of My Computer, My Documents, Recycle bin, My Network Places, Control Panel, Searching Files

SECTION B

Introduction to Internet

Introduction to internet, www, urls, portals, web browsers, ip addresses, searching and downloading content, e-mail, intranet.

SECTION C

Word Processing

Creating and handling documents, Editing, Spellcheck, Formatting, Tables, Macros, Mail merge, Page setting, Headers and footers, Printing documents

Spreadsheet Package

Creating and handling workbook and spreadsheet, Editing, Formatting, Cell referencing, Formulae and Functions, Charts and Graphs, Macros, Views, Sorting, Page setting, Headers and footers, Printing worksheets

SECTION D

Presentation Package

Creating and handling presentations, Using templates, Views, Handling Master slide - Notes and Handouts, Slide Design and layout, Animations, Transition, Slide Show, Custom Show, Timing, Headers and footers, Printing Presentations and handouts.

Reference Books and Readings

1. Bharihok, D. (2000). Fundamentals of Information Technology. Pentagon Press: New Delhi.

2. Jain Amit; Sharma Samart; & Banerji Saurab (2002). Microsoft Powerpoint. NISCOM, CSIR: New Delhi.

3. Lee, William w., Dianna, L. Owens, (2001) Multimedia based Instructional Design: Computer based training. Jossey-Bass

4. Mishra, S.(Ed.) (2009). STRIDE handbook 08: E-learning. IGNOU: New Delhi.

5.National Policy on ICT in Education. (2010). New Delhi: Department of School Education and Literacy. Ministry of HRD, GOI, Retrieved from: http://mhrd.gov.in/ict_school

6. Roblyer, M.D. (2008). *Integrating Educational Technology into Teaching*. New Delhi: Pearson Education, South Asia, India.

Course Title/Code	Education for Conserving Environmental (CHH137)
Course Type	University Compulsory
Course Nature	NTCC
L-T-P Structure	(2-0-4-0)
Credits	4
Course Objective	The Environmental Studies programme trains students to be leaders in recognising and resolving difficult environmental concerns from an interdisciplinary, problem-solving perspective.
	Course Outcome
CO1	To understand about the concept of environmental education.
CO2	To develop sense of awareness about the environmental pollution, and possible hazards and its causes and remedies.
CO3	To build up a sense of responsibility towards conservation of environment, bio-diversity and sustainable development.
CO4	To widen reasonable understanding about the role of school and education in fostering the idea and learning to live in harmony with nature.
CO5	To enable the students to understand about the various measures avaiLable to conserve the environment for sustaining the development

SECTION A

Multidisciplinary nature of environmental studies

Definition, scope and importance. Need for public awareness.

Natural Resources: Renewable and non-renewable resources:

Natural resources and associated problems.
Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
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)

SECTION B

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, oceans, estuaries)

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-sports 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)

SECTION C

Environmental Pollution

- Definition
- Cause, effects and control measures of: -
- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- nuclear hazards
- 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)

Social Issues and the Environment

a) From Unsustainable to Sustainable development
b) Urban problems related to energy
c) Water conservation, rain water harvesting, watershed management
d) Resettlement and rehabilitation of people; its problems and concerns. Case Studies
e) Environmental ethics: Issues and possible solutions.
f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.

g) Waste land reclamation.
h) Consumerism and waste product.
i) Environment Protection Act.
j) Air (Prevention and Control of Pollution) Act.
k) Water (Prevention and control of Pollution) Act
l) Wildlife Protection Act
m) Forest Conservation Act
n) Issues involved in enforcement of environmental legislation.
o) Public awareness. (7 lectures)

SECTION D

Human Population and the Environment

a) Population growth, variation among nations.
b) Population explosion – Family Welfare Programme.
c) Environment and human health.
d) Human Rights.
e) Value Education.
f) HIV/AIDS.
g) Women and Child Welfare.
h) Role of Information Technology in Environment and human health.
i) Case Studies.
j) (6 lectures)

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)

Reference Books and Readings:

a) Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
b) Bacharach, the Biodiversity of India, Maupin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net(R)
c) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
d) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

e) Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
f) De A.K., *Environmental Chemistry*, Wiley Eastern.
g) *Down to Earth*, Centre for Science and Environment(R)
h) Gleick, H.P.1993.Waterincrisis, PacificInstituteforStudiesinDevEnvironment & Security. Stockholm Env. Institute Oxford Univ. Press473p
i) Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural
History Society, Bombay(R)
j) Heywood, V.H &Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press1140p.
k) Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
l) McKinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition.639p.
m) Bhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
n) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co.(TB)
o) Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA,574p
p) Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd.345p.
q) Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
r) Survey of the Environment, The Hindu(M)
s) Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
t) Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media(R)
u) Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
v) WangerK.D., 1998EnvironmentalManagement.W.B.SaundersCo.
Philadelphia, USA 499p
(M) Magazine
(R)Reference
(TB) Textbook

Further Readings:

1. Cunningham W.P., CooperT.H. Gorhani Bharucha Erach, 2003.The Biodiversity of India, Mapin Publishing Pvt. Ltd, Ahmedabad–380013, India. Email:mapin@icenet.net
2. BrunnerRC, 1989, HazardousWasteIncineration, McGrawHillInc.
3. Clark RS, Marine Pollution, Clanderson Press, Oxford (TB).

	SEMESTER - 2									
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/ Workshop/ NTCC)**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH136-T	**States of Matter and Nuclear Chemistry**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
CHH136-P	**States of Matter and Nuclear Chemistry Lab**				**0**	**0**	**2**	**0**		
PHH122-T	**Elasticity, Waves, Heat and Thermodynamics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
PHH122-P	**Elasticity, Waves, Heat and Thermodynamics Lab**				**0**	**0**	**2**	**0**		
EDH132-T	**Bryophytes and Pteridophytes**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH132-P	**Bryophytes and Pteridophytes Lab**				**0**	**0**	**2**	**0**		
MAH147-T	**Partial Differentiations and Integral Calculus**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
MAH147-P	**Partial Differentiations and Integral Calculus Lab**				**0**	**0**	**2**	**0**		
EDH131-T	**Animal Diversity-II**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH131-P	**Animal Diversity-II Lab**				**0**	**0**	**2**	**0**		
EDH133-T	**Learner and Learning Process**	**EDU**	**HARD**	**CORE**	**3**	**0**	**0**	**0**	**5**	**4**
EDH133-P	**Learner and Learning Process Lab**				**0**	**0**	**2**	**0**		
EDS134	**Communicative English-II**	**EDU**	**SOFT**	**CORE**	**1**	**0**	**2**	**0**	**3**	**2**
EDW125	**Drama and Art Education**	**EDU**	**WORKSHOP**	**CORE**	**0**	**0**	**3**	**0**	**3**	**2**

EDN 136	**Project Report on Field Trip**	**EDU**	**NTCC**	**UNIVERSITY COMPULSORY**	**0**	**0**	**0**	**0**	**0**	**2**
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**13**	**0**	**13**	**0**	**26**	**22 (PCM/ZBC)**

Course Title/Code	States of Matter and Nuclear Chemistry (CHH136-T)
Course Type	Core
Course Nature	Hard
L-T-P Structure	3-1-0-0
Credits	3
Course Objective	The student will use knowledge of states of matter to explain the chemical and physical properties of common elements and compounds.
Course Outcomes (COs)	
CO1	To understand concepts of solids and gaseous state and demonstrate professional knowledge of the physical, social and intellectual development of students
CO2	To analyze various properties of liquids and colloids and develop the ability to conduct research in the related thrust area.
CO3	To explain the concepts of acids and bases and develop attitude of reflection, social entrepreneurship and innovation
CO4	To understand the concepts related to atoms, nucleus and demonstrate the practical and theoretical understanding of core science courses: Botany/zoology/physics/chemistry/mathematics
CO5	Understand the concept and application of nuclear chemistry and demonstrate bridging of the gap between academia, industry and society through field-based projects and social engagements
Prerequisites	Nil

SECTION A

GASEOUS AND SOLID STATE

Explanation of the macroscopic properties of solids in terms of structure, bonding and defects. Definition of space lattice, unit cell.Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Law of symmetry. Symmetry elements in crystals.X-ray diffraction by crystals.Derivation of Bragg equation. Predicting crystal structure. Defects in solids, Dielectric properties. Review a perfect gas connecting temperature with kinetic theory. Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of state.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. (8 L)

SECTION B

LIQUIDS AND COLLOIDS

Accounting the Isotropic and intermediate behaviour of liquids as a link between solids and gases. Also tracing the role of liquids as solvents and reaction regulators
Intermolecular forces, structure of liquids (a qualitative description).
Structural differences between solids, liquids and gases.
Liquid crystals: Difference between liquid crystal, solid and liquid.
Classification, structure of nematic and cholesteric phases.
Thermography and seven segment cell. Definition of colloids, classification of colloids.
Solids in liquids (sols): Properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy – Schulze law, gold number.
Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifier.
Liquids in Solids (gels): Classification, preparation and properties, inhibition, general applications of colloids.

SECTION C

ACIDS AND BASES

A discussion on changing concepts of acids and bases involving concentrations and effects of solvent medium. Arrhenius, Bronstead-Lowry and Lewis concepts of acids and bases.
Hard and Soft Acids and Bases (HSAB) -Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness. (8 L)

SECTION D

NUCLEAR CHEMISTRY

To familiarise with the nuclear properties and phenomenon in order to understand the mechanism of some chemical reactions and synthesis of new elements. Fundamental particles of Nucleus, Concept of Nuclides isotopes, isobars and isotones (with specific examples), Qualitative idea of stability of the nucleus (n/p ratio), Natural and artificial radioactivity,
Radioactive Disintegration, half life, average life, artificial transmutation, nuclear fusion and fission. Application of Radioactivity and Radio isotopes as tracers in analysis. (8 L)

References Books and Readings:

- University Chemistry: Bruce Mahan
- Concise Inorganic Chemistry: J D Lee
- An Introduction to Inorganic Chemistry: Mackay and Mackay
- Principles of Physical Chemistry: Marron and Prutton
- Elements of Physical Chemistry: Samuel Glasstone and Lewis
- Physical Chemistry: P W Atkins

Course Title/Code	States of Matter and Nuclear Chemistry Lab (CHH136-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To skill students in handling instruments like pH meter, conductivity meter for various analysis for soil samples and other inorganic samples.
Course Outcomes (COs)	
CO1	To introduce the basics of titration for determining strength of unknown – a knowledge highly recommended for industrial work
CO2	To identify different parameters (physical and chemical) to assess water quality
CO3	To demonstrate the ability to conduct research in different areas like soil analysis, etc.
Prerequisites	NIL

- To evolve a scheme of analysis of anions and cations based on solubility products and common ion effect.
- classification of anions and cations.
- Quantitative inorganic analysis of mixtures containing four radicals.
- Determination of density by specific gravity bottle and viscosity of the given liquid by Ostwald's viscometer.
- Determination of density by specific gravity bottle and surface tension of the given liquid by stalagmometer.
- Measurement of vapour pressure of pure liquids and solutions, finding enthalpy of vaporisation of water.
- Determination of refractive index of pure liquids and mixtures.
- Determination of concentration of a given substance by colorimetry.

References:

A Text Book of Quantitative Inorganic Analysis, A I Vogel

Practical Physical Chemistry, A Findlay

Course Title/Code	Elasticity Waves Heat & Thermodynamics (PHH122-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	3
Course Objective	Students would be able to understand the production and propagations of waves in elastic media. Further, they would be able to understand and apply the laws of heat & thermodynamics in day-to-day life problems
Course Outcomes (COs)	
CO1	Students would be able to explain, demonstrate the concepts of elasticity, oscillations and waves and solve problems related
CO2	Students would be able to explain and compare the concepts and principles in kinetic theory of gasses and hence would be able to apply them on daily scenario.
CO3	Students would be able to demonstrate a clear understanding of laws of thermodynamics and apply basic concepts of heat on real life problems. They would further be able to formulate new problems based on thermodynamical laws
CO4	Students would be able to compare and apply the concepts of entropy and hypothesize problems related to entropy
Prerequisites (if any)	

SECTION A

ELASTICITY AND WAVES

Hooke's law, Moduli of elasticity, Relation between elastic constants. Poisson's ratio – limiting values. Elastic potential Energy, bending moment. Theory of the cantilever. Torsion – calculation of couple per unit twist. The torsional pendulum. Static torsions, Searle's double bar experiment. **Oscillations :** Simple Harmonic Motion (SHM), the restoring force along with its kinematical model, force law, SHM equation and idea of phase and phase difference, energy considerations in simple harmonic motion. Superposition of the SHMs, Lissajous figures, Equation for damped vibrations, forced vibrations. Analysis of complex waves. Fourier Series, Application to square wave, triangular wave.

Waves in elastic media: Review of Mechanical waves, types of waves, travelling waves, the superposition principle, wave speed, power and intensity in wave motion, expression for transverse waves in a stretched string, interference of waves, standing waves, resonance, simulation and demonstrations using ripple tank. **Sound Waves:** Audible, ultrasonic and infrasonic waves, propagation and speed of longitudinal waves, travelling longitudinal waves, standing longitudinal waves, vibrating systems and source of sound, beats and Doppler effect, wave equation for sound pressure, sound power and measuring unit (decibel). Model of sound being a pressure wave caused by longitudinally oscillating particles must be developed.

SECTION B

KINETIC THEORY OF GASES

Introduction, Kinetic Theory of Gases, kinetic theory as particle model and usefulness of the model in explaining the regular structure of crystals (Review), an ideal gas – a macroscopic description, an ideal gas – a microscopic description, kinetic calculation of pressure, kinetic interpretation of temperature, ideal gas scale, intermolecular forces, specific heat of an ideal gas, law of equi-partition of energy. Mean free path, Maxwell' distribution law, distribution of molecular speeds, van der Waal's equations of State, critical constants, application to liquefaction of gases.

SECTION C

HEAT AND FIRST LAW OF THERMODYNAMICS

Thermal equilibrium, Zeroth law of thermodynamics, ideal gas temperature scale, heat as a form of energy, quantity of heat and specific heat, molar heat capacities of solids, the mechanical equivalent of heat, heat and work; First law of thermodynamics, Discussion on usefulness of First Law of Thermodynamics in Meteorology, some special cases of the first law of thermodynamics – (i) adiabatic process, (ii) isothermal process, (iii) isochoric process, (iv) cyclic process, (v) free expansion.

SECTION D

ENTROPY AND SECOND LAW OF THERMODYNAMICS

Introduction, reversible and irreversible processes, the Carnot cycle, Carnot engine, Carnot theorem, absolute scale of temperature, second law of thermodynamics, efficiency of engines, the thermodynamic temperature scale, entropy in reversible and irreversible processes, entropy and the II law, entropy and disorder, consequences of II and III law of thermodynamics, Second law of thermodynamics as a probabilistic statement. Low temperature Physics – Porous Plug experiment, temperature of inversion, principle of regenerative cooling, liquefaction of air by Linde's method.

References Books and Readings:

1. Fundamentals of Physics, 6th Edition, David Halliday, Robert Resnick and Jay Walker, John Wiley and Sons, Inc.
2. University Physics, Revised Edition, Harris Benson, John Wiley and Sons Inc.
3. Heat and Thermodynamics, Zeemansky, McGraw Hill.
4. Physics of Vibration and Waves, H J Pain.

Course Title/Code	Elasticity Waves Heat & Thermodynamics Lab (PHH122-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	Students would be able to understand the production and propagations of waves in elastic media. Further, they would be able to understand and apply the laws of heat & thermodynamics in day-to-day life problems
Course Outcomes (COs)	
CO1	Students will be able to demonstrate an ability to conduct investigations of practical/technical issues.
CO2	they will demonstrate an ability to analyze data and reach a valid conclusion.
Prerequisites (if any)	

List of Experiments

1. To determine the frequency of A.C. mains using sonometer.

2. To find the frequency and amplitude of given waves (sine wave triangular wave, square wave) using CRO.

3. To determine the modulus of rigidity of material of given wire by dynamical method using Maxwell needle.

4. To find the spring constant.

5. To determine J by Callender and Barne's constant flow method.

6. To determine coefficient of thermal conductivity of copper by Searle's apparatus.

7. To determine temperature coefficient of resistance by Pt resistance thermometer.

References:

1. PSSC Physics Laboratory Guide.
2. Practical Physics, E Armitage, John Murray.

Course Title/Code	**Bryophytes and pteridophytes (EDH132-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P Structure	**3-0-0**
Credits	**3**
Course Objective	The course focuses on morphology, anatomy, reproduction, and evolution in Bryophytes and Pteridophytes. The students develop the basic understanding of important characteristics, anatomy, reproduction and evolution along with economic importance of these two groups.
Course Outcomes (COs)	
CO1	To get acquainted with the structure, classification, and life history of Bryophytes.
CO2	To understand the Geological time scale and the importance of fossils.
CO3	To get acquainted with the structure, classification, and life history of Pteridophytes.
CO4	To analyse the evolutionary trends among Pteridophytes.
Prerequisites (if any)	Basic understanding of Plant Kingdom and Taxonomy

SECTION A

Bryophytes- Origin, General characteristics, distribution, structure, reproduction, alternation of generation, classification, and economic importance

Study of morphology, anatomy and reproduction in- Hepaticopsida: *Marchanti*a
Anthocerotopsida: *Anthoceros*
Bryopsida: *Funaria*
Affinities of bryophytes – brief account

SECTION B

General account of geological time scale, types of fossils, fossilization process, radioactive carbon dating, and importance of fossils.
Study of *Rhynia, Lepidodendron, Lepidostrobus.*

SECTION C

Pteridophytes- General characters, distribution, structure, reproduction, life cycle, classification, and economic importance.
Study of morphology, anatomy, and reproduction in- Psilopsida: *Psilotum*
Lycopsida: *Lycopodium, Selaginella*
Sphenopsida: *Equisetem*
Pteropsida: Marsilea

SECTION D

Evolution of steles in Pteridophytes
Origin and significance of heterospory and seed habit
Apogamy and Apospory

References Books and Readings:

1. Smith.G.M. (1971). Cryptogamic Botany Vol.II. New Delhi: TMH Publishing House.
2. Sporne, K.R. (1974). Morphology of Pteridophytes. London: Hutchinson & Co.
3. Rashid, A. (1999). An Introduction to Pteridophyta.Vikas Publishing House.
4. Pandey, Mishra & Trivedi. (2004). A Textbook of Botany Vol.II, Meerut: Rastogi Publications.
5. Singh,V., Pande, P. &Jain,D.K. (2006). A Textbook of Botany. Meerut: Rastogi Publications.
6. Singh,V., Pande, P. & Jain, D.K. (2005).Diversity and Systematics of Seed plants. Meerut: Rastogi Publications.
7. Parihar, N.S. (1961). Bryophyta.Central Book Depot.
8. Parihar, N.S. (1966). PteridophytesAn Introduction of Embryophyta: Volume II.Central Book Depot.
9. Vashishta, P.C. (1982). Peridophyta. New Delhi: S.Chand& Co. Ltd.
10. Gangulee H.C., Kar, A.K. (1982). College Botany Vol.II. Calcutta: New Central Book Agency.
11. Anrold, C.A. (1947). An Introduction to Palaeobotany. London: McGraw-Hill Book Company Inc.

Course Title/Code	**Bryophytes and pteridophytes Lab (EDH132-P)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	The course deals with the characteristics and economic importance of Bryophytes and Pteridophytes.
Course Outcomes (COs)	
CO1	To observe and identify temporary micro-preparations and permanent slides.
CO2	Study of the taxa included under Bryophytes and Pteridophytes by observing temporary micro-preparations and permanent slides.
CO3	Study of the morphology, thallus organization and reproductive structures of taxa studied in Bryophytes and Pteridophytes through permanent slides.
CO4	To prepare temporary, double-stained micro-preparations.
Prerequisites (if any)	Basic understanding of Plant Kingdom and Taxonomy

Practical

1. To observe and identify temporary micro-preparations and permanent slides
2. Study of the taxa included under Bryophytes and Pteridophytes by observing temporary micro-preparations and permanent slides.
3. To develop the skill of freehand sectioning, staining, and mounting, Bryophytes and Pteridophytes.
4. To prepare temporary, double-stained micro-preparations.

5. Study of the morphology, thallus organization and reproductive structures of taxa studied in Bryophytes and Pteridophytes through permanent slides.
6. Preparation and submission of 2 double-stained slides

References Books and Readings:

1. Smith.G.M. (1971). Cryptogamic Botany Vol.II. New Delhi: TMH Publishing House.
2. Sporne, K.R. (1974). Morphology of Pteridophytes. London: Hutchinson & Co.
3. Rashid, A. (1999). An Introduction to Pteridophyta.Vikas Publishing House

SECTION A

Theory of Numbers

Division Algorithm – Prime and Composite Numbers – proving the existence and uniqueness of GCD and the Euclidean Algorithm – fundamental theorem of Arithmetic - the least common multiple – congruences – linear congruences – Wilson's theorem – Simultaneous congruences – Theorem of Euler – Fermat and Lagrange.

SECTION B

Theory of Equations

Relation between roots and coefficients, Symmetric functions, Transformations, Reciprocal equations, Descarte's rule of signs,Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's method and Ferrari's method.

SECTION C

Matrices – I

Matrices of order $m \times n$, Algebra of matrices, Symmetric and Skew Symmetric, Hermitian and Skew Hermitian matrices and their standard properties, Determinants Adjoint of a square matrix, Singular and non-singular matrices, Rank of a matrix, Elementary row / column operations, Invariance of rank under elementary operations, Inverse of a non-singular matrix by elementary operations.

SECTION D

Matrices - II

System of m-linear equations in n-unknowns, Matrices associated with linear equations, Trivial and non-trivial solutions, Criterion for existence of non-trivial solution of homogeneous and non- homogeneous systems, Criterion for uniqueness of solutions. Eigen values and Eigen vectors of

a square matrix, Characteristic equation of a square matrix, Eigen values and Eigen vectors of a real symmetric matrix properties, Diagonalisation of a real symmetric matrix, Cayley – Hamilton theorem, Applications to determine the powers of square matrices and Inverse of non-singular matrices.

REFERENCES

1. Elementary Number Theory by David M. Burton.
2. Algebra by Natarajan, M. Pillay and Ganapathy, S. Vishwanath Pvt. Ltd.
3. Theory of Equations by Uspensky, McGraw Hill Book Co. Ltd.
4. Matrices by Frank Ayres, Schaum Publishing Co.
5. Textbook of Matrix Algebra by Suddhendu Biswas.

Course Title/Code	Partial Differentiations and Integral Calculus (MAH147-T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-1-0-0**
Credits	**4**
Course Objective	To acquaint the learner with fundamentals of partial differentiation.
Course Outcomes (COs)	
CO1	Describe and demonstrate common computer literacy skills
CO2	Understand the fundamentals of the internet and perform basic internet skills;
CO3	Describe and perform basic word processing skills;
CO4	. Enhance a word-processed document by including appropriate visual components.
Prerequisites (if any)	

Unit I: Partial Derivatives – I

Functions of two or more variables, Limits, Continuity, Partial derivatives, Differentiable functions, Linear approximation theorem.

Unit II: Partial Derivatives - II

Homogeneous functions, Euler's Theorem, Chain Rule, Change of Variable, Directional Derivative, Partial Derivatives of higher order, Derivate of Implicit functions.

Unit III: Applications of Partial Derivatives

Jacobians, Properties of Jacobians ,Taylor's theorem for a function of two variables, Maxima and Minima of function of two variables, Lagrange Method of Undetermined Multipliers.

Unit IV: INTEGRAL CALCULUS

Integration of Standard Forms, Definition of Integration. Elementary Principle, Fundamental Integrals, Derivation of Formulae, Simple Applications of Integration, Derivative of Area. Area of Curve, Integration of Rational Fractions, Formulae for Integration of Rational Functions, Integration of Irrational Functions, Integration by Parts. Reduction Formulae, Integration by Substitution, Integration as a Summation., Definite Integrals.

References:

1. Calculus by Anton, Wiley.
2. Calculus with Analytic Geometry by S K Stein, McGraw Hill.
3. Calculus and Analytical Geometry by Thomas and Finney, Shand and Co. Ltd.

Course Title/Code	Partial Differentiations and Integral Calculus (MAH147-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	4
Course Objective	To enable a learner to apply concept of Partial differentiation in real life.
Course Outcomes (COs)	
CO1	Describe and demonstrate common computer literacy skills
CO2	Understand the fundamentals of the internet and perform basic internet skills;
CO3	Describe and perform basic word processing skills;
CO4	. Enhance a word-processed document by including appropriate visual components.
Prerequisites (if any)	

LAB EXERCISE:

1. Solution of Cauchy problem for first order PDE.

2. Finding the characteristics for the first order PDE.

3. Plot the integral surfaces of a given first order PDE with initial data.

4. Solution of the wave equation ∂2u∂t2-c2∂2u∂x2=0 for any two of the following associated conditions:

a. u(x,0)=∅(x),ut(x,0)=φ(x), x∈R,t>0.

b. u(x,0)=∅(x), ut(x,0)=φ(x), u(0,t)=0, x∈(0,∞), t>0.

c. u(x,0)=∅(x), ut(x,0)=φ(x), ux(0,t)=0, x∈(0,∞), t>0.

d. u(x,0)=∅(x), ut(x,0)=φ(x), u(0,t)=0, u(l,t)=0, 0<x<l, t>0.

5. Solution of one-dimensional heat equation ut=kuxx ,for a Homogeneous rod of length l i.e. to solve the IBVP:

ut=kuxx ,0<x<l,t>0

u(0,t)=0,u(l,t)=0,t≥0,

u(x,0)=f(x),0≤x≤l

References:

1. TynMyint-U and Lokenath Debnath, Linear Partial Differential Equation for Scientists and Engineers, Springer, Indian reprint, 2006.

2. Ioannis P Stavroulakis and Stepan A Tersian, Partial Differential Equations: An Introduction with Mathematica and MAPLE, World Scientific, Second Edition 2004.

Course Title/Code	**Animal Diversity-II (EDH131-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**

Course Objective	To enable students to understand invertebrates and vertebrates, their organizational hierarchies and complexities; the evolutionary trends in external morphology and internal structure; identification and classification with examples; to enable them to understand various modes of adaptations in animals.
Course Outcomes (COs)	
CO1	Critically analyse the basic structure, classification and life history of Arthropoda, Mollusca and Echinodermata
CO2	Comprehend the systemic position and phylogeny of Onycophora
CO3	Reflect upon the classification of Mollusca and to gain the knowledge of formation of the pearl
CO4	To have the Knowledge of the evolutionary trends among arthropoda, mollusca and echinodermata
CO5	Critically analyze the classification Of Protochordata
CO6	Critically analyze the classification and life history of Cylostomata
Prerequisites (if any)	Basic knowledge of animal kingdom

SECTION A

ARTHROPODA AND ONYCHOPHORA

Arthropoda: General characters and classification of Phylum Arthropoda up to orders with examples. Type study: Palaemon– External morphology, digestive system, circulatory system, respiratory system, excretory system and reproductive system; Mouth parts in Insects;
Metamorphosis in insects; Crustacean larvae (Nauplius, Zoaea, Mysis and Megalopa) and their significance. Insects as vectors a. mosquito b. housefly c. sand-fly d. tsetse fly. Social behavior in Honey Bees.Onychophora: Salient features of Peripatus, systematic position and phylogeny of Onychophora.

SECTION -B

MOLLUSCA

General characters and classification of Phylum Mollusca up to orders with examples (1); Type study: Pila– External morphology, digestive system, respiratory system and life cycle; Modifications of foot in Mollusca ; Comparative account ofshells in Mollusca; Torsion and detorsion in Mollusca .Pearl formation in Mollusca Molluscan larvae :Glochidium and Veliger

SECTION C

ECHINODERMATA

General characters and classification of Phylum Echinodermata up to orders with example; Type study: Asterias– External morphology, digestive system, water- vascular system, haemocoel system and reproductive system; Life-cycle and metamorphosis; Pedicellaria ; Skeletal system in Echinoderm , Echinoderm larvae and their significance- Bipinnaria and Auricularia

SECTION D

CHORDATA – PROTOCHORDATA AND CYCLOSTOMATA

Chordata: General characters and outline classification of Phylum Chordata up to orders with examples
Protochordata: i) Balanoglossusand its affinities (1); Tornaria larva ; ii) Amphioxus –
Digestive system, circulatory system and nervous system.
Cyclostomata: General characters, affinities and classification of Class Cyclostomataup to ordersexamples;

Type study: Petromyzon– External morphology, digestive system and.

References Books and Readings:

1. Invertebrate Zoology by E.L.Jordon and P.S. Verma – S. Chand & Co., Delhi).
2. Invertebrate Zoology by J.K.Dhami and P.S.Dhami – S. Chand & Co., Delhi).
3. Invertebrate Zoology series (Protozoa to Echinodermata) by R.L. Kotpal –(Rastogi Publications, Meerut, 2008).
4. A Textbook of Invertebrate Zoology by S.N. Prasad – (Kitab Mahal, Allahabad).
5. A life of Invertebrates by Russel and Hunter – (MacMillan)
6. Invertebrate Zoology by Redarns – (W.B.Saunders, Philadelphia)
7. The Invertebrate series of L.H.Hyman – (McGraw Hill).
8. A student's textbook of Zoology by Adam Sedgwick Vol. I, II & III –
9. (Central Book Depot, Allahabad).
10. A Textbook of Zoology vol.1 by Parkar and Haswell – (MacMillan).
11. Destructive and Useful Insects- Their habits and control by Metcalf and Flint –
12. Protochordates by K.S. Bhatia.
13. Modern Textbook of Zoology Invertebrates by R.L. Kotpal –(Rastogi Publications, Meerut, 10th Revised Edition, 2008).

	Animal Diversity-II Lab (EDH131-P)
Course Type	**Core**
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	To develop in the students the skills of staining and mounting of materials (temporary and permanent); of dissection, display and Labelling; of collection, preservation, mounting, identification and Labelling of collected specimens; of field observation of animals.
Course Outcomes (COs)	
CO1	To develop in the students the skills of staining and mounting of materials (temporary and permanent); of dissection, display and Labelling
CO2	To develop in the students the skills of collection, preservation, mounting of specimens
CO3	To develop in the students the skills of identification and Labelling of collected specimens
CO4	To develop in the students the skills of field observation of animals
Prerequisites (if any)	-----

- Dissection of Palaemon and flag Labelling: a) Digestive system b) Nervous systemii) Mounting of appendages.
- Study of specimens of Arthropoda and Onychophora:a) Lepas b) Balanus c) Hippad d)Cancer e) Limulus f) Scolopendra g) Spirobolush) Peripatus
- Study of mouth parts: a) Culex/Anopheles b) Periplaneta c) Apisd) butterfly
- Study of Crustacean larvae: a) Nauplius b) Zoaeac) Mysis d) Megalopa
- Preparation of permanent slides of fresh water and marine crustacean specimens.
- Identification and classification of Anopheles, Culex and Aedes mosquitoes.
- Study of specimens and permanent slides of Mollusca:Pila b) Unio c) Sepia d) Octopuse e) Chiton

- Dentalium g) Radula of Pila i) T.S. of Ctenidium
- Glochidium
- Dissection and mounting of Pila (Study of dissected specimen):
- Nervous system b) radula
- Study of specimens and permanent slides of Echinodermata:
- Astropecten/ Asterias b) Ophiothrix c) Echinus
- Holothuria e) Antedon f) Bipinnaria larva
- Ophiopluteuslarvah) Echinopluteuslarva i) Pedicellaria
- Study of specimens and permanent slides of Protochordata:
- Balanoglossus,Entire,T.S. through proboscis
- T.S. through collar d) T.S. through trunk region
- Ascidia Doliolum
- Salpa Amphioxus: a) Entireb) T.S. through oral cirri
- T.S. through pharynx d) T.S. through intestinee) T.S. through tail
- Study of specimens of Cyclostomata: Petromyzon , Myxine Field Visit- Zoo

Course Title/Code	Learner and Learning Process (EDH133-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-0-0-0
Credits	3
Course Objective	To enable a learner to become aware of aspects of learning and learning process
Course Outcomes (COs)	
CO1	Comprehend the Nature of both the Psychology of the learner and Learning
CO2	Assimilate the nature of different components of cognition and their role in producing learning
CO3	Apply the knowledge of concepts and principles of growth in the classroom situation
CO4	Elucidate the concept of Group dynamics in their day-to-day activities.
CO5	Exhibit all the traits of an effective teacher
Prerequisites (if any)	

SECTION A

EDUCATIONAL PSYCHOLOGY, LEARNING AND MOTIVATION

Educational Psychology - Meaning, Scope and Importance, Concept & factors affected to the learning
Approaches to learning- Behaviorism, Cognitivism, Humanism, Social Constructivism Theories of learning (Pavlov, Skinner, Thorndike, Kohler, Roger , Vygotsky) and their educational implications
Motivation in learning: Concept, types and educational implications, Abraham Maslow's Motivational Theory, Role of Teacher in Motivation.

SECTION B

INTELLIGENCE, CREATIVITY AND PERSONALITY

Intelligence: Meaning, theories of intelligence-Spearman, Thorndike, Thurstone, Gardener and Guilford, Measurement of intelligence, uses and limitations of intelligence test.
Creativity - concept, identification of creative potential, educational programme for developing creativity Intelligence and Creativity

Personality- concept, big five theory, and Jung's theory

SECTION C

ADOLESCENTS AND DEVELOPMENT

Role of Heredity and Environment in human development

Concept of growth and development, Principles of development, Dimensions and stages of development, Factors influencing development (with special reference to Adolescents) Developmental characteristics of an adolescent: Physical, Cognitive, Social, Emotional, Moral & Language

Role of teacher, Parents and Society in catering the needs and problems of Adolescents

SECTION D

THEORIES OF GROWTH AND DEVELOPMENT

Piaget's Cognitive Development Theory- Concept, Stages and Implications Kohlberg 's Theory of Moral Development- Concept, Stages s Erickson's Theory of social and moral development- Concept, stages and implications with special reference to Indian context.

Maria Montessori's Planes of development.

Reference Books and Readings

- Claridge, Gordon & Davis, Caroline (2003). *Personality and Psychological Disorders*. New Delhi: Atlantic Publishers.
- Arnes, Peter at al (Ed.), (1984). Personality Development and learning, A Reader Kent
- Bower, G. H., (1986). The Psychology of Learning and Motivation, Academic Press
- Chauhan S. S., (1983). Advanced Educational Psychology, (5th revised edition) New Delhi; Vikas Publishers
- Gange R. M. and Briggs, L. J., (1979). Principles of Instructional Design, New York; H
- Joshi, Kirit. (2011). Child, Teacher and Teacher Education. Gandhinagar: Children University.
- Kochar, S. K., Method & Techniques of Teaching, New Delhi; Sterling Publishers.
- Kratochwill, Thomas R., (1983). Advances in School Psychology, New Jersey; Lawrence Erlbaum Associated Publishers.
- Kundu, C. L., and Tutoon, D. N. (1985). Educational Psychology, New Delhi; Sterling Publishers.
- Rinehart and Winston Gange, R. M. and Briggs, L. J., (1979). The Conditions of Learning and Theory of Instruction, New York; Halt, Rinehart and Winston
- Malek Parveen Banu M.,(2014). Technology & Teacher, Ahmedabad; SSTCT Publication.
- Cole, M., Cole, S. R. and Lightfoot, C. (2004). *The Development of Children.* New York: Worth Publishers
- K. Behera (Ed.), *Childhoods in South Asia.* New Delhi: Pearson Education India.

- Farrell, M. (2009). *Foundations of Special Education: An Introduction*. (4th ed.). Wiley Blackwell
- Gardner, H. (1980). Frames of mind: The theory of multiple intelligence. London:
- H.Havighurtst, R. et al.(1995). *Society and Education*. Baston: Allyen ad Bacon
- Piaget, J. (1952). *The Origins of Intelligence in Children*. New York: International University Press.
- Newman, B. M. and Newman, P.H. (2007). *Theories of Human Development.* London: Lawrence Erlbaum Associates, publishers. Paladin Books
- Saraswathi, T.S. (Ed). (1999). *Culture, Socialisation and Human Development: Theory, Research and Application in India*. New Delhi: Sage.
- Sharma, K.N. (1990). *Systems, Theories and Modern Trends in Psychology*.Agra: HPB
- Singh, Agya Jit (2012). *Development of the Learner and Teaching-Learning Process.* Patiala: Twenty First Century Publications.
- Woolfork, A (2014). *Educational Psychology(12th ed.). New Delhi: Pearson Education.*

Course Title/Code	Learner and Learning Process Lab (EDH133-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To enable learners to apply concepts of Education Psychology in real life situations w.r.t Education.
Course Outcomes (COs)	
CO1	To develop teaching aids as per interests and capabilities of the learners .
CO2	To assign tasks /assignments as per the abilities of the learners
CO3	To enable a learner to test various factors of personality of an individual
Prerequisites (if any)	

1. Prepare your own SWOT analysis
2. Prepare a case study on an adolescent near you and mention his/her problems during that period and provide remedial measures after discussing the case with your teacher.
3. Study of a case and prepare a report on influential factors of learning
4. *Conduct a Sociometric Test in the class and interpret the result
5. Discuss the role of Emotions in the learning process
6. Presentation on educational implications of any one learning or development theory
7. Administration and Interpretation of any one psychological test - Intelligence test/Personality test/Creativity test/Attitude test/Aptitude test.
8. Conduct an experiment on transfer of learning
9. Preparation of learner profile based on cognitive/non-cognitive characteristics

Course Title/Code	Communicative English II (EDS134)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	1-0-2-0
Credits	2
Course Objective	The course aims at developing skills related to Communicative English
Course Outcomes (COs)	
CO1	Demonstrate accuracy in the usage of grammar in their communication
CO2	showcase skills while Communicating verbally
CO3	Display proficiency while using morphology and syntax of English language
CO4	Express themselves accurately in writing
Prerequisites (if any)	

Section – A

Lexis & Semantics: Vocabulary Building: The Concept of Word Formation, Root Words from Foreign Languages and their use in English Sentence: Parts and Kinds, Simple, Compound & Complex Sentences, Use of Phrase & Clause in Sentences.

Section – B

Oral Communication: Importance of Speech Sounds, Organs of Speech, Vowel Sounds, Consonant Sounds, Intonation, Word Stress, Sentence Stress, Listening Comprehension, Conversations & Dialogues

Section – C

Presentation Skills: Communication, Process of Communication, Basic forms of Communication, Barriers & Filters of Communication, Body Language and Paralanguage, Gestures and Postures, , Importance of Body Language in Presentation, Hearing and Listening, Essentials of Effective Listening, Importance of Effective Listening,

. **Section – D**

Technical Writing: Nature & Style of Sensible Writing, Techniques of Writing Precisely, Writing Practices: Paragraph & Essay Writing , Paraphrasing, importance of proper punctuation in writing. Job application, resume writing, circular writing, memo writing & blog writing

Suggested Text Book Reading:

CIEFL, Hyderabad. *Exercises in Spoken English Parts I-III*. Oxford University Press.
Koneru, Aruna. *Professional Communication*. Mcgraw Hills Education Pvt. Ltd.
Kumar, Sanjay and Pushpa Lata. Oxford University Press, 2011. Print.
Lyons, Liz Hamp and Ben Hearsly. Study Writing. Cambridge University Press. 2006. Print.
Swan, Michael. *Practical English Usage*. OUP, 2014. Print.
Wood, F T. Remedial English Grammar. Macmillan, 2007. Print.
Zinsser, William. *On Writing Well*. Harper Resource Book, 2006. Print.
Subhrmania, T. Bala. *A Textbook of English Phonetics for Indian Students*.: Macmillan.
R C Sharma & Krishna Mohan. *Communication.* McGraw Hill Education, Chennai, 2017.
Effective Technical Communication. M Ashraf Rizvi. McGraw Hill Education, Chennai, 2018.

Course Title/Code	Drama and Art Education (EDW125)
Course Type	Soft
L-T-P-O Structure	0-0-3-0
Credits	1.5
Course Objective	Student Readiness for art-based education
Course Outcomes (COs)	
CO1	To develop the skills to use visual art in teaching learning process effectively.
CO2	To develop the skills to use literary art in teaching learning process effectively.
CO3	To develop the skills to use performing art in teaching learning process effectively.
CO4	To develop the skills to integrate technology and art in teaching learning process effectively.
Prerequisites (if any)	

SECTION A

THEORETICAL FRAMEWORK

Meaning and concept of Arts and Aesthetics and its significance at secondary level of School Education**,** Role of Art (Visual arts, Literary Arts and performing Arts), Theatre: Introduction, Importance and role of Drama in education, the impact of Music on Human behaviour.

SECTION B

EDUCATIONAL IMPLICATIONS

Need and importance of Art and Drama in Teaching and Learning, Planning lessons based on ArtIntegrated Learning, Role of teacher as facilitator of learning Arts and Drama, Role Plays and Skits, Ethics of drama practice by students,

Reference Books and Readings:

- Sahi, J. and Sahi, R. (2008). *Learning through Art*. Eklavya, Bangalore.
- Chawla, S. S. (1986). *Teaching of Art.* Publication Bureau, Punjabi University, Patiala.
- Minhas, N. S. (1974). *Art and Education*. N.B.S Educational Publishers, Chandigarh.
- NCERT (2006).*Position Paper, National Focus Group on Arts, Music, Dance andTheatre.*. Publication department, NCERT

Course Title/Code	**Project Report on Field Trip (EDN136)**
Course Type	**University Compulsory**
Course Nature	**NTCC**
L-T-P-O Structure	**0-0-0-0**
Credits	2
Course Objective	Student Readiness for value education
Course Outcomes (COs)	
CO1	To develop skills related to the core competencies like commitment to profession and honouring diversity
CO2	To develop skills including communication and problem solving
CO3	To develop skills like sensitization towards the environment and solving imminent problems
CO4	To develop skills like team work, co-operation and leadership
Prerequisites (if any)	

Course Title/Code	**Post Second Semester Summer Training (EDO165)**
Course Type	**Outcome**
L-T-P-0 Structure	**0-0-0-0**
Credits	**1.5**
Course Objective	**Student Readiness for value education**
Course Outcomes (COs)	
CO1	**To develop interest in listening, speaking, reading & writing.**
CO2	**To comprehend & paraphrase the ideas and their use in professional as well as in personal life**
CO3	**To give presentation in a structured manner on provided topic**
CO4	**To understand the importance of teamwork and its use in professional life.**
CO5	**To minimize the gap/translation pattern**
Prerequisites (if any)	

SEMESTER - 3										
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/ Workshop/ NTCC)**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH237-T	Organic Chemistry I	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH237-P	Organic Chemistry I Lab				0	0	2	0		
PHH226-T	Electricity and Electromagnetism	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH226-P	Electricity and Electromagnetism Lab				0	0	2	0		
EDH204-T	Gymnosperms and Reproduction in Angiosperms	EDU			3	0	0	0	5	
EDH204-P	Gymnosperms and Reproduction in Angiosperms Lab				0	0	2	0		
MAH248-T	Real Analysis	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH248-T	Real Analysis Lab				0	0	2	0		
EDH205-T	Animal Diversity-III and Comparative Anatomy of Vertebrates	EDU			3	0	0	0	5	
EDH205-P	Animal Diversity-III and Comparative Anatomy of Vertebrates Lab				0	0	2	0		
EDH221-T	Basics of Biophysics	EDU	HARD	CORE	3	0	0	0	5	4

EDH221-P	Basics of Biophysics Lab				0	0	2	0		
EDH206-T	Knowledge and Curriculum	EDU	HARD	CORE	3	0	0	0	5	4
EDH206-P	Knowledge and Curriculum Lab				0	0	2	0		
EDS207	Gender, school and society	EDU	SOFT	CORE	1	0	2	0	3	2
EDW208	Craft and visual arts	EDU	WORK SHOP	CORE	0	0	3	0	3	2
FLS101	Spanish-I	MRCFL	ELECTIVE	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS102	German-I									
FLS103	French-I									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				17	4(PCM)/ 2 (ZBC)	15	0	36(PCM)/34(ZBC)	24

Course Title/Code	**Organic Chemistry-I (CHH237-T)**	
Course Type	**Core**	
Course Nature	**Hard**	
L-T-P-O Structure	**3-1-0-0**	
Credits	3	
Course Objective	**To give an in-depth exposure of Organic Chemistry and familiarize the students with basic concepts of Organic Chemistry**	
Course Outcomes (COs)		
CO1	To Understand the stereo-chemistry of organic compounds and its applications.	
CO2	To establish a basic concept for structure, properties and reactivity of aliphatic hydrocarbons.	
CO3	To develop a firm foundation for scientific application of aromatic hydrocarbons	
CO4	To apply knowledge to communicate reactions and mechanism in alkyl halides	
Prerequisites		

SECTION A

STEREOCHEMISTRY OF ORGANIC COMPOUNDS

Review of Concept of Isomerism and Types of isomerism with examples.

Optical Isomerism: Structural changes responsible for properties: 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
Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

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

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

SECTION B

ALIPHATIC HYDROCARBONS

Alkanes: Review of IUPAC nomenclature of branched and unbranched alkanes. Isomerism in alkanes and industrial source. Methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation), physical properties and chemical reactions of alkanes (halogenation, nitration, sulphonation, oxidation and isomerisation reactions) Mechanism of free radical halogenation of alkanes : orientation, reactivity and selectivity.

Cycloalkanes: Nomenclature, methods of formation (from acetoacetic ester / malonic ester and Dieckmann reaction), chemical reactions (halogenation), 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.

Alkenes: Accounting for Reactions due to unsaturation in compounds. Nomenclature of alkenes, methods of formation (by dehydration, dehydrohalogenation and dehalogenation) with mechanism. Regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

Cycloalkenes: Methods of formation and chemical reactions of cycloalkenes.

SECTION C

AROMATIC HYDROCARBONS

Factors responsible for the characteristic reactions of Aromatic compounds. Nomenclature of benzene derivatives. Structure of benzene : molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity : The Huckel rule, aromatic ions.

Aromatic electrophilic substitution: General pattern of the mechanism, 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. Birch reduction.

SECTION D

ALKYL AND ARYL HALIDES

Alkyl halides: A study of Alkyl halides highlighting its synthetic applications. Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides S_N2 and S_N1 reactions with energy profile diagrams.

Aryl halides: Methods of formation of aryl halides, nuclear and side chain reactions. The addition- elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

Course Title/Code	Organic chemistry I Lab (CHH237-P)
Course Type	Core
Course Nature	Hard
L-T-P Structure	0-0-2-0
Credits	1
Course Objective	To give an in-depth exposure of Organic Chemistry and familiarize the students with basic concepts of Organic Chemistry
Course Outcomes (COs)	
CO1	To Understand the stereo-chemistry of organic compounds and its applications.
CO2	To establish a basic concept for structure, properties and reactivity of aliphatic hydrocarbons.
CO3	To develop a firm foundation for scientific application of aromatic hydrocarbons
CO4	To apply knowledge to communicate reactions and mechanism in alkyl halides
Prerequisites	

Laboratory Techniques:

- Calibration of Thermometer using naphthalene / acetanilide / urea
- 2.Determination of melting point of Benzoic acid / cinnamic acid / m – dinitro benzene / p- dichlorobenzene
- Distillation of water – alcohol mixture using water condenser; Distillation of chlorobenzene – nitrobenzene mixture using air-condenser
- Crystallization: Benzoic acid from hot water, naphthalene from ethanol
- Sublimation of camphor / phthalic acid/succinic acid
- **Electrophilic Substitution Reactions**
- Preparation of Iodoform from ethanol / acetone
- Preparation of *m*-dinitrobenzene from nitrobenzene by nitration
- Preparation of *p*-Bromo acetanilide from acetanilide by bromination

Course Title/Code	Electricity and Electromagnetism (PHH226-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	3
Course Objective	To enable students to acquire a broad conceptual of electromagnetic phenomena.
CO1	Students would be able to understand, explain and demonstrate about vector calculus, Gauss law and its application to determine D with problems and diagrams.
CO2	Students would be able to understand, construction and working of different types of capacitors. Also, they will able to understand polarization phenomenon.
CO3	Students would be able to understand about Biot Savarts law, Amperes law and different types of forces in magnetostatics.
CO4	Students would be able to understand about propagation of electromagnetic waves and electromagnetic induction.
Prerequisites (if any)	Nil

SECTION A

ELECTROSTATICS & ELECTRIC CURRENTS

Vector Calculus: Scalar and Vector fields, Gradient of a Scalar, Divergence and Curl of a vector, Line, surface and volume integrals.Review of

Coulomb's law – Electric field and potential – Field due to a monopole,dipole, torque on a dipole in uniform and non-uniform E fields, Flux of an electric field. Gauss's law, applications to deduce electric fields, P.E. of a system of two charges, of many charges.Basic circuit analysis – Kirchhoff's laws. Voltage and Current divider Rules. Single loop and two loop circuits, Mesh analysis, RC circuits, Maximum power transfer theorem. (9L)

SECTION B

ELECTRIC FIELDS IN MATTER

Electric Fields: Capacitance, parallel plate capacitor, calculation of capacity of a spherical and cylindrical capacitor, energy stored in a capacitor, capacitor with dielectric, atomic view of dielectrics, polarization, electric field due to a polarized material, Gauss's law in dielectrics, Dielectric constant, Energy density of an electrostatic field (with and without dielectric).

Polarizability and susceptibility – Frequency dependence of polarizability, Clausius-Mossotti equation. (10L)

SECTION C

MAGNETOSTATICS

Review of Ampere's law, B near a long wire, Magnetic lines of induction, force between two parallel conductors, definition of ampere, B for a solenoid, Biot-Savart's law, applications.

The magnetic field, Lorentz force and definition of magnetic field, magnetic induction, magnetic force on a current element, circulating charges, Cyclotron resonance frequency, Cyclotron. Magnetisation, magnetisation current density, magnetic field intensity, magnetic susceptibility and permeability.(10L)

SECTION D

ELECTROMAGNETIC INDUCTION

Review of Faraday's law, Faraday's experiment, Lenz's law, Time varying magnetic fields, Application in Betatron.

Inductance: Self-inductance, LR circuit, energy in a magnetic field, magnetic energy density.

AC circuits: Sinusoidal voltage, current voltage relation in resistance, capacitance and inductance, Reactance and impedance, Power in AC circuits, RMS values, Power factor, LR and CR circuits. Series and parallel LCR circuits. Resonance, mutual inductance and transformers.(11L)

References Books and Readings:

Electricity and Magnetism, Fewkes and Yarwood.
Electricity and Magnetism: A N Matveev, Mir Publishers, Moscow.
Fundamentals of Physics, 6th Edition, David Halliday, Robert Resnick and Jearl Walker, John Wiley, Inc.
Electricity and Magnetism, F.W.Sears, Addison Wesley Co.
Fundamentals of Electricity and Magnetism : A F Kipp, McGraw Hill.

Course Title/Code	Electricity and Electromagnetism Lab (PHH226-P)
Course Type	Core
Course Nature	Hard
L-T-P -O Structure	0-0-2-0
Credits	1
Course Objective	To learn about fundamentals of electricity and magnetism
Course Outcomes (COs)	
CO1	Students would be able to understand, explain and demonstrate about vector calculus, Gauss law and its application to determine with problems and diagrams.
CO2	Students would be able to understand, construction and working of different types of capacitors. Also, they will able to understand polarization phenomenon.
CO3	Students would be able to understand about Biot Savarts law, Amperes law and different types of forces in magnetostatics.
CO4	Students would be able to understand about propagation of electromagnetic waves and electromagnetic induction.
Prerequisites (if any)	NIL

Electricity and Electromagnetism Practical

- To measure resistance and capacitance measurements using multi meter and coding method.
- To measure the radius of a coil using Stewart and Gees experiment.
- To implement series and parallel combinations of resistance on breadboard.
- To verify and design AND, OR, NOT and XOR gates using NAND gates.
- To determine the frequency of AC mains using sonometer.
- To determine quality factor and resonance of the series and parallel LCR circuit.
- To draw output wave of half wave and full wave rectifier.
- To draw forward and reverse diode characteristics

Course Title/Code	**Gymnosperms and Reproduction in Angiosperms (EDH204-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**(3-0-0-0)**
Objectives	After going through this course, the learner will be able to understand the morphology, anatomy, reproduction and classification of Gymnosperms and the structure, development and processes associated with Angiosperm embryology.
Course Outcomes (COs)	
CO1	Understand the General characteristics, classification and economic importance of Gymnosperms
CO2	Understand the diverse structural and morphological characteristic features of Angiosperm Flower
CO3	Understand the development of male and female gametophyte
CO4	Describe Pollination and Fertilization. Different types of Endosperms, Fruit and Seed
Prerequisites (if any)	----------

SECTION A

Gymnosperms

a) General characters, distribution, classification, affinities and economic importance.

b) Study of morphology, anatomy and reproduction in- Cycadopsida: *Cycas* , Coniferopsida: *Pinus*

Gnetopsida: *Gnetum*

SECTION B

Reproductive structures Angiosperms

a) Flower: Review of structure, morphology, embryological perspective.

b) Microsporangium: Development of wall layers, Tapetal types, microsporogenesis, tetrad types.

c) Male gametophyte: Development and structure; vegetative and generative cells; male gametes.

d) Megasporangium (ovule): Development, types, megasporogenesis, tetrad types.

e) Female gametophyte: Development, ultrastructure, mono, bi and tetrasporic embryo sacs.

SECTION C

Reproduction in Angiosperms

a) Pollination and fertilization -Definitions, Types of Pollination, Pollen-Pistil interaction, Self- incompatibility, Double-fertilization.

b) Endosperm: Definition, Types–Cellular, Nuclear and Helobial; Endosperm haustoria.

SECTION D

a) Embryo: Classification, types, development of Crucifer type.

b) Fruit and Seed: Development, structure of Monocot and Dicot seeds, dispersal mechanisms, importance.

c) Brief account of Apomixis and Polyembryony.

References Books and Readings:

1. Sporne, K.R. (1974). *Morphology of Gymnosperms*. London: Hutchinson & Co.
2. Gangulee, S.C., Kar, Ashok Kumar. (1982).*College Botany Vol.II*.Calcutta: Central Book Agency.

3. Singh,V., Pande,P.C. &Jain,D.K. (2007). *Diversity and systematics of seed plants.* Meerut:Rastogi Publications.

4. Pandey, S.N., Mishra, S.P. & Trivedi, P.S. (2004). *A Textbook of Botany Vol.II*, Delhi:Vikas Publishing House. 4. Chopra G.L. (1972).*Gymnosperms*.Jullandar: S. Nagin & Co.
5. Bhojwani, S. S. and Bhatnagar, S.P. 000. *The Embryology of Angiosperms*. Delhi: Vikas Publishing House.
6. Raven, P.H., Evert, R.F.and S.E.Eichhorn. (1999).*Biology of Plants, 5th Ed*., New York: W.H.Freeman and Co., Worth Publishers. Swamy, B.G.L. and Krishnamurthy, K.V.(1980).*From Flower to Fruit*.New Delhi: TMH Publishing House.
7. Johri, B.M.(Ed.).(1984). *Embryology of Angiosperms*. Germany: Springer- Verlag.

Course Title/Code	Gymnosperms and Reproduction in Angiosperms Lab (EDH204-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	(0-0-2-0)
Credits	1
Course Objective	To observe and identify temporary and permanent slides of Gymnosperms and Angiosperm Embryology.
Course Outcomes (COs)	
CO1	To enable students to identify temporary slides of Gymnosperms and Angiosperm Embryology.
CO2	To enable students to identify permanent slides of Gymnosperms and Angiosperm Embryology.
CO3	To develop among students skills of free hand sectioning, staining and mounting embryological materials.
CO4	To describe characteristics of Gymnosperms and Angiosperms on basis of slide studies
Prerequisites (if any)	------

Gymnosperms and Reproduction in Angiosperms Lab (EDH204-P)

- Observation of disease symptoms in hosts infected by virus, mycoplasma and bacteria.
- Gram staining of bacteria.
- Preparation of bacterial media and culture of bacteria.
- Study of genera included in theory under Cyanobacteria, algae and fungi by making temporary micro preparations and using permanent slides.
- Study of crusto se, foliose and fruticose lichens.

Course Title/Code	Real Analysis (MAH219B)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	4
Course Objective	Students shall be able to apply the Characterization of Real numbers, concepts of Sequences and series of Real numbers and their convergence behaviour in solving the mathematical problems.
Course Outcomes (COs)	
CO1	Understand properties of the real line $\mathbb{R}$ and learn to define sequence in terms of functions from $\mathbb{R}$ to a subset of $\mathbb{R}$.
CO2	Understand properties of topology of real line $\mathbb{R}$ and their application.
CO3	Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
CO4	Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

Prerequisites (if any)	Basic knowledge of sets and number system.

Section A

Real Numbers: The field axioms; Theorems about field properties, Order in R-Absolute value, Completeness, some important subsets of Intervals, Countable and Uncountable sets. Introduction, Neighborhoods, Open Sets, Closed Sets, Limit points of a set, Closure of a set, Interior of a set, Compactness, Connectedness.

Section B

Sequences: Introduction, Convergent sequences, Divergent sequences, Oscillatory sequences, Bounded sequences, Some important limit theorems, Cauchy sequences, Monotonic sequences, Cluster points of a sequence, Limit superior and limit inferior of a sequence, Subsequences.

Section C

Infinite Series: Introduction, Sequence of partial sums of a series, Convergent series, Cauchy's general principle of Convergence for Series, A necessary condition for convergence, Series of positive terms, A fundamental result for series of positive terms, Geometric series, Comparison test, Cauchy's nth root test, D'Alembert's Ratio test, Raabe's test, Integral test, alternating series, Leibniz test, Conditional Convergence, Absolute convergence.

Section D

Riemann Integral: The Upper and lower R-integrals, Integrable (R) functions, Properties of definite and indefinite integral Riemann condition of integrability, Riemann sum, Basic inequality of Riemann integral, algebraic and order properties of the Riemann integral. Riemann integrability for continuous functions, monotonic functions and functions with finite number of discontinuities.

Recommended Books:

1. Real Analysis by Malik, Wiley Eastern.
2. Mathematical Analysis by Shanti Narayan, S. Chand and Co. Ltd.
3. Mathematical Analysis by Malik and Savita Arora, New Age International Pvt. Ltd.
4. Principles of Mathematical Analysis by Walter Rudin, 2nd Edition, McGraw Hill Book Company, 1984.

Course Title/Code	**Animal Diversity III and Comparative Anatomy Of Vertebrates (EDH205-T)**
Course Type	**Core**
Course Nature	Hard
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	To enable students to understand in respect of vertebrates; their organizational hierarchies and complexities; the evolutionary trends in external morphology and comparative studies of internal structures; Identification and classification with examples; to enable them to understand various modes of adaptations in animals.
Course Outcomes (COs)	
CO1	To understand and analyse characteristics of Pisces
CO2	To Understand basic characteristics of amphibians and parental care
CO3	To understand and analyse hierarchy in reptiles and aves
CO4	. To develop the understanding of evolutionary trends in Mammalia
CO5	To develop the understanding of heart and aortic arches
CO6	To understand the structure and evolution of kidneys and gonads in vertebrates
Prerequisites (if any)	Basic knowledge of animal kingdom

SECTION A

PISCES AND AMPHIBIA

a) Pisces: General Characters and Classification of SuperclassPiscesupto classes with examples and comparison of Chondrichthyes and Osteichthyes ; Type study: Scoliodon– External morphology, respiratory system, structure of heart and arterial system, structure of brain and lateral line system ; Dipnoi, air bladder, migration in fish
b) Amphibia: General characters and classification of class Amphibia, origin of Amphibia, parental care in Amphibia

SECTION B

REPTILIA, AVES AND MAMMALIA

a) Reptilia: General characters and classification of class Reptilia up to orders with examples.
b) Aves: General characters and classification of class Aves up to orders with examples (5 important orders only), salient features of Archaeornithes and Neornithes, flight adaptation and migration in birds
c) Mammalia: General characters and classification of class Mammalia up to order with examples; General characters of Prototheria ; Adaptive radiation in Marsupials and Primates ; Adaptive features of Chiropetera and Cetacea ;Dentition in mammal

SECTION C

TYPE STUDY – RABBIT AND COMPARATIVE ANATOMY–I

Type study: Oryctolagus(Rabbit) – Respiratory system and structure of brain Sense organs – eye and ear,Comparative studies in amphibians, reptiles, birds and mammals:i) Digestive system and associated glands , Respiratory organs, Evolution of heart in vertebrates ,Evolution of aortic arches in vertebrates

SECTION D

COMPARATIVE ANATOMY–II

- Comparative studies in amphibians, reptiles, birds and mammals:
- Brain
- Eye and ear of birds and mammals
- Cranial and spinal nerves, Autonomous nervous system
- Different types of vertebrae in vertebrates
- Structure and evolution of kidneys in vertebrates
- Structure of gonads and gonoducts formation

References Books and Readings:

- Modern Textbook of Zoology: Vertebrates by R.L. Kotpal – Rastogi Publications, Meerut, 3rd edition, 2008.
- A Text Book of Zoology Vol.II by Parkar and Hasswel – (MacMillan).
- A Text Book of Zoology Vol.II by R.D.Vidyarthi – (S. Chand & Co., Delhi). 4.Life of Vertebrates by J.Z.Young – (Oxford University Press).
- The Vertebrate Body by A.S.Romer – (Vakils, Ferrer& Simons, Bombay). 6.Elements of Chordate Anatomy by Weichert – (McGraw Hill).
- The Birds by R.L Kotwal (4th edition) – (Rastogi Publications, 2008). 8.Bird Migration by D.R. Griffin – (Doubleday, Garden City, USA).
- The Book of Indian birds by Salim Ali

- Hand Book of the Birds of India & Pakistan by Salim Ali, Ripley, Dillon –(Oxford University Press, Delhi).
- Fish and Fisheries by K. Pandey and J.P. Shukla (2nd Edition) (Rastogi Publications, 2008). 12.Indian Fishes by Qureshi and Qureshi – (Brij Brothers, Bhopal).
- Comparative anatomy of the vertebrates by George C Kent – 3rd saint Louis: The C.V. Mosby Company

Course Title/Code	**Animal Diversity III and Comparative Anatomy of Vertebrates Lab (EDH205-P)**
Course Type	**Core**
Course Nature	Hard
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	To develop in the students the skills of staining and mounting of materials (temporary and permanent); of dissection, display and Labelling; of micro techniques (fixing, embedding, section cutting, staining and mounting); of collection, preservation, mounting, identification and Labelling of collected specimens; field observation of animals.
Course Outcomes (COs)	
CO1	To develop in the students the skills of staining and mounting of materials (temporary and permanent); of dissection
CO2	To develop in the students the skills of display and Labelling; of micro techniques of fixing, embedding, section cutting, staining and mounting
CO3	To develop in the students the skills of collection, preservation, mounting, identification and Labelling of collected specimens
CO4	To develop in the students the skills of field observation of animals
Prerequisites (if any)	-----

- Study of specimens of Chondrichthyes:

- Zygaenab) Pristis
- Trygone) Skate
- Study of specimens of Osteichthyes:
- Echeneisb) Clariasc) Hippocampusd) Anguilla
- Belonef) Synaptura g) Tetradonh) Diodon
- Mounting of fish scales:
- Dissection of Scoliodon(Study of dissected specimens):
- Afferent and efferent branchial system.
- Cranial nerves (5th, 7th, 9th and 10th).
- Study of specimens of Amphibians:
- Salamanderf) Ichthyophisg) Axolotal larva.
- Study of specimens of Reptilia:
- Chameleon b) Varanusc) Draco
- Tortoisee) Crocodile
- Identification of poisonous and non-poisonous snakes:
- Cobrab) Kraitc) Rat snake
- Vipere) Dryophisf) Hydrophis
- Study of specimens of Aves:
- Barn owlb) Water henc) Wood pecker
- Cattle egret e) Koelf) King fisher
- Local field visit to identify and classify 10 fauna (common birds and mammals); submission of report.
- Dissection of rat (demonstration):
- Digestive system
- Urinogenital system
- Arterial system
- Osteology:
- Study of skulls of Frog, Varanus/Calotes, Bird and Rabbit.
- Study of fore and hind limb bones of Frog, Varanus/Calotes, Bird and Rabbit
- Study of different types of vertebrae:
- Study of pectoral and pelvic girdles of Frog, Varanus/Calotes, Bird

Course Title/Code	**Basics of Biophysics (EDH221-**T)
Course Type	**Core**
L-T-P-O Structure	**(3-0-0-0)**
Credits	**3**
Course Objective	To enable the learner to apply the principles of physics and chemistry to understand the biological systems.
CO1	Understand and explain basic concepts of Biophysics.
CO2	Understand and explain the multidisciplinary dimensions of Biophysics.
CO3	Understand the principles of Biophysics and underlying fundamentals.
CO4	Understand and explain about the various Bio-molecular mechanisms.
CO5	Appreciate the invention of instruments for welfare of human beings and life.
Prerequisites (if any)	

Section A

Introduction to Bio- Physics

Meaning, Nature, Scope, Need and Importance of Biophysics. Dynamic nature of Biophysics and Instrumentation. Fundamental of Biophysics in understanding the dynamics of Bio- Molecules.

Section B

Biophysical properties and Cellular Bio-physics

Surface tension, adsorption, diffusion, osmosis, dialysis and colloids. Molecular alphabets of life Amino acids, nucleic acid bases and lipids. Classification and properties of amino acids, peptides and poly peptides. Nucleosides, nucleotides, polynucleotides, pentose and hexose poly saccharides. Cell membrane and Transport Structure and function of cellmembrane. Types of transport across cell membrane. Transport of ions and molecules through cellmembranes.

Section C

Fundamentals of Bio-Physics and instrumentation

Basic of Bio-Physics instrumentation system, Functional component in design of biomedical instrumentation systems. Fundamentals of microscopic imaging Physics of light and color, basic concepts in microscopy, anatomy of the microscope, (light microscopy), specialized microscopy techniques- phase contrast and dark field microscopy, simple fluorescence microscopy, confocal microscopy, time lapse fluorescence, fluorescence resonance energy transfer (FRET), Labeling biomolecules for fluorescence microscopy, electron microscopy, interaction of electron beam with samples, scanning and transmission electron microscopy (SEM and TEM).

Section D

Principles of x-ray crystallography

Unit cell, cell content, crystal symmetry, crystal systems, Bravais lattices, symmetry elementsand operations, point groups and space groups. Bragg's law. Diffraction of x-rays by crystals, atomic scattering factors and structure factors, amplitude and phase.

Text Books and References

1. Physical Chemistry for Life Sciences by Barrow C, MC-Grow Hill.
2. Biophysical Chemistry by Bloomfield V A and Harrington R E, W A Freeman and Co.
3. Biophysical Chemistry by Cantor C R and Schimmel, P R, W A Freeman and Co.
4. Protein, by Hasehemyer R N and Hasehemyer ACBV,John Willy and Sons.
5. Aspects of Biophysics, Hughe S W, John Willy andSons.

Course Title/Code	**Basics of Biophysics Lab (EDH221-P)**
Course Type	**Core**
L-T-P- O Structure	**(0-0-2-0)**
Credits	**1**
Course Objective	To develop skills of using basic biophysical techniques, instrumentation and computer modelling to analyse and understand biomolecules and other biological systems.
Course Outcomes (COs)	
CO1	Demonstrate skills used to analyze biomolecules using various biophysical techniques.
CO2	Demonstrate proficiency in using optical microscopes to study biological specimens and slides.
CO3	Demonstrate use of bioinformatic tools to analyse sequence and structure of biomolecules
Prerequisites (if any)	

LIST OF EXPERIMENTS

1. Analysis of DNA fragments using agarose gel electrophoresis.
2. Separation of pigments present in the leaves (spinach) and flowers (rose, marigold) by paper chromatography and determination of Rf value of components.
3. Study of microscopes: Simple, compound, dissecting and fluorescence. Handling of microscopes.
4. Preparation and study of stained and permanent slides.

Bioinformatics:

5. Exploration of the resources available in NCBI, PDB, PUBMED etc.
6. Retrieval of a Genbank Entry using an accession number.
7. Retrieval and analysis of a amino acid and gene sequence in FASTA format.
8. Retrieval and analysis of a protein sequence from protein database.
9. Primary and Secondary structure analysis of a protein.

Course Title/Code	**Knowledge and Curriculum (EDH206-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**(3-0-0-0)**
Credits	**3**
Course Objectives	The course helps students to identify various dimensions of the curriculum and their relationship with the aims of Education. Also to help prospective teachers to take decisions about and shape educational and pedagogic practice with greater awareness of the theoretical and conceptual context.

Course Outcomes (COs)	
CO1	Explain the concept of knowledge and its relationship with various aspects of curriculum Development
CO2	Analyse epistemological thoughts of various Indian and western educationists with regard to significant aspects of curriculum
CO3	Infer the interrelationship among Education, social forces and curriculum development
CO4	Assimilate the process of curriculum development with all its significant components
CO5	Reflect on the role of National Level institutions in curriculum Planning
Prerequisites (if any)	NA

SECTION A

KNOWLEDGE AND EDUCATION

Concept of knowledge, Methods of acquiring knowledge, Different kinds of knowledge, Nature of knowledge, belief, information, skill, perception,Epistemological thoughts of M.K. Gandhi, Rabindranath Tagore, Rousseau, John Dewey, Plato and Paulo Freire in context to activity/ discovery/ dialogue as defined for contemporary education

SECTION B

SOCIAL SYSTEMS AND KNOWLEDGE

Aims of Education and Society, Impact of social structure on concept of knowledge and teaching practices, Role of teacher in knowledge construction, concept of Academic Freedom, Interrelationship of education with culture, secularism, economy, politics, modernization and History

SECTION C

CURRICULUM- BASICS AND DEVELOPMENT

Concept of Curriculum and Syllabus, Core and Hidden Curriculum- Meaning and Role,
Curriculum Development- Basic considerations, Principles, Determinants, Different Approaches of Curriculum Development, Process of Curriculum Development, Interrelationship between market forces, assessment, and curriculum

SECTION D

CURRICULUM FRAMEWORK AND TRANSACTION

Meaning of Curriculum Framework and Curriculum Transaction**,** Critical analysis of NCF2005 and its recommendations**,** Role of National and State level agencies in framing of the Curriculum- NCERT,SCERT, Boards of Education**,** Role of textbooks in Curriculum transaction**,** Addressing critical issue through Curriculum: Environmental concern, Gender Difference, inclusiveness and value inculcation

Reference Books and Readings:

1. Bawa, M. S. & Nagpal, B. M. eds (2016). *Developing Teaching Competencies*. New Delhi: Viva Books pvt. ltd.

2. Butchvarov, P. (1970). *The Concept of Knowledge*. Evanston, Illinois: North Western University Press.
3. Dewey, J. (1997). *Experience and Education.* Touchstone, New York.
4. Kelly, A. V. (2006). *The Curriculum: Theory and Practice* (Fifth Edition). Sage Publications
5. Krishna, D. (1997). *Gyan Mimansa*. Jaipur: Rajasthan Hindi Granth Academy.
6. NCERT (2005). *National Curriculum Framework*. New Delhi: NCERT.
7. NCERT (2006). *Position Paper, National Focus Group on Curriculum, SylLabus and textbooks*. New Delhi: NCERT.
8. NCERT (2006). *Position Paper, National Focus Group on Systematic Reforms for Curriculum Change.* New Delhi: NCERT.
9. Sarangapani, P. (2003). *Construction of School Knowledge*. New Delhi: Sage Publication.

Course Title/Code	**Knowledge and Curriculum Lab (EDH206-P)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**(0-0-2-0)**
Credits	**1**
Course Objectives	The course helps students to identify various dimensions of the curriculum and their relationship with the aims of Education. Also, to help prospective teachers to take decisions about and shape educational and pedagogic practice with greater awareness of the theoretical and conceptual context.

Course Outcomes (COs)	
CO1	discuss the educational thoughts of great educational thinkers on child centered education
CO2	Analyse epistemological thoughts of various Indian and western educationists with regard to significant aspects of curriculum
CO3	To comprehend curriculum process and practice
Prerequisites (if any)	NA

1. Analyze and make report on the transactional curriculum of any one upper primary and secondary class in any one school subject in light of various considerations of Curriculum Development
2. *Write a report on different methods used by school teacher for construction of knowledge based on survey and observation in school
3. Analyze NCF 2005 with respect to different areas of Curriculum and prepare a presentation on it.
4. Draft out a few activities related to social concerns which can be incorporated in the
5. curriculum transaction.

Course Title/Code	Gender, School and Society (EDS207)
Course Type	Core
Course Nature	Soft
L-T-P-O Structure	1-0-2-0
Credits	2
Course Objective	To examine the role of school and society in shaping gender identities.
Course Outcomes (COs)	
CO1	To develop a positive notion on sexuality amongst young people.
CO2	To identify social construction of gender under the lens of class and caste intersectionality.
CO3	To analyse the role of schools in promoting gender equality through value education.
CO4	To develop a strategic approach towards women empowerment with the support of government agencies.

SECTION A: PARADIGM SHIFT GENDER ROLES

Concept of gender, difference between gender and sex. Paradigm shift from women studies to gender studies: Brief discussion of landmarks in social reform from Vedic period to 21st century. Patriarchy vs. Matriarchy.

SECTION B: SOCIAL CONSTRUCTION OF GENDER

Gender Identity and its theoretical approaches, agencies of gender socialization (family, school, society, media).

Gender roles and stereotypes. Gender and its intersection with Poverty, Caste, Disability and Region (rural, urban and tribal). Protection of children from sexual offences act 2012.

SECTION C: GENDER AND SCHOOL

LGBT concepts Gender Bias in School Environment, Gender Bias in Dropouts, Gender Bias in Household responsibilities, Social attitudes towards Girl's Education, Value accorded to Women's Education.

Gender equality- Role of schools in reinforcing gender equality, Role of peers in reinforcing gender equality, Role of teachers in reinforcing gender equality, Role of curriculum and textbook in reinforcing gender equality

SECTION D: STRATEGIES FOR CHANGE

Role of media in reinforcing gender parity, The role of family, religion, etc. in reinforcing gender parity. The role of NGOs and women's action groups in striving towards gender equity, The efforts of the government agencies to achieve gender parity: reservations and legal provisions Millenium Development Goal: Promoting gender equality and empowerment

Reference Books

1.Government of India (1975).*Towards Equality: Report of the committee on the status of Women in India*. Delhi: Department of Social Welfare, Government of India.

2.Kumar, K. (2010). Culture, State and Girls: An Educational Perspective. *Economic and Political Weekly,* XLV(17), p. 24.

Activities:

1. Analysis of folk songs in different languages to identify the myths prevailing in different regions.
2. Poster making: A society with complete gender parity.
3. Short plays with Gender equality as theme.
4. A case study based on Gender bias and intervention given to create awareness.
5. *Covert observation: To observe the distribution of roles and responsibilities among different gender groups in the school and identify their significance in promoting gender bias/ parity.
6. Develop and present a skit that portrays gender inequality (Group activity).
7. Choose any one woman achiever from an unconventional field and analyze the various gender biases she would have overcome to achieve her goals.

Reference Books:

1. Bordia,A. (2007). *Education for gender equity.* The Lok Jumbish experience, p. 313-329.
2. Chatterji,S.A. (1993). *The Indian Women in Perspective.* New Delhi: Vikas Publishing.

Course Title/Code	Craft and Visual Arts (EDW208)
Course Type	**Core**
Course Nature	**Workshop**
L-T-P-O Structure	**0-0-3-0**
Credits	**1.5**
Course Objective	Demonstrate an understanding of the relationships between the arts and other disciplines.
Course Outcomes (COs)	
CO1	To demonstrate awareness and understanding of craft and visual art forms
CO2	To demonstrate skill at integrating craft and visaul art for effective teaching
CO3	To demonstrate aesthetic sensibility to respond through expression
CO4	To demonstrate imagination through participation in craft and visual art activities

SECTION A

Meaning and concept of Crafts and Visual Arts, various forms of Crafts and Visual Arts and their significance at secondary level of school education, relationship of arts and craft with aesthetics, identification and experimentation with different forms of crafts and visual arts

SECTION B

APPLICATION OF CRAFTS AND VISUAL ARTS IN EDUCATION

Knowledge of Indian art and craft tradition and its relevance in education, Exploring crafts and visual arts in education as pedagogy across school curriculum, planning lessons with systematic classroom integration, Role of teacher in visual art and craft in integrated learning in the form of

Sketching, Quilling, Calligraphy, Mask Making etc.

Practical

- Monotype surface painting: thread painting, vegetable painting, stamp painting, block painting, spray print
- Making a Digital story on emerging social issue by making use of software, apps and other technological tools
- Preparation of two teaching learning materials; Charts, Models, Flash Cards, Flip books etc
- Mindfulness based activity - Portrayal of the ‘Self concept’/ ‘Future Me’ in the form of mind map through different symbols, colors, shades and designs
- Recycling activity (Making usable papers through paper waste)
- Paper folding activity; Folders, paper bags, lanterns and Greeting Cards
- Candle making activity
- Decorating Activity - Pottery and Diyas
- Glass painting
- Quill art and flower making activity
- Paper Sculpture, Paper craft, and Paper Mache
- Jumping Clay, Calligraphy and Mask Making
- Creating Best out waste
- Making an E-portfolio in the form of digital compilation and documentation of all art and craft activities undertaken

Course Title/Code	**Spanish-I/** FLS101
Course Type	University Compulsory
Course Nature	Elective
L-T-P-O Structure	1-1-0-0
Credits	0
Course Objective	Demonstrate advanced proficiency in spoken and written Spanish
Course Outcomes (COs)	
CO1	Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.
CO2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes.
CO3	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

CO4	Students will be able to understand audio text and comprehend to the same. They will be able to form paragraph using auxilary verb and basic verbs.
CO5	Students will be introduced to Spanish culture and civilization. They will be able to describe various places and locations of Francophonic countries.

SECTION A

Introduction to Spanish and SER

1.1 Presentation on Spanish language

1.2 Greetings and goodbyes

1.3 Spanish letters

1.4 Introduction of verboSER

SECTION B

Verb Ser, Nationality, Profession and Counting

2.1 Uses of verbo SER

2.2 Adjectives related to verbo SER.

2.3 Introduction of Nationality

2.4 Professions and vocabulary related to professions.

2.5 Counting till number 20.

SECTION C

Articles, Interrogative and Estar

3.1 Introduction of Articles and Indefinite articles

3.2 Interrogatives

3.3 Introduction of VerboEstar

SECTION D

Estar, Preposition, Tener and Self Introduction

4.1 Uses of Verbo ESTAR and adjectives related to it

4.2 Introducton of ‘my house’ vocabulary

4.3 Prepositions related to the positioning of an object

4.4 Self – introduction

Day, Month and Regular AR verb

5.1 Days

5.2 Months

5.3 Introduction to regular –AR verbs

Text Books/Reference Books:

1.¡Ole!-Langers
2¡Uno, dos, tres……

Weblinks:

http://studyspanish.com/

Assessment Tools:

Sessional tests
Term end examination scores
Participation in class activities
Home assignments
Class attendance

Section A

Subjekt oder Nominativ Personal Pronomen
wichtige Verben (sein , haben , heiβen, kommen, wohnen)
Formelle und informelle Fragen
Kardinalzahlen 1-20
Kardinalzahlen 21-100 und Ordinalzahlen
wie geht es dir?, kleine Dialoge

Section B

regelmäβige Verben/ unregelmäβige Verben
Zahlen 0 -100
Articles
Fragen bilden (W_Fragen oder Ja/nein Fragen)
Länder und Sprachen
Translation

Section C

die Grüβe
Subjekt oder Nominativ Personalpronomen

wichtige Verben (sein , haben , heiβen, kommen, wohnen)

Formelle und informelle Fragen
Kardinalzahlen 1-20
Kardinalzahlen 21-100 und Ordinalzahlen
wie geht es dir?, kleine Dialoge
regelmäβige Verben – spielen, schlafen, fliegen
unregelmäβige Verben

Section D

Articles
Ja oder Nein Fragen
Länder und Sprachen
Translation
Dates
Hobbies and profession
Sport
Time
Weekdays and months

Course Tittle/Code	**GERMAN-I/ FLS102**
Course Type	**University Compulsory**
Course Nature	**NTCC**
L-T-P Structure	**1-1-0**
Prerequisite	**0**

CO	Course Outcomes (COs)	Mapping
1	Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.	Employability, Skill Development
2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary.	Employability
3	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.	Employability, Skill Development
4	Students will be able to understand audio text and comprehend to the same. They will be able to form paragraph using auxilary verb and basic verbs.	Employability, Skill Development

SECTION-A

Unit-1: Begrüßungen

1.1 Salutations/Greetings

1.2 Introduction

Unit-2: sichvorstellen und Zahlen

2.1 Introduction

2.2 Alphabets

2.3 Numbers 1-20

SECTION-B

Unit-3: Berufe/ Pronomen

3.1 Personal pronouns

3.2 Hobbies and professions

SECTION-C

Unit-4:Café

4.1 Café related vocabulary and dialogues

4.2 Revision personal pronouns

Unit-5: Café dialog

5.1 Café related vocabulary and dialogues

5.2 Common verbs and their conjugations

SECTION-D

Unit-6: Zeit und Monate

6.1 Time

6.2 Days

6.3 Months

Text Books/Reference Books:

1. Studio D A1, Hermann Funk, 2011, Cornelson Publication
2. TangaramAktuell A1, Kursbuch&Arbeitsbuch, 2011, Hueber
3. Netzwerk, Stefanie Dengler, Paul Ruschet. Al, 2011, Klett

Weblinks:

http://www.nthuleen.com/

Course Title/Code	French-I/FLS103
Course Type	University Compulsory
Course Nature	Elective
L-T-P-O Structure	1-1-0-0
Credits	0
Course Objective	Demonstrate advanced proficiency in spoken and written French
Course Outcomes (COs)	
CO1	Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.
CO2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes.
CO3	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.
CO4	Students will be able to understand audio text and comprehend to the same. They will be able to form paragraph using auxilary verb and basic verbs.

CO5	Students will be introduced to French culture and civilization. They will be able to describe various places and locations of Francophonic countries.

SECTION-A

Unit 1 - Saluerетépelerl'alphabet

1.1 Les Salutations & forms of politeness

1.2 Alphabets

Unit 2- Usage de Vouset de Tu

2.1 Taking leave expressions

2.2 Les pronomssujets

2.3 Basic Questions

SECTION-B

Unit 3- Présentez-vous

3.1 Les verbes ER

3.2 Self introduction

3.3 Décrivezvotreami(e)

SECTION-C

Unit 4- Identifier unnombre, compter

4.1 Les nomS.2 VerbesAvoir, Etre, Aller& Faire

4.3 Lesnombres

Unit 5- Demander/ donnerl'explications

5.1 Les articles define etindefini

5.2 Les mois de l'annee

5.3 Lesjours de la semaine

SECTION-D

Unit 6- Parler des saisonset demander l'heure

6.1 Time

6.2 Weather

6.3 Unseen Passage

Text Books/Reference Books/ Suggested Readings:

1. Alter Ego Level One Textbook, Annie Berthet, Catherine Hugot, Hachette Publications
2. Apprenons Le Francais II & III,MahithaRanjit, 2017, Saraswati Publications

Weblinks:

www.bonjourfrance.com
www.allabout.com

SEMESTER - 4											
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/ Workshop/ NTCC)**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH238-T	Thermodynamics, Equilibrium and Solutions	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH238-P	Thermodynamics, Equilibrium and Solutions Lab				0	0	2	0		
CHH313-T	Organic Chemistry II	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
CHH313-P	Organic Chemistry II Lab				0	0	2	0		
PHH227-T	Optics	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
PHH227-P	Optics Lab				0	0	2	0		
EDH224-T	Angiosperm Anatomy, Evolution and economic Botany	EDU			3	0	0	0	5	
EDH224-P	Angiosperm Anatomy, Evolution and economic Botany Lab				0	0	2	0		
MAH249 T	Differential Equation	APPLIED SCIENCE	HARD	CORE	3	1	0	0	6	4
MAH249 T	Differential Equation Lab				0	0	2	0		
EDH225	Animal Physiology and Endocrinology	EDU			3	0	0	0	5	
EDH225	Animal Physiology and Endocrinology Lab				0	0	2	0		
EDH122-T	Assessment For Learning	EDU	HARD	CORE	3	0	0	0	5	4

EDH122-P	Assessment For Learning Lab				0	0	2	0		
EDS227	School Organization & Management	EDU	SOFT	CORE	1	0	2	0	3	2
EDW228	Skill Lab, Robotics-Project Based Learning	EDU	WORK SHOP	CORE	0	0	3	0	3	2
MOOC-18E-EDN-205	Design Thinking- A Primer	EDU	MOOC	CORE	0	0	0	3	3	2
EDN229	Street Play/ Skit/ Mime		Elective Workshop	CORE	1	0	2	0	3	
MOOC-19E-EDS-201	Principles of Human Resource Management	EDU	MOOC	CORE	0	0	0	3	3	2
FLS105	Spanish-II	MRCFL	ELECTIVE	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS106	German-II									
FLS107	French-II									
TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)					18	5(PCM)/3(ZBC)	17	6	46(PCM)/44(ZBC)	28

(EDO239) Two weeks Community Connect internship (1.5 credits)

Course Title/Code	**Thermodynamics, Equilibrium & Solutions CHH238-T**	
Course Type	**Core**	
Course Nature	**Hard**	
L-T-P-O Structure	**3-1-0-0**	
Credits	**3**	
Course Objective	**To make student able to understand the practical aspects of kinetics of the reactions & different potentiometric titrations**	
Course Outcomes (COs)		**Mapping**
CO1	**To develop an understanding of the chemistry heat of neutralization of acids and bases**	**Skill Development**
CO2	**To develop basic skills for Verification of Hess's law of constant heat summation**	**Skill Development**
CO3	**Learn Determination of dissociation constant of a weak acid in Physical chemistry Laboratory**	**Employability**
CO4	**Perform determination of dissociation constant of phenolphthalein/methyl orange by colorimeter**	**Skill Development**
Prerequisites	**Nil**	

SECTION A

Concept of Energy, Historical perspectives, Generalization of laws of Thermodynamics based on human experience with Nature and natural Processes. Language of thermodynamics: system, surroundings, etc. Types of system, 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, Joule– Thomson coefficient and inversion temperature. Calculation of w.q. dU and dT for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.Thermochemistry: 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. **(10 L)**

SECTION B

To unify the equilibrium properties of simple mixtures on the basis of chemical potential. Solutions of Gases in liquids. Henry's law and its applications, solutions of solids in liquids. Distribution law, application of distribution law to association, dissociation and extraction.

ECTION C

SOLUTIONS

Dilute Solution: Colligative properties, Osmosis, Osmotic pressure, Vant Hoff Theory, Lowering of Vapour Pressure, Depression in Freezing point and Elevation in Boiling Point, Vant Hoff Factor.
Liquid – liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system –
Azeotropes – HC – H_2O and ethanol – water systems.
Partially miscible liquids – Phenol-water, trimethylamine – water, nicotine – water systems.

SECTION D

Dilute Solution : Colligative properties, Osmosis, Osmotic pressure, Vant Hoff Theory, Lowering of Vapour Pressure, Depression in Freezing point and Elevation in Boiling Point, Vant Hoff Factor.
Liquid – liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system –
Azeotropes – HC – H_2O and ethanol – water systems.
Partially miscible liquids – Phenol-water, trimethylamine – water, nicotine – water systems.

Reference Books and Readings:

4. University Chemistry : Bruce Mahan
5. Concise Inorganic Chemistry : J D Lee
6. An Introduction to Inorganic Chemistry : Mackay and Mackay
7. Concise Inorganic Chemistry : J D Lee
8. An Introduction to Inorganic Chemistry : Mackay and Mackay
9. Principles of Physical Chemistry : Marron and Prutton
10. Elements of Physical Chemistry : Samuel Glasstone and Lewis

Course Title/Code	Thermodynamics, Equilibrium & Solutions CHH238-P	
Course Type	Core	
L-T-P-O Structure	0-0-2-0	
Credits	1	
Course Objective	To make student able to understand the practical aspects of kinetics of the reactions & different potentiometric titrations	
Course Outcomes (COs)		Mapping
CO1	To understand that conservation of energy is the central concept which governs all the changes and to appreciate its role in various thermo chemical equations.	Skill Development
CO2	Explain the origin of the driving force of physical and chemical changes and evolution of second law of thermodynamics and related concepts	Skill Development
CO3	To apply the concept of equilibrium to construct and interpret the phase diagrams.	Employability
CO4	To relate the measurement of colligative properties with molar mass to analyze van't Hoff factor for association and dissociation of non-volatile solutes in solutions	Skill Development
Prerequisites	Nil	

1. Determination of heat of neutralization of acids and bases.
2. Verification of Hess's law of constant heat summation.
3. Determination of solubility of sparingly soluble salt at various temperature, calculation of enthalpy of solution.

4. pH titration of acid versus base (observation of change in pH).
5. Construction of phase diagram for a two-component system. (Solid-solid, liquid-liquid).
6. Determination of equivalent constant of hydrolyses of an ester.
7. Determination of dissociation constant of a weak acid.
8. A comparative study on methods of finding pH using universal indicator, pH paper strips (both wide and narrow range), pH meter.
9. Determination of solubility product constant (Ksp) of a sparingly soluble salt.
10. Determination of dissociation constant of phenol phthalein/methyl orange by colorimeter.

References:

A Text Book of Qualitative organic Analysis, A I Vogel

Course Title/Code	Organic Chemistry-II (CHH313-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	3
Course Objective	To give an in-depth exposure of Organic Chemistry and familiarize the students with advance concepts of Organic Chemistry
Course Outcomes (COs)	
CO1	To develop an understanding of the chemistry of Functional groups and mechanisms of Organic Reactions.
CO2	To develop basic skills of separation of organic compounds and evolve a scheme of analysis of organic compounds based on properties of functional groups for identification
CO3	Learn the properties, synthesis and chemical reactions of halogen and/or oxygen containing functional groups in organic chemistry
CO4	Perform inter-conversions of various functional groups in organic chemistry.
Prerequisites	

SECTION A

ALCOHOLS AND PHENOLS

Monohydric alcohols: Nomenclature, methods of formation (reduction of aldehydes, ketones, carboxylic acids and esters). Hydrogen bonding, Acidic nature. Reactions of alcohols (oxidation, esterification, dehydration).
Dihydric alcohols: Nomenclature, methods of formation (from alkenes and alkyl dihalides), chemical reactions of vicinal glycols - oxidative cleavage [Pb $(OA_c)_4$ and HIO_4] and Pinacol-pinacolone rearrangement.
Trihydric alcohols: Nomenclature and methods of formation (from alkenes and alkenals), chemical reactions of glycerol (with nitric acid, oxalic acid and HI). Phenols: Nomenclature, structure and bonding, Preparation of phenol, resorcinol and 1 and 2- naphthols (one method each). Physical properties and acidic character of phenol. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols: Electrophilic aromatic substitution, acylation and carboxylation.

(10 L)

SECTION B

CARBONYL COMPOUNDS 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. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Use of acetals as protecting group. Baeyer-Villager oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. **(8 L)**

SECTION C

ORGANIC SYNTHESIS VIA CARBANIONS

Synthesis of ethyl acetoacetate by Claisen condensation and diethyl malonate. Acidity of α – hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthetic applications of malonic ester: dicarboxylic acids – succinic acid and adipic acid; α,β – unsaturated acids – crotonic acid and cinnamic acid; barbituric acid.Synthetic applications of acetoacetic ester: dicarboxylic acids – succinic acid and adipic acid; α, β – unsaturated acids – crotonic acid and cinnamic acid; antipyrine, uracil and acetyl acetone. keto-enol tautomerism of ethyl acetoacetate. **(8 L)**

SECTION D

ORGANIC COMPOUNDS OF NITROGEN

Nitro Compounds: Introduction, Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.

Aliphatic and Aromatic amines: Structure and nomenclature of amines, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitrites), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reactivity, physical properties, stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines (Hinsberg's method). Structural features effecting basicity of amines. Amine salts as phase – transfer catalysts. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations by aryl diazonium salts, azo coupling.

Course Title/Code	**Organic chemistry ii Lab (CHH313-P)**
Course Type	**Core**
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	**To give an in-depth exposure of Organic Chemistry and familiarize the students with advance concepts of Organic Chemistry**
Course Outcomes (COs)	
CO1	**To develop an understanding of the chemistry of Functional groups and mechanisms of Organic Reactions.**
CO2	**To develop basic skills for the analysis of organic compounds based on properties of functional groups for identification**
CO3	**Learn the properties, synthesis and chemical reactions of halogen and/or oxygen containing functional groups in organic chemistry Laboratory**
CO4	**Perform inter-conversions of various functional groups experimentally**
Prerequisites	

Experiments

List of practicals:

1. Qualitative organic analysis:

(i) Separation of organic mixtures containing two solid components using water , $NaHCO_3$, NaOH

(ii) Analysis of an organic compound: Detection of extra elements (N,S and X) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, alcohols, amines, amides, nitro and anilides) in simple organic compounds. Identification of organic compound based on functional group analysis, determination of physical constant (mp /bp).

2. Separation of green leaf pigments (spinach leaves may be used) by chromatography.

3. Preparation and separation of 2,4-dinitrophenylhydrazones of acetone / 2-butanone using toluene : light petroleum (2:3 ratio) by chromatography.

4. Separation of mixture of dyes by chromatography.

5. Separation of mixture of amino acids by chromatography.

6. Separation of mixture of D-galactose and D-fructose using n-butanol:acetic acid:water (4:5:1) ; Spray reagent: anilinehydrogenphthalate.

Course Title/Code	Optics (PHH227-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	3
Course Objective	To enable students to understand that light is a wave phenomenon and to apply the understanding of wave phenomenon to light.
Course Outcomes (COs)	
CO1	Students would be able to understand about interference of light.
CO2	Students would be able to understand about diffraction of light.
CO3	Students would be able to understand about polarisation of light.
CO4	Students would be able to understand about LASER and Optical fiber.
Prerequisites (if any)	Nil

Section A: WAVE NATURE OF LIGHT AND INTERFERENCE

Light-electromagnetic spectrum, Rotating mirror method of determination of speed of light, Huygen's principle, explanation of reflection and refraction, Fermat's Principle, Phase change on reflection, total internal reflection. Young's experiment - coherence, intensity

distribution and visibility of fringes, Newton's rings, Fresnel's Biprism, interference in thin films, colours of thin films, interference at an air wedge, Michelson's interferometer.

Section B: DIFFRACTION

Fraunhoffer and Fresnel: Diffraction, Diffraction at a single slit, double slit, Diffraction by multiple slits, Diffraction grating, Resolving power – Rayleigh's criterion, Resolving power of a grating and telescope. Fresnel diffraction, half period zone, zone plate, diffraction at a circular aperture and at a straight edge (qualitative treatment only).

Section C: POLARISATION

Polarization by reflection, Brewster's law, Malus law, Double refraction, Production and detection of linearly, circularly and elliptically polarized light, Quarter and half wave plates, Polariods, Discussion on use of Polaroid sheets in preparing tinted sunglasses, Optical activity

Section D: SCATTERING OF LIGHT AND LASERS

Laser and Fibre optics

Laser: Stimulated absorption, Spontaneous and stimulated emission, Population inversion, Conditions for laser action, Types of laser: He-Ne laser, Ruby Laser. Dye laser, Semiconductor laser. Laser properties and laser applications

Fibre Optics: Introduction, Propagation of light through a fiber, Numerical aperture, Types of fiber, Modes of propagation (simple idea), V-number, applications of optical fibers.

References Books and Readings:

a) Textbook of Optics, Brijlal and Subramaniam
b) Optics, A K Ghatak.
c) Fundamentals of Optics, Jenkins and White.
d) Fundamentals of Optics, Khanna and Gulati.
e) Engineering Physics by S.L. Gupta

Course Title/Code	**Optics Lab (PHH227-P)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	To develop in students the skills of understanding the phenomenon of light
Course Outcomes (COs)	
CO1	Students would be able to understand about interference of light.
CO2	Students would be able to understand about diffraction of light.
CO3	Students would be able to understand about polarisation of light.
CO4	Students would be able to understand about LASER and Optical fiber.
Prerequisites (if any)	-----

List of Experiments:

1. To determine the wavelength of sodium light by Newton's rings experiment.
2. To determine the wavelength of sodium light by Fresnel's biprism experiment.
3. To determine the wavelength of various colors of white light with the help of a plane transmission diffraction grating.
4. Determination of dispersive power of the given grating.
5. To determine the refractive index and Cauchy's constants of a prism by using spectrometer.
6. To determine the wavelength of sodium light by Michelson interferometer.

7. To determine the resolving power of a telescope.
8. To determine the pitch of a screw using He-Ne laser
9. To determine the specific rotation of optically active solution by using Laurent's half shade polarimeter.
10. To determine the numerical aperture of an optical fibre using laser light.

References:

1. Advanced Practical Physics- B. L. Workshop and Flint.
2. Practical Physics- S. L. Gupta and V. Kumar
3. B. Sc. Practical Physics- Harnam Singh and P. S. Hermine
4. Advanced Practical Physics- Chauhan and Singh

Course Title/Code	**Angiosperm Anatomy, Evolution and Economic Botany (EDH224-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	This course aims to add to understanding of the students about the diversity of plants, their description, identification, nomenclature and their classification including recent advances in the field.
Course Outcomes (COs)	
CO1	Understand the development, organization, and functions of various plant tissues in angiosperms.
CO2	Understand the diversity of histological complexity in Angiosperms.
CO3	Understand evolution, brief account of origin of life and economic importance of plants.
CO4	Understand the secondary growth in root and stem.
Prerequisites (if any)	Basic understanding of Plant Anatomy and Evolution

SECTION A

Angiosperm Anatomy

Meristems: Characteristics, Classification, Theories of meristematic activity, Organization of shoot-apex Epidermis: Structure and function, Stomatal types, Trichomes.

Simple tissues: Definition, Types (parenchyma, collenchyma, sclerenchyma), Structure, Function
Vascular tissues: Xylem and Phloem-Structure, function, primary and secondary vascular tissues, Types of wood

SECTION B

Review of anatomy of stem, root and leaf in Dicots
Review of anatomy of stem, root and leaf in Monocots.
Secondary growth in root and stem.
Brief account of Anomalous secondary growth– *Bougainvillea*, *Dracaena*.

SECTION C

Evolution:

Brief account of origin of life.
Conc ept of evolution.
Evolutionary theories – Lamarckism, Darwinism, Germ plasm and Mutation theories.
Neo-Darwinism, Isolation, Mutation, Speciation, Genetic drifts.

SECTION D

Economic Botany

Brief account (botanical name, family, extraction/ processing where necessary) and uses of the following:

Cereals and Pulses: Rice, wheat, maize, millets, pigeon, pea, bengal gram, green gram, black gram.
fibres: Cotton, jute, linen, coir.
Vegetable oils: Groundnut, coconut, sunflower, safflower, castor.
Timber and bamboos: Rosewood, teakwood, canes and bamboos.
Beverages: General account, coffee, tea, cocoa.
Spices and condiments: General account, cardamom, clove, pepper, ginger, cinnamon, saffron, turmeric, mustard.
Rubber: General account, Hevea, Ficus.
Medicinal plants: Brief account of ethnobotany, uses of Cinchona, Rauwolfia, Phyllanthes, Catharanthus, Ocimum, Tylophora and other locally available medicinal plants.

References Books and Readings:

- Esau, K. (1977). *Anatomy of Seed Plants, 2nd Ed*. New York: John Wiley & Sons.
- Fahn, A. (1974). *Plant Anatomy 2nd Ed.* Oxford: Pergamon Press.
- Mouseth J.D. (1988). *Plant Anatomy*. California: The Benjamin Cummings Publishing Co. Inc.
- Singh, V., Pande, P.C. & Jain, D.K. (2007). *A textbook of Botany Angiosperms.* Meerut: Jullandar: Rastogi Publications.

- Vashishta, P.C. *A Text book of Plant Anatomy*. Pradeep Publications,
- Gangulee S.C. &Kar, A.K. (1980). *College Botany Vol.I*, Calcutta: Central Book Agency.
- Sharma, P.D. (2006). *Environmental biology*. Meerut: Rastogi Publications.
- Mitra, J.N. *An Introduction to Systematic Botany and Ecology*. Calcutta: World Press.
- Odum, E.P. (1983). *Basic Ecology*. Philadelphia: Saunders.
- Kormondy, E.J. (1996). *Concepts of Ecology*. New Delhi: Viva Books Pvt. Ltd.
- Moore P.W. and Chapman, S.B. (1986). *Methods in Plant Ecology*. Blackwell Scientific Publications.
- Krebs, C.J. (1989). *Ecological Methodology*. New York: Harper and Row.

Course Title/Code	**Angiosperm Anatomy, Evolution and Economic Botany (EDH224-P)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	**0-0-2-0**
Credits	**1**
Course Objective	The course gives an understanding about the systematic position of Genera, Species and Families, and knowledge about plant nomenclature.
Course Outcomes (COs)	
CO1	To develop the skill of free hand sectioning, staining and mounting of plant parts for anatomical study.
CO2	To observe and identify different types of tissues using temporary and permanent slides.
CO3	To study the anomalous secondary growth of Bougainvillea.
CO4	To give a brief account (botanical name, family, extraction/ processing where necessary) and uses of various economically beneficial plants.
Prerequisites (if any)	Basic understanding of Plant Anatomy and Evolution

- To get familiarized with the techniques of section cutting, double staining maceration and clearing.
- To study anatomical details of angiosperms through permanent slides and Laboratory specimens.
- Microscopy techniques
- Section cutting
- Staining and mounting
- Root section of monocot

- Root section of dicots
- Stem section of monocot
- Stem section of dicot
- Economic importance of plants

Course Title/Code	**Animal Physiology and Endocrinology (EDH225-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	To enable students to comprehend the modern concepts of physiological aspects on various organs and systems of animals and human being; to comprehend chemical nature, biological molecules and physiological roles.
Course Outcomes (COs)	
CO1	Comprehend the enzyme action and physiology of digestion
CO2	Critically analyse the complexity of respiration and understand the mechanism of transport of gases
CO3	Reflect upon the mechanism of blood circulation, blood clotting and functioning of human heart
CO4	Explain the process of excretion and homeostasis
CO5	Explain the process of excretion and homeostasis
CO6	To conceptualize the mechanism of endocrine and exocrine glands
Prerequisites (if any)	----------

SECTION A

ENZYME, DIGESTION AND RESPIRATION

a) Enzymes – Nomenclature and classification, mechanism of enzyme action, Coenzymes
b) Digestion – Physiology of digestion, absorption of carbohydrates, proteins andlipids; Role of vitamins and minerals in normal health
c) Respiration – Mechanism of breathing (external respiration) in man; Respiratory pigments – haemoglobin, haemocyanin, haemerythin and chlorocruorin; Transport ofgases - oxygen transport, oxygen equilibrium curve, Bohr effect; Transport of carbondioxide, chloride shift; Control and regulation of respiration; Review of cellular respiration

SECTION B

CIRCULATION, EXCRETION AND HOMEOSTASIS

a) Circulation: Blood – Composition and physiology of blood clotting ;Lymphatic system , myogenic and neurogenic hearts, structure and functioning of human heart, blood pressure
b) Excretion: Nitrogenous waste products – Ammonotelism, ureotelism, uricotelism;Ornithinecycle, structure of human kidney and nephron, physiology of urineformation, counter-current multiplier system
c) Homeostasis – Meaning; Osmo conformers and osmoregulatory in marine and freshwater animals; thermoregulation in animals – Poikilotherms, heterotherms and homeotherms, adaptive changes in animals

SECTION C

NEURO-MUSCULAR CO-ORDINATION

a) Nervous Co-ordination – Structure of neuron and neuroglia , Physiology of transmission of impulse along non-myelinated and myelinated axons ; Synapses –Structure, types and mode of impulse transmission
b) Muscle contraction – Types of muscles, ultrastructure of striated muscle, Contractile andregulatory proteins, Mechanism of muscle contraction, Neuro-muscular junction and relaxation, sliding filament theory, chemical changes during muscle contraction .

SECTION D

ENDOCRINOLOGY AND HORMONAL CONTROL OF REPRODUCTION

Endocrinology – Outline views of endocrine glands – Pituitary, thyroid, adrenaland pancreas,
their structures, secretion and mode of hormone action (steroid andpeptides); hormone feedback mechanism.
Gonads – Microscopic structure, hormones produced and their role; Hormonal
regulation of a) Estrous cycle, b) Menstrual cycle, c) Implantation; Family planning - Need and methods of contraceptives .

References Books and Readings:

a) Animal Physiology and Biochemistry by K.V. Sastry – (Rastogi Publications,2008).
b) Regulatory mechanism in Vertebrates by Kamlesh war Pandey and J.P. Shukla- (Rastogi Publications, 2008).
c) Animal Physiology by K.A. Goyal and K.V. Sastry – (Rastogi Publications,2008).
d) Endocrinology and Reproductive Biology by K.V. Sastry – (Rastogi Publications, 2008).
e) Animal Physiology by Arora M.P. (1989) – Himalaya Publishing House.
f) Textbook of Medical Physiology by Guyton A.C. & Hall J.E. (1996) – (W.B.Saunders & Co.).
g) General and Comparative Physiology by Hoar W.S. (1983) – (Prentice Hall Publications).

Course Title/Code	**Animal Physiology and Endocrinology Lab (EDH225-P)**
Course Type	**Core**
L-T-P-0 Structure	**0-0-2-0**
Credits	**1**
Course Objective	To enable students to analyse biochemically the foodstuffs and urine; to analyse he biochemical action of enzymes and to develop the skills of separation of macro molecules using chromatography and electrophoresis; to demonstrate physiological experiments; to develop the skills of haematology and endocrinology.
Course Outcomes (COs)	
CO1	To enable students to analyse biochemically the foodstuffs and urine
CO2	To enable students to analyse the biochemical action of enzymes
CO3	To develop in the students the skills of separation of macro molecules using chromatography and electrophoresis
CO4	To demonstrate physiological experiments and the skills of haematology and endocrinology
Prerequisites (if any)	------

- Demonstration of endocrine glands in rat and man (Chart).
- Effect of temperature and pH on the salivary amylase enzyme activity.
- Detection of various enzymes in the digestive tract of cockroach.
- Preparation of blood smears of Frog and man
- Separation and analysisof amino acids in body fluids and food using paper chromatography

- B) Analysis of nitrogenous wastes in bird and fish.
- Demonstration of heart beat in Frog – a) Preparation of simple cardiogram, b)Effect of various chemicals on heartbeat.

- To set up simple experiments to find out the rate of respiration in terrestrial animals like cockroach and rat.
- Qualitative and quantitative estimation of carbohydrates, proteins and lipids in food
- Demonstration of separation of proteins/enzymes with electrophoresis.
- Study of permanent slides of mammals: a) Pituitary, b) Adrenal gland, c) Thyroid, testis, e) Ovary, f) Placenta, g) Pancreas.

Field Visit- Museum

References Books and Readings:

1. Animal Physiology and Biochemistry by K.V. Sastry – (Rastogi Publications,2008).
2. Regulatory mechanism in Vertebrates by Kamleshwar Pandey and J.P. Shukla- (Rastogi Publications, 2008).
3. Animal Physiology by K.A. Goyal and K.V. Sastry – (Rastogi Publications,2008).

Course Title/Code	Assessment for learning (EDH122- T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	To enable a learner to develop basic understanding of concept of assessment and evaluation systems in education.
Course Outcomes (COs)	
CO1	To reflect critically on issues in assessment and evaluation
CO2	To justify the role of continuous and comprehensive assessment in holistic development
CO3	To organise appropriate assessment methods
CO4	To design learning indicators and rubrics as a part of assessment
CO5	To devise ways to imlement and report learning landmarks to be supported by feedback
CO6	To access the habit of self-critiquing to improve performance.
Prerequisites (if any)	

SECTION A

CONCEPT OF EVALUATION

CONCEPT: Concept of measurement, assessment, examination, evaluation and their interrelationships, Distinction between 'assessment of learning' and 'assessment for learning'.

FORMS OF ASSESSMENT: Based on purpose**:** (formative, summative; prognostic, diagnostic; norm referenced, criterion referenced), Based on nature of information gathered: Qualitative (observation, introspection, projection and sociometry) or Quantitative (written, oral, practical), Purpose of assessment in a 'constructivist paradigm'.

SECTION B

ASSESSMENT AND RECORDKEEPING

ABILITY TO DEVELOP INDICATORS FOR ASSESSMENT: tasks for assessment (projects, assignments); formulating tasks and questions that engage the learner and demonstrate the process of thinking; scope for original responses.

OBSERVATION of learning process by self, by peers, by teachers, Self appraisal. Organizing and planning for student portfolios and developing rubrics for portfolio assessment, teacher's diaries.

GROUP ACTIVITIES FOR ASSESSMENT (nature of group dynamics, socio-metric techniques, steps for formation of groups, criteria for assessing tasks; criteria's for assessment of social skills in cooperative and colLaborative leaning situations)

DIMENSIONS AND LEVELS OF LEARNING, assessing conceptual development, recall of facts and concepts, application of specific skills, problem solving; application of learning to diverse and new situations (Construction of achievement test).

SECTION C

INTERPRETATION OF STUDENT'S PERFORMANCE

Descriptive statistics (measures of central tendency and percentages), Measures of variability, Graphical representations -histogram, frequency curves, pie charts, NPC –percentile, skewness and kurtosis. Grading –meaning, types and uses

SECTION D

FEEDBACK: feedback as an essential component of assessment, Role of feedback to stakeholders (students/peers, parents, teachers), to improve teaching-learning process, identifying the strengths and weaknesses of learners.

REPORTING STUDENTS' PERFORMANCE: progress reports, cumulative records, Developing and maintaining a comprehensive learner profile and their uses, portfolios, Challenges of assessment, Remedial Teaching.

References Books:

- Ved Prakash, et.al. (2000): *Grading in schools*, NCERT, Published at the publication Division by the secretary, NCERT, Sri Aurobindo Marg, New Delhi
- Popham, W. J. (2002). *Classroom Assessment: What teachers need to know* (Third Edition) Boston: Allyn &Bacon.
- Gredler, M. E. (1999). *Classroom Assessment and Learning*. USA: Longman.
- Linn, Robert L. and Gronlund, Norman E. (2000). Measurement and Assessment in Teaching. Pearson Education Inc.
- Oosterhof, A. (1994). *Classroom Applications of Educational Measurement* (Second Edition). New York: Macmillan College Publishing Company Inc.

Course Title/Code	Assessment for learning Lab (EDH122-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	To enable a learner to apply the concepts of assessment and evaluation systems in education
Course Outcomes (COs)	
CO1	Demonstrate the standards learners are required to achieve and help them recognise when they have achieved that standard
CO2	To give effective feedback on assessment decisions
CO3	To reflect on the last performance and review learner's progress
Prerequisites (if any)	

1. Critically read and reflect on the 'National Focus Group Position Paper on Examination Reforms'
2. A perception scale to explore perceptions of stakeholder (parents, teachers and students) about prevailing examination system and present a report.
3. Critique of prevailing culture of popular tests such as Olympiads.
4. Devise a strategy to incorporate the suggestions given in the first CCE report for the progress of the learner.
5. Essay on 'Effect of assessment on self-esteem, motivation and identity of learners'.
6. Critical Analysis of "CCE Manual for Teachers-Elementary level"
7. Prepare rubrics for assessment of a topic of your choice from Elementary School Level.
8. Prepare a PowerPoint presentation on the outline of scholastic and co-scholastic components of CCE.
9. Constructing a unit test using a table of specification, administering it to a group of students and interpreting the result.

Course Title/Code	School Organisation and Management (EDS227)
Course Type	**Core**
Course Nature	**Soft**
L-T-P-O Structure	**1-0-2-0**
Credits	**2**
Course Objective	**To Facilitate the Basics of School Organisation and management in the Learners.**
Course Outcomes (COs)	
CO1	Use various strategies to create positive school climate
CO2	Analyse various features of school as an organization.
CO3	Discuss different components of school management
CO4	Assimilate the concept and process of educational administration
Prerequisites (if any)	

Practical Topics:

1. Preparation of an Academic Calendar of School
2. Preparation of an annual calendar for the schools co-curricular activities for the current session.
3. Class Presentations on difference in the competencies required for a traditional and 21st century Teachers.
4. Organize a group discussion on the Professional Ethics and Code of Conduct for teachers.
5. Survey of hostel and library and make a report of the problems faced by the students.
6. A Practical activity on the positive school climate.
7. Preparation of an outline of an institutional planning on any aspect of school organization.
8. Preparation of Class Time Table.
9. Write an assignment on how NCERT, SCERT and NAAC is ensuring external & internal quality at higher education
10. Critically analyze the allocation of budget to the education sector in the current Financial Year
11. Identify different ICT resources used by School Management and Administration.

References And Readings:

1. Agarwal, J.C. and Sharma, K. R.(2006): *Basic School Organisation,* Doaba House, Delhi
2. Agarwal, J.C. (2006): *School Administration,* Arya Book Depot, Delhi.

3. Mohanthy, Jagannath (2007). *Educational Management, Supervision, School Organization*. Hyderabad: Neelkamal Publications
4. Owens, Robert G (1970): *Organizational Behaviour in Schools*. Prentice Hall Inc., Englewood Cliffs, N.J., Publishing House.
5. Safaya, R.N. and Shaida, B.D.(2000). School Administration and Organization. Dhanpat Rai and Sons, Delhi

Course Title/Code	Skill Lab, Robotics-Project Based Learning
Course Type	Core
Course Nature	Workshop
L-T-P-O Structure	0-0-3-0
Credits	2
Course Objective	The Course aims at developing skills related with design thinking
Course Outcomes (COs)	
CO1	To know about Robotics
CO2	To learn about soft skills
CO3	To know about the laws of Robotics
CO4	To know about Robot Drives and Knietics
Prerequisites (if any)	**NA**

Course Title/Code	Design Thinking: A Primer (MOOC-18E-EDN-205)
Course Type	Core
Course Nature	NTCC
L-T-P-O Structure	0-0-0-0
Credits	2
Course Objective	The Course aims at developing skills related with design thinking
Course Outcomes (COs)	
CO1	To know about design thinking
CO2	To learn about customer journey mapping
CO3	To know about the analysis phase of design thinking
CO4	To know about the ideation phase of design thinking
Prerequisites (if any)	**NA**

Syllabus

- Introduction to Design Thinking Week
- Empathize Phase: Customer Journey Mapping We3. Analyze Phase: 5-Whys and How might we... Week 4. Solve Phas

Course Title/Code	Street Play/Skit/Mime (EDN229)
Course Type	Core
Course Nature	Workshop
L-T-P-O Structure	0-0-3-0
Credits	2
Course Objective	The course aims at developing social awareness
Course Outcomes (COs)	
CO1	To develop a social sensitivity
CO2	understand and identify the social needs of society
CO3	To organize camps related with social issues
Prerequisites (if any)	

Course Title/Code	**Spanish-II/ FLS105**
Course Type	University Compulsory
Course Nature	Elective
L-T-P-O Structure	1-1-0-0
Credits	0
Course Objective	Demonstrate advanced proficiency in spoken and written Spanish
Course Outcomes (COs)	
CO1	Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.
CO2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes.
CO3	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.
CO4	Students will be able to understand audio text and comprehend to the same. They will be able to form paragraph using auxilary verb and basic verbs.

CO5	Students will be introduced to French culture and civilization. They will be able to describe various places and locations of Francophonic countries.

SECTION-A

Unit 1- Mi famila

1.1 Describe your family

1.2 Adjectives to describe a person

1.3 Short essay on family & friend

Unit 2- Gustar

2.1 Likes and dislikes

2.2 Conjugation

2.3 Comprehension

SECTION-B

Unit 3- Verbos Irregulares y reflexivos

3.1 Conjugation

3.2 Routina diaria

3.3 Sentence formation

SECTION-C

Unit 4- El horario

4.1 Timings

4.2 Colours

Unit 5- Estar+gerundio

5.1 Conjugation

5.2 Prepositions

5.3 Picture description

SECTION-D

Unit 6- Ser y estar

6.1 Direction

6.2 Comprehension

Text Books/Reference Books:

¡Ole!-Langers

¡Uno, dos, tres……

Weblinks:

1. http://studyspanish.com/¡Ole!-Langers
2. ¡Uno, dos, tres……

Weblinks:

http://studyspanish.com/

Assessment Tools:

Sessional tests
Term end examination scores
Participation in class activities
Home assignments

Course Title/Code	(German-II/FLS106
Course Type	University Compulsory
Course Nature	Elective
L-T-P-O Structure	1-1-0-0
Credits	0
Course Objective	Demonstrate awareness of cultural and historical differences between the culture of German-speaking countries and the student's native culture.
Course Outcomes (COs)	
CO1	Students will be able to exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.
CO2	Students will be able to discuss everyday life and daily routines, using simple sentences and familiar vocabulary.
CO3	Students will be able to identify key details in short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Students will be able to discuss likes and dislikes, understand simple conversations about familiar topics (e.g., greetings, weather, sports, hobbies and daily activities,) with repetition when needed.

CO4	Students will be able to differentiate certain patterns of behavior in the cultures of the German- speaking world and the student's native culture. Students will be able to describe various places, location, themselves using simple sentences and vocabulary.

SECTION-A

Unit 1- Mifamila

1.1 Describe your family

1.2 Adjectives to describe a person

1.3 Short essay on family & friend

Unit 2- Gustar

2.1 Likes and dislikes

2.2 Conjugation

2.3 Comprehension

SECTION-B

Unit 3- VerbosIrregulares y reflexivos

3.1 Conjugation

3.2 Routinadiaria

3.3 Sentence formation

SECTION-C

Unit 4- El horario

4.1 Timings

4.2 Colours

Unit 5- Estar+gerundio

5.1 Conjugation

5.2 Prepositions

5.3Picture description

SECTION-D

Unit 6- Ser y estar

6.1 Direction

6.2 Comprehension

Text Books/Reference Books:

¡Ole!-Langers

¡Uno, dos, tres……

Weblinks:http://studyspanish.com/

Course Title/Code	FRENCH-II (FLS107)	
Course Type	Elective	
L-T-P-O Structure	1-1-0-0	
Credits	0	
Course Outcomes (COs)		Mapping
1	.Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.	Employability, Skill Development
2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.	Employability, Skill Development
3	Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.	Employability, Skill Development
4	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.	Employability, Skill Development
5	Express Gorand justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.	Employability, Skill Development
6	Describe various places, location, themselves using simple sentences and vocabulary.	Employability, Skill Development

SECTION-A

Unit 1- Se présenter (1)

1.1 Les pluriels

1.2 Adjectives to describe a person

Unit 2- Se présenter (2)

2.1 Professions

2.2 Short essay on family & friend

2.3 Comprehension

SECTION-B

Unit 3- Parler de ses habitudes quotidiennes

3.1 Lesverbespronominaux

3.2 Décrivezvotrejournée

SECTION-C

Unit 4- Nommezetlocaliser des lieuxdans la ville

4.1 Prepositions

4.2 Asking & telling the way

Unit 5- Informationssimplessur le climat, la météo

5.1 Les saisons

5.2 Les expressions de la saison

5.3 Comprehension

SECTION-D

Unit 6- Demander/ indiquer les horaireset les couleurs

6.1 Timings

6.2 Colours

Text Books/Reference Books/ Suggested Readings:

1. Alter Ego Level One Textbook, Annie Berthet, Catherine Hugot, Veronique M Kizirian,Hachette Publications
2. Apprenons Le Francais II & III,MahithaRanjit, 2017, Saraswati Publications.
3. Weblinks: www.bonjourfrance.com

Course Title/Code	Principles of Human Resource Management/ **MOOC-19E-EDS-201**
Course Type	Elective
Course Nature	MOOC
L-T-P-0 Structure	0-0-0-3
Credits	2
Course Objective	The Course aims at developing communication skills among learners
Course Outcomes (COs)	
CO1	To know about staffing/recruitment
CO2	To explore performance management and appraisal process
CO3	To explore training and development
CO4	To evaluate processes of career management
Prerequisites (if any)	

SECTION A

Management: Definition, nature, purpose and scope of management, Skills and roles of a Manager, functions, principles; Evolution of Management Thought, Scientific Management. Planning: Types of plans, planning process, Characteristics of planning, Traditional objective setting, Strategic Management, premising and forecasting,Decision-Making: Process, Simon's model of decision making, creative problem solving, group decision making.

SECTION B

Management by Objectives: Management by exception; Styles of management: (American, Japanese and Indian), McKinsey's 7-S Approach, Self Management ,Organizing: Organizational design and structure, Coordination, differentiation and integration.
Span of management, centralization and de-centralization Delegation, Authority & power - concept & distinction, Line and staff organizations

SECTION C

Staffing: Human Resource Management and Selection, Performance appraisal and Career strategy, Coordination- Concepts, issues and techniques
Organizational Change: Introduction, Resistance to Change, Behavioural Reactions to Change, Approaches Or Models to Managing Organizational Change.
Organizational Change: Introduction, Resistance to Change, Behavioural Reactions to Change, Approaches Or Models to Managing Organizational Change.

SECTION D

Leading: Human Factors and Motivation, Leadership, Communication, Teams and Team Work
Leading: Human Factors and Motivation, Leadership, Communication, Teams and Team Work
Controlling: Concept, planning-control relationship, process of control, Types of Control, Control Techniques Characteristics of team

SEMESTER - 5										
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/Workshop/ NTCC)**	**COURSE TYPE (Core/Elective /University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH312-T	**Transition Elements, Coordination Compounds and Chemical Kinetics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
CHH312-P	**Transition Elements, Coordination Compounds and Chemical Kinetics Lab**				**0**	**0**	**2**	**0**		
PHH330-T	**Basic Electronics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
PHH330-P	**Basic Electronics Lab**				**0**	**0**	**2**	**0**		
EDH301-T	**Plant Systematics and Angiosperm Phylogeny**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH301-P	**Plant Systematics and Angiosperm Phylogeny Lab**				**0**	**0**	**2**	**0**		
MAH319B	**DIFFERENTIAL EQUATIONS**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**4**	**4**
EDH302-T	**Ecology and Animal Behaviour**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH302	**Ecology and Animal Behaviour Lab**				**0**	**0**	**2**	**0**		

EDH 303-T	Cell Biology and Genetics	EDU	HARD	CORE	3	0	0	0	5	4
EDH 303-P	Cell Biology and Genetics Lab				0	0	2	0		
EDH 214-T	Education in Contemporary India	EDU	HARD	CORE	3	0	0	0	5	4
EDH 214-P	Education in Contemporary India Lab				0	0	2	0		
EDH 109-T	Pedagogy of Biological Sciences	EDU	HARD	CORE ELECTIVE	3	0	0	0	5	4
EDH 109-P	Pedagogy of Biological Sciences Lab				0	0	2	0		
EDH 110-T	Pedagogy of Mathematics				3	0	0	0		
EDH 110-P	Pedagogy of Mathematics Lab				0	0	2	0		
EDW228	e-learning	EDU	WORKSHOP	CORE	0	0	3	0	3	1.5
EDW304	Yoga & Health Education	EDU	WORKSHOP	CORE	0	0	3	0	3	1.5
EDN 305	Colloquium	EDU	NTCC	CORE	0	0	0	0	0	2
EDO 209	Phase I (Field Engagement)	EDU	OUTCOME	CORE	0	0	0	0	0	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				15(PCM)/18(ZBC)	3(PCM)/1(ZBC)	11(PCM)/15(ZBC)	0	29 (PCM)/34 (ZBC)	27 (PCM)/31 (ZBC)

Course Title/Code	Transition Elements, Coordination Compounds and Chemical Kinetics (CHH312-T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-1-0-0**
Credits	**3**
Course Objective	**Students learn the properties of coordination compounds in terms of bonding theories, able to identify the properties of d and f block elements and their compounds in terms of their electronic configuration and understand the Principles of Chemical Kinetics and Surface Chemistry**
Course Outcomes (COs)	
CO1	Interpret the properties of d and f block elements and their compounds in terms of their electronic configuration and bonding.
CO2	Identify the properties of coordination compounds in terms of bonding theories
CO3	Develop knowledge on Principles of Chemical Kinetics
CO4	Develop knowledge on Principles of Surface Chemistry
Prerequisites	Atomic structure & Bonding; States of matter and nuclear chemistry; Thermodynamics, Equilibrium and Solutions

SECTION A

D-BLOCK AND F-BLOCK ELEMENTS

To relate the electronic configuration to the properties and structure of transition metals and their compounds. Characteristic properties of block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Chemistry of Elements of Second and Third Transition Series General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry. Powder metallurgy– extraction of tungsten. Position of lanthanides and actinides in the periodic table, lanthanide contraction, spectral and magnetic properties of lanthanides, separation of lanthanides and actinides.

SECTION B

COORDINATION COMPOUNDS

Discussion of experiential knowledge to account for the spontaneity in changes around us.: need for the Second law of thermodynamics, 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

changes, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Gibbs and

Gibbsfunction (G) and Helmholtz function (A) as thermodynamic quantities. A and G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. **(8 L)**

SECTION C

CHEMICAL KINETICS

Understanding the factors that influence a chemical reaction and rationalizing them on the basis of known theories of reaction rates. Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light, catalyst.Concentration dependence of rates, mathematicalcharacteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half-life and mean life. Determination of the order of reaction – differential method, method of integration, method of half-life period and isolation method. Radioactive decay as a first order phenomenon.Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy,Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis).Expression for the rate constant based on equilibrium constant and thermodynamic aspects. **(8 L)**

SECTION D

SURFACE PHENOMENA

Study of Characteristics of Solid surface, surface phenomenon to explain various applications in daily life situations. Catalysis, characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples. Physical and Chemical adsorptions. Derivation of Langmuir Adsorption Isotherm. Statement and explanation of BET and Gibbs Isotherms. Determination of surface area of adsorbent using Langmuir equation. Adsorption theory of Catalysts using Langmuir's Equation **(8 L)**

Reference Books and Readings:

1. Concise Inorganic Chemistry: J D Lee
2. An Introduction to Inorganic Chemistry: Mackay and Mackay
3. Principles of Physical Chemistry: Marron and Prutton
4. Elements of Physical Chemistry: Samuel Glasstone and Lewis
5. Physical Chemistry: P W Atkins
6. Inorganic Chemistry: James Huhe

Course Title/Code	Transition Elements, Coordination Compounds and Chemical Kinetics Lab (CHH312-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**0-0-2-0**
Credit	**1**
Course Objective	**Students familiarize in transition metal estimation, synthesis of inorganic compounds, study the kinetics and understand surface chemistry concepts by experiments.**
Course Outcomes (COs)	
CO1	To familiarize the transition metals and estimating them by gravimetric analysis
CO2	To familiarize the properties of coordination compounds and determine the crystal field stabilization energy of metal complexes
CO3	To explore the kinetics of a reaction by titrimetric and spectrophotometric methods
CO4	To understand surface chemistry by adsorption, viscosity and partition coefficient experiments
Prerequisites	XII, TESLab

Chemical Kinetics

1. Iodination of Acetone by titration and Colorimetry.
2. Acid Hydrolysis of Ester
3. Reaction between Potassium Peroxy disulphate and Potassium Iodide.
4. Base Hydrolysis of an Ester by Titration and Conductometry
5. Iodine clock reaction
6. Solvolysis of Tertiary Butyl Chloride by Titrimetry, conductometry and pH metry
7. Inversion of Cane Sugar

Coordination Complexes Preparation of Cobalt and Chromium Complexes and analysing them titrimetrically and spectrophotometrically

References :

a) A Text Book of Quantitative Inorganic Analysis, A I Vogel
b) Practical Physical Chemistry, A Findl

Course Title/Code	Basic Electronics (PHH330-T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-1-0-0**
Credits	**3**
Course Objective	To provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in various applications.
Course Outcomes (COs)	
CO1	CO1: Understand, explain and demonstrate various laws and concepts of basic semiconductor physics and simulate applications for diodes, LEDs and rectifiers. The students would be able to analyze and evaluate the related problems.
CO2	Understand, explain and demonstrate various laws and concepts of basic semiconductor physics and simulate applications for Transistor, FETs and MOSFETS. The students would be able to analyze and evaluate the related problems.
CO3	Understand, explain and demonstrate various number systems, construction and working of basic logic gates, Discussing the working of transistors, diodes, and operational amplifiers and solving the related problem.
CO4	Understand, explain and demonstrate various Modulation methods and their application in daily communications. Solving the problem related to methods of communications is also discussed and practiced.
CO5	Demonstrate an ability to conduct investigations of practical/technical issues consistent with their level of knowledge and understanding while designing/performing/resolving the experiments to develop their individual capabilities and representing the collective team work. Demonstrate an ability to analyze data and reach a valid conclusion.
Prerequisites (if any)	Knowledge of basic semiconductors is required.

SECTION A

Semiconductor Characteristics and Applications: Review: Intrinsic and extrinsic semiconductors, electrons and holes in intrinsic and extrinsic semiconductors, conduction by electrons and holes, conductivity of a semiconductor, Energy bands in semiconductors. Carrier

concentrations in intrinsic and extrinsic semiconductors, Fermi level, donor and acceptor levels in extrinsic semiconductors. P-N junction diode – depletion layer, conduction in PN junction diode (FB and RB Condition), characteristics, diode resistance. Half wave and full wave rectifiers, power output and efficiency, Ripple factors. Breakdown in diodes – Zener breakdown, Zener diode characteristics and application in voltage regulation. LED's, Photo diodes.

Section B

Transistors and Applications: Bipolar junction transistor (PNP and NPN) transistors, different configurations and characteristics, current components in CE configuration, large signal and small signal dc current gains, transistor biasing – self bias circuit, Load line and operating point. *Transistor as an amplifier*: Transistor as a two-port device, *h*-parameters and analysis of CE amplifier using *h* parameter equivalent circuit, simplified *h*-parameter circuit, stabilization of voltage gain in CE amplifiers, frequency response of CE amplifier. Two stage amplifiers, RC coupling, Comparison of transistor configurations. Emitter follower circuit and its use. Transistor as Power amplifier. FET construction and its characteristics – MOSFET characteristics. Amplifiers: Concept of feedback in amplifiers and advantages of negative feedback. Oscillators: Requirements for oscillation, Barkhausen criterion, Hartley and Colpitts oscillators.

Section C

Digital Electronics: Binary to decimal and decimal to binary conversion, Binary addition and subtraction, Octal number system, Hexadecimal system and their conversions. Construction and working of AND, OR, NOT logic gates using diodes and transistors. Construction of NOT gate using transistor. Symbols and truth table for AND, OR, NOT, NAND, NOR and Ex-OR logic gates. Boolean algebra, Boolean laws, D'Morgan's theorem. NAND and NOR as universal gates. *Introduction to OP-AMP*. Differential amplifiers, principle of OP-AMP, OP-AMP parameters, Applications – Addition, Subtraction, differentiation and integration.

Section D

Communication Electronics: Basic theory of Amplitude modulation, Power in modulated carrier, single side band transmission, Basic idea of frequency and phase modulation. Modulated class C amplifier, Demodulation, PN diode as demodulator linear and square law detection. Propagation of Radio Waves, different layers of ionosphere and their functions.

Text/Reference Books

1. David. A. Bell, Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India
2. Antireal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India
3. Thomas L. Floyd and R. P. Jain, Digital Fundamentals by Pearson Education
4. Paul B. Zbar, A.P. Malvino and M.A. Miller, Basic Electronics – A Text-Lab. Manual, TMH
5. R. T. Paynter, Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson

Course Title/Code	Basic Electronics Lab (PHH330-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	To provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in various applications.
Course Outcomes (COs)	
CO1	Demonstrate an ability to conduct investigations of practical/technical issues consistent with their level of knowledge and understanding while designing/performing/resolving the experiments to develop their individual capabilities and representing the collective team work. Demonstrate an ability to analyze data and reach a valid conclusion.
Prerequisites (if any)	Mathematical knowledge and experimental understanding of electronics components and their behaviour is required

Blooms Taxonomy Level: BT5

The list of experiments are*:*

1. To plot the VI characteristics of PN Junction Diode.
2. To study the half wave rectification
3. To study the full wave rectification using bridge rectifier
4. To study the Zener diode as voltage regulator
5. To study the common emitter characteristics of BJT.
6. To study the common base characteristics of BJT.
7. To study the BJT as Common Emitter amplifier.
8. To study the Differentiator and Integrator properties of Operational Amplifier

References:

1. Practical Physics- S. L. Gupta and V. Kumar
2. B.Sc. Practical Physics- Harnam Singh and P. S. Hemine
3. Advanced Practical Physics- Chauhan and Singh

Course Title/Code	**Plant Systematics ,and Angiosperm Phylogeny (EDH301-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**(3-0-0-0)**
Credit	**3**
Objectives	After going through this course, the learner will be able to appreciate the evolution of taxonomic thought and the various systems of classification
Course Outcomes (COs)	
CO1	Understand the basis, aim and principles of classification of Angiosperms
CO2	Understand the salient features of Bentham and Hooker Classification
CO3	Understand the diagnostic features, salient vegetative and floral characteristics and economically important plant of various Angiosperm (dicot) families.
CO4	Understand the diagnostic features, salient vegetative and floral characteristics and economically important plant of various Angiosperm (monocot) families.
Prerequisites (if any)	----------

SECTION A

PLANT SYSTEMATICS

a) ICN (formerly known as ICBN), principles and aims; type Concept, Concept of genus and specific epithet, Principle of priority, Units of classification.
b) Brief history, Development of taxonomic thought, Outlines of artificial, natural and phylogenetic systems of classification.
c) Salient features and outline classification of Bentham & Hooker and Cronquist. Brief
d) introduction to Angiosperm Phylogeny Group classification (APG).

SECTION B

ANGIOSPERM PHYLOGENY-I

Study of the diagnostic features, salient vegetative and floral characteristics and economically important plants of following families:

Magnoliaceae

Malvaceae

Rutaceae

Euphorbiaceae

Capparidaceae

Fabaceae

SECTION C

ANGIOSPERM PHYLOGENY-II

a) Study of the diagnostic features, salient vegetative and floral characteristics and economically important plants of following families: Apiaceae

Amaranthaceae

Apocyanaceae

Acanthaceae

Lamiaceae

SECTION D

ANGIOSPERM PHYLOGENY-III

a.) Study of the diagnostic features, salient vegetative and floral characteristics and economically important plants of following families:

Poaceae

Asclepiadaceae

Solanaceae

Liliaceae

Arecaceae

References Books and Readings:

1. Jones, A.B. and Luchsinger, A.(1979). *Plant Systematics*. New York: McGraw-Hill Book Co.
2. Shukla Pritiand Misra.(1988).*Taxonomy of Angiosperms*, New Delhi: Vikas Publishing House.
3. Hutchinson, J.(1959).*The families of Flowering Plants*.Oxford: Clarendon Press.
4. Davis, P.H. and Heywood,V.H.(1963).*Principles of Angiosperm Taxonomy*.London:
5. Oliver and Boyd.
6. Heywood, V.H. and MooreD.M.(1984).*Current concepts in Plant Taxonomy*. London: Academic Press.
7. Singh, G. (1999). *Plant Systematics: Theory and Practice*.New Delhi: Oxford and IBH Pvt. Ltd., New Delhi.
8. Stace, C.A. (1989).*Plant Taxonomy and Biosystematics (2nd Ed.*). London: Edward Arnold.
9. Singh V. andJain,D.K.(2005).*Taxonomy of Angiosperms*. Meerut.Rastogi Publications.

10. Kochhar S.L.(1981).*Economic Botany in the Tropics*. Delhi: MacMillan India Ltd.
11. Vashista P.C. (1980).*Taxonomy of Angiosperms*.New Delhi: Sultan Chand & Co.

Course Title/Code	**Plant Systematics, and Angiosperm Phylogeny Lab (EDH301-P)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**(0-0-2-0)**
Credit	**1**
Objectives	To acquaint students with the technical terms and identification keys for describing and identifying angiosperms.
Course Outcomes (COs)	
CO1	To acquaint students with the technical terms and identification keys for describing and identifying angiosperms.
CO2	To familiarize the students with local plants belonging to families included in the study (only those available during the season).
CO3	To enable the students to describe the vegetative and floral characteristics, draw floral diagram and write floral formulae of angiosperms.
CO4	To develop the skill of undertaking field study and preparing herbarium sheets.
Prerequisites (if any)	------

1. To identify common taxa using taxonomic keys.

2. Detailed study of at least one plant specimen per family as given in theory syllabus.

3. Field study (3-5 days) to a nearby forest, for collection, identification and submission of 5 herbarium sheets.

Course Title/Code	**Multivariate Calculus & Vector Calculus (MAH 350- T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	**3-1-0-0**
Credits	**4**
Course Objective	**Students shall be able to understand and apply the concept of multiple integral, improper integral and vector calculus.**
Course Outcomes (COs)	
CO1	**Apply change of variables, change of order of integration involving double and triple integrals.**
CO2	**Apply the concept of triple integral to evaluate volume of region.**
CO3	**Analyse problems related to improper integrals.**
CO4	**Explain physical meaning of gradient of a scalar field, curl and divergence in terms of fluid flow and also be able to evaluate line integrals, surface integrals and volume integrals**
CO5	**Solve & analyze the Mathematical problems related to Integral calculus & vector calculus and its applications using mathematical software.**
Prerequisites (if any)	**Basic knowledge of sets and real number system.**

Unit I: Line and Double Integrals

Definition of a line integral and basic property, Evaluation of line integrals, Definition of double integral, Conversion to iterated integrals, Evaluation of Double integral, change of variables, Surface areas.

Unit II: Triple Integrals

Definition of a triple integral, Evaluation, Volume of a Triple integral.

Unit III: Improper Integrals

Improper integrals of the first and second kinds, Convergence, Gamma and Beta functions, Connection between Beta and Gamma functions, Application to Evaluation of Integrals, Duplication formula, Sterling formula.

Unit IV: Vector Calculus Vectors, Scalars, Vector field, Scalar field, Vector differentiation, The Vector Differential operator del, gradient, curl, Vector integration, The Divergence theorem of Gauss, Stoke's Theorem, Green's Theorem in plane.References

References:

1. Calculus by Lipman Bers, Vols 1 and 2.First Course in Calculus by Serge Lang
2. Calculus – Single and Multivariable by Hughes Hallet
3. Calculus by Thomas and Finny.

Course Title/Code	**Multivariate Calculus & Vector Calculus (MAH 350- P)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	**0-0-2-0**
Credits	**4**
Course Objective	**Students shall be able to understand and apply the concept of multiple integral, improper integral and vector calculus.**
Course Outcomes (COs)	
CO1	**To develop proficiency with the differentiation and integration of functions involving multiple variables as well as applications in the real world.**
CO2	**To develop problem solving among students based on multivariable calculus of real and vector functions.**
CO3	**To apply the principles of vector calculus and multivariable calculus to real world problems.**
Prerequisites (if any)	**Basic knowledge of sets and real number system.**

List of Experiment

1.To find the Eigen values and Eigenvectors of a square matrix.

2. Evaluation of Single integral (Definite & Indefinite) and its application.

3 Evaluation of Double integral and its application.

4. To study limit, continuity and differentiability of a vector point function.

5. To find the gradient of of a scalar point function.

6. To find the divergence and curl of a vector point function.

7. To find the work done using line integral of a vector point function.

8. To find surface and volume integral of a vector point function.

9. To verify Divergence theorem , Green’s theorem and Stoke’s theorem

Course Title/Code	Ecology and Animal Behavior (EDH302-T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-0 Structure	**3-0-0-0**
Credits	**3**
Course Objective	To enable students to understand the energy sources, flow of energy and conservation; to understand the recycling of minerals and nutrients in ecosystems; to understand the dynamics of population; to understand causes of pollution and suggest measures; to understand behavioral patterns in animals
Course Outcomes (COs)	
CO1	To understand the concept of population dispersal and distribution pattern
CO2	To understand the dynamics of community Diversity
CO3	To understand the dynamics of Ecosystem
CO4	. To develop understanding of the animal behaviour
CO5	To understand the evolution of society
CO6	To develop the understanding of biological rhythm
Prerequisites (if any)	

Section A

COMMUNITY

a) Population- Unitary and modular populations, its unique and group attributes- population density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex-ratio. Population dispersal and distribution patterns.

b) Characteristics of community diversity, diversity index, types of biodiversity species richness, abundance, species area relationship, community stratification, ecotone/edge effect, succession, stages of primary succession, climax community.

SECTION B

Dynamics of Ecosystem

a) Food chains, food web, trophic levels, grazing and detritus type of food chain, Y- shaped food chain in forest, one example of food web- Terrestrial or Aquatic, Nutrient cycle.
b) Ecological pyramids (review), energy flow in ecosystem, productivity; Biogeochemical cycle – nitrogen, phosphorus and sulphur cycles; recycling of organic nutrients.
c) Application of the study of ecology in wild life conservation and sustainable development.

SECTION C

Animal behaviour

a) Concepts and patterns of behaviour, Contributions of Lorenz, Tinbergen and C V Frisch, Instinct and learning, types of learning,
b) Genetic basis of behaviour, Control of behaviour, Neural control, Hormonal control.
c) Concept of motivation and releaser in behaviour; Innate behaviour, taxes, reflexes.

SECTION D

a) Social organization, Communication, Living in groups, Evolution of sociality. Study of interspecific association between cattle and egrets. Social behaviour in birds and primates, Aggressive behaviour; Control of behaviour.

b) Habituation in earthworms/mosquito larvae, biological rhythms and biological clock

References Books and Readings:

a) Fundamentals of Ecology by E.P. Odum – W.B. Saunders, Philadelphia).
b) Environmental Studies by S.V.S. Rana – (Rastogi Publications, 2008).
c) Animal Ecology by S.P. Singh, 6th Revised Edition – (Rastogi Publications,2008).
d) Basic Ecology by E.P Odum (Holt, Rinehart & Winston, New York).
e) Ecology by S.K.Charles – (Prentice Hall Of India, New Delhi)

f) Animal Behaviour by V.G.Dethier and E Stellar -(Prentice hall of India, NewDelhi)
g) Current Problems in Animal Behaviour by W.H. Thorpe and L.Zangwill
h) Experimental Animal Behaviour-A selection of Lab. Exercises by H Hansell and JJ Aitken –
i) Blakie & Sons, Glasgow)
i) The study of Instinct by N Tinbergen.
j) The Dancing Bees by K V Frisch
k) Learning and Instincts in Animals by W H Thorpe and W Homan.
l) Animal behaviour: An evolutionary approach by AICOK J (1984) – Sinauer Associates.
m) Ecology: Principles and Applications by Chapman E (1988) – Cambridge University Press.
n) Modern Concept of Ecology by Kumar HD (1986) – Vikas Publishing House.
o) Ecology and Environment by Sharma PD (1991) – Rastogi Publications.
p) Environmental Biology by Trivedi PR & Gurudeep Raj

Course Title/Code	Ecology and Animal Behavior Lab/(EDH302-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To enable students to develop the skills of studying animal behaviour patterns
Course Outcomes (COs)	
CO1	To enable students to understand Animal adaptation in different habitats
CO2	To enable students to study Collection and qualitative and quantitative analysis of soil organisms
CO3	To enable students to study Estimation of dissolved oxygen, alkalinity and salinity in the pond water
CO4	To enable students to study Experiments with maze for studying behavioural motivation
Prerequisites (if any)	-----

Practical

a) Estimation of dissolved oxygen in the pond water.
b) Estimation of dissolved alkalinity in the pond water.
c) Qualitative analysis of marine plankton to identify the most common mero- and holo- plankton.
d) Identification of the most common benthos, and Nekton in aquatic environment (marine and fresh water).
e) Population study of Local insects and ciliates in the culture medium for growth pattern (logistic and exponential curves).
f) Collection and qualitative and quantitative analysis of soil organisms – Depiction of histogram and pie diagram.
g) Animal adaptation in different habitats- Study of specimens: a) Morphological) physiological adaptation with respect to excretion
h) Study of Preferences, a) Preening behaviour in birds, b) Photo–, chemo–, and Geotaxis in Drosophila (Project work).
i) Experiments with maze for studying behavioural motivation in rat.

Field Visit- Lake or pond

Course Title/Code	Cell Biology and Genetics EDH303-T
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-0-0-0
Credits	3
Course Objective	After going through this course, the learner will be able to understand the structural complexity of a eukaryotic cell and understand the structure and function of various cell organelles
Course Outcomes (COs)	
CO1	To understand the structural complexity of a eukaryotic cell
CO2	To understand the structure and function of various cell organelles
CO3	To get acquainted with the structure and significance of nucleus and chromosomes
CO4	To review Mendelian inheritance in the light of gene interactions
Prerequisites (if any)	Basic knowledge of Biological Science

SECTION A

Cell and Cell organelles

a) Ultrastructure of Prokaryotic and Eukaryotic cells.
b) Ultrastructure and functions- Cell wall, Plasmamembrane, Golgi complex, Endoplasmic reticulum, Mitochondrion, Microbodies.

c) **Nucleus** –Ultrastructure of eukaryotic nucleus.

SECTION B

a) Ultrastructure and functions- Chloroplast, Ribosome, Lysosome and
b) **Cell Division**: Cell-cycle, events of cell division (karyokinesis, cytokinesis)
c) Mitosis, Meiosis and their significance.

SECTION C

Genetics and Inheritance of genes:

a) **Mendelism** – Review of Mendel's laws of inheritance
b) Solving problems related to Mendel's laws.
c) Incomplete dominance, complementary gene action (flower colour in sweet pea).
d) Supplementary gene action (coat colour in mice),

SECTION D

a) Epistasis (fruit colour in summer squash)

a. Multiple factor inheritance (ear size in maize).
b. Sex determination in plants – *Melandrium.*
c. **Cytoplasmic inheritance** –plastid inheritance in *Mirabilis*
d. *C*ytoplasmic male sterility in maize.

References Books and Readings:

- Snustad, D.P. and Simmons, M.J.(2000).*Principles of Genetics*. USA: John Wiley & Sons, Inc.
- Gupta, P.K.(1999).*A Textbook of Cell and Molecular Biology*.Meerut: Rastogi Publications.
- Wolfe,S.L. (1993).*Molecular and Cell Biology*.California: Wadsworth Publishing Co.
- Harris, N. and Oparka,K.J.(1994). *Plant Cell Biology: A Practical Approach*.Oxford: IRL Press, Oxford Univ.Press.

- Singh, S.P. and Tomar,B.S.(2006).*Cell Biology*, Meerut: Rastogi Publications.
- Gupta, P.K. (2005).*Elements of Genetics*. Meerut: Rastogi Publications. 7. Gardner, A. (1990).*Principles of Genetics (6th Ed.)*. USA: John Wiley & Sons Inc.
- Gupta P.K. (2000).*Cytology, Genetics and Evolution*. Meerut: Rastogi Publications.

- Atherly, A.G., Girton, J.R. and MacDonald,J.F.(1999).*The Science of Genetics*. Fortworth: Saunders College Publishing.

- Russel,P.J. (1998). *Genetics*. USA: The Benjamin/Cummings Publishing Co. Inc.

- Gunning, B.E.S. and Steer, M.W.(1999).*Plant Cell Biology, Structure and Function*. Massachusettes: Jones & Bartlett Publishers.

Course Title/Code	Cell Biology and Genetics Lab (EDH 303-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P Structure	**0-0-2-0**
Credits	**1**
Course Objective	To develop skills of staining cells and observing cell organelles and prepare temporary and permanent cytological preparations of suitable plant materials to study mitosis and meiosis.
Course Outcomes (COs)	
CO1	To develop skills of staining cells and observing cell organelles
CO2	To prepare temporary and permanent cytological preparations of suitable plant materials to study mitosis and meiosis
CO3	To verify Mendelian laws of inheritance
CO4	. To understand the cell structure in details
Prerequisites (if any)	Basic knowledge of Biological Science

Activities

- Comparative study of cell structure in onion cells *Hydrilla* and *Chara*/*Spirogyra*.
- Study of plastids to examine pigment distribution in plants (e.g. *Cassia*,
- *Lycopersicon* and *Capsicum*)
- Examination of electron micrographs of virus, bacteria, Cyanobacteria. and eukaryotic cells with special reference to organelles

- Study of various stages of mitosis and meiosis by preparing slides of suitable plant materials (onion root tips and onion flower buds).

- Working out genetic problems related to Mendelian laws of inheritance and interaction of genes.

Course Title/Code	Education in Contemporary India (EDH214-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-0-0-0
Credits	3
Course Objective	This course aims to develop an understanding of education as an agenda for the nation state and its policy visions and efforts in evolving a national system of education. To keep up with new developments in the knowledge change and the curriculum shifts. Changing the way teachers teach students by adopting the latest methods and pedagogy. Emphasize vocational subjects, Science education, and Research.

Course Outcomes (COs)	
CO1	Explain diverse social realities and challenges faced by India Education system.
CO2	Examine Indian Constitutional provisions and safeguards available for Indian citizens particularly in context of cotemporary educational set up for bringing social equality.
CO3	Analyse current educational scenario in light of the recommendations of various committees, commissions and National policies.

CO4	Appreciate the role of nodal educational agencies and policymaking institutions in national development.
CO5	Reflect upon the structural organisation of India Education System and role of teacher in Inckusive Education.
Prerequisites (if any)	NA

SECTION A

INDIAN SOCIETY AND CONSTITUTION

Social Stratification of Indian Society on the basis of Castes, Languages, Tribes, Religions and Regions. Preamble of Constitution, Directive principles, Fundamental rights and duties of Indian citizens, Article 45,21A,
Equality of opportunities in education: Constitutional Provisions: Article 28,29,350,351, Education of socially disadvantaged segments namely Dalits, SC, ST, OBC, Women, PWD'S and minorities.
EDUCATIONAL REFORMATION IN THE PRE-INDEPENDENCE PERIOD: Charter Act, Macaulay'minutes, Wood &Despatch, Hunter Commissions, Sargent Report, Basic education

SECTION B

EDUCATION AND POLICY FRAMEWORK

EDUCATION IN POST INDEPENDENCE PERIOD: Mudaliar Commission (1952), Education Commission (1964-66), NPE 1968; NPE 1986 and its modified version 1992, Yashpal Committee Report, National Curriculum Framework-2005, Right to Education Act 2009: Right of children to free and compulsory education, NPE 2019, Midday meal scheme, Three language Formula

SECTION C

EDUCATION SYSTEM AND STRUCTURES

Concurrent status of education, Public Private Stratification in education, Types of schools in India, Role of educational agencies-NCERT, SCERT, CBSE, ICSE, Open and Distance Education: Concepts, merits and demerits.

SECTION D

EQU ITY AND QUALITY ISSUES IN EDUCATION

Equity in education, Modernization and Privatization of Education: Concept, merits and demerits, Role of teacher in universal and inclusive education,National System of Education, SarvaShikshaAbhiyan (SSA), Kasturba Gandhi BalikaVidyalaya, RashtriyaMadhyamikShikshaAbhiyan(RMSA)

Reference Books and Readings

- GOI. (1966). *Report of the Education Commission-1964-66*. New Delhi: Ministry of Education.
- GOI. (1992*). National policy on education, 1986* (As modified in 1992). Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/NPE86-mod92.pdf
- GOI (1993). *Learning Without Burden*. Report of the National Advisory Committee retrieved from http://www.teindia.nic.in/Files/Reports/CCR/Yash%20Pal_committe_report_lwb.pdf
- GOI. (2009). The right of children to free and compulsory education act, 2009. Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/rte.pdf
- Kashyap, S.C. (2009). *The constitution of India,* New Delhi: National Book Trust.
- Mishra, B.K. &Mohanty, R.K. (2003). *Trends and issues in India Education,* Meerut: Surya publications.
- Nambissan, G. B. (2009). *Exclusion and discrimination in schools: Experiences of dalit children*. Indian Institute of Dalit Studies and UNICEF.
- NCERT. (2006). *Position paper-National focus group on problems of scheduled caste and scheduled tribe children (NCF2005).* New Delhi: NCERT
- Rajput, J.S. (1994). *Universalisation of Elementary Education*, New Delhi: Vikas Publishing House.
- Sachdeva,M.S. et.al (2011). *Philosophical, Sociological and Economic bases of Education*, Patiala: Twenty First Century Publications.
- Shankar, M. (2007*). Contemporly issues in modern Indian education*, New Delhi: Authors Press.
- Stormquist, N. P.(2002). *Education in a Globalised world.* New York: Rowman & Littlefield publishers.
- Walia,J.S.(1979). *Modern Indian Education and its Problems,* Jalandhar City: Paul Publishers, Gopal Nagar.

Course Title/Code	**Education in Contemporary India Lab (EDH214-P)**
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	This course aims to develop an understanding of education as an agenda for the nation state and its policy visions and efforts in evolving a national system of education.To keep up with new developments in the knowledge change and the curriculum shifts. Changing the way teachers teach students by adopting the latest methods and pedagogy. Emphasize vocational subjects, Science education, and Research.

Course Outcomes (COs)	
CO1	Appreciate the policies and schemes developed to achieve the objectives of education.
CO2	Analyze the efforts to achieve the goals of UEE

CO3	Appreciate the efforts of various agencies in improving the education of children of the country.
Prerequisites (if any)	NA

Practical Activities

- ColLaboration with any NGO working for Marginalized groups, Conducting field visits, case studies, and participating in their projects.
- Review of Mid-day meal programme in a particular rural area.
- Review of recent articles, editorials, research papers etc. on emerging issues e.g. implementation of RTE/ Equal opportunities for all/various govt. schemes for universalization of education, girl education/and modernization of education etc.
- Group discussion on fundamental rights, duties and directive principles.
- Debate on true women empowerment.

Reference Books and Readings

- GOI. (1966). *Report of the Education Commission-1964-66*. New Delhi: Ministry of Education.
- GOI. (1992*). National policy on education, 1986* (As modified in 1992). Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/NPE86-mod92.pdf
- GOI (1993). *Learning Without Burden*. Report of the National Advisory Committee retrieved from http://www.teindia.nic.in/Files/Reports/CCR/Yash%20Pal_committe_report_lwb.pdf
- GOI. (2009). The right of children to free and compulsory education act, 2009. Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/rte.pdf
- Kashyap, S.C. (2009). *The constitution of India,* New Delhi: National Book Trust.
- Mishra, B.K. &Mohanty, R.K. (2003). *Trends and issues in India Education,* Meerut: Surya publications.
- Nambissan, G. B. (2009). *Exclusion and discrimination in schools: Experiences of dalit children*. Indian Institute of Dalit Studies and UNICEF.
- NCERT. (2006). *Position paper-National focus group on problems of scheduled caste and scheduled tribe children (NCF2005).* New Delhi: NCERT
- Rajput, J.S. (1994). *Universalisation of Elementary Education*, New Delhi: Vikas Publishing House.
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- Shankar, M. (2007*). Contemporly issues in modern Indian education*, New Delhi: Authors Press.
- Stormquist, N. P.(2002). *Education in a Globalised world.* New York: Rowman & Littlefield publishers.
- Walia,J.S.(1979). *Modern Indian Education and its Problems*, Jalandhar City: Paul Publishers, Gopal Nagar.

Course Title/Code	**Pedagogy of Biological Science (EDH109-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	To focus on the various aspects of biological science like knowledge, understanding of science, nurturance of process skills, development of scientific attitude, scientific temper, nurturance of curiosity, creativity, and aesthetic sense, imbibing values, developing problem solving and relating biological science education with nature, social environment, technology, and society common at all educational processes.
Course Outcomes (COs)	
CO1	Understand and appreciate the nature of Science and contributions by eminent Biologists.
CO2	Design learning objectives for content related to Biological Sciences.
CO3	Explain a Constructivist approach of building knowledge.
CO4	Apply different pedagogical approaches to design lesson plans.
CO5	Design effective assessment strategies related to Biological Sciences and ICT mediated online assessment sheets.
Prerequisites (if any)	Basic knowledge of Biological Science

SECTION A

NATURE OF SCIENCE

Introduction to Pedagogy: Concept; Cardinal Principles of Learning; Why study Science; What is Science? Science as a domain of inquiry and exploration. Scope of biological sciences for understanding the diversity of the living world, origin of life and its evolution. History of Biological Sciences. Some Eminent Biologist's contributions and reflections on society: William Harvey, Lamarck, Charles Darwin, Rosalind Franklin, M.S. Swaminathan. Recent advancements and research in biological sciences. An illustration of how children learn science?

SECTION B

AIMS AND OBJECTIVES OF LEARNING BIOLOGICAL SCIENCES

Aims of learning Sciences, Development of scientific attitude and scientific temper- Respect for evidence, open mindedness, Truthfulness in reporting observation, Critical thinking, logical thinking, Skepticism, objectivity, Nurturing the natural curiosity, creativity, and Aesthetic sense.Meaning of learning objectives, Developing learning objectives; Anderson and Krathwohl's Taxonomy. Writing learning objectives: Remembering, understanding, Applying, Analysing, Evaluating, Creating. Learning objectives from a Constructivist perspective.

SECTION C

PEDAGOGICAL SHIFTS IN BIOLOGICAL SCIENCES

Pedagogical Shift: biological science as a fixed body of knowledge to the process of Constructing Knowledge, nature of science, knowledge, learners, learning and teachers, assessment, science curriculum and planning. Democratizing science learning: Critical Pedagogy. Need of Inclusion in science curriculum, approaches, ICT and professional development of teachers (*with special reference to Reflective practices and its role*).Content cum methodology: concept and nature, steps to content cum methodology, pedagogical analysis (any three topics). Approaches and Strategies of learning Biology: Expository approach, investigation, projects, peer interactions, colLaborative approach, experiential learning, concept mapping and self-learning.

SECTION D

ASSESSMENT OF LEARNING

Development of Assessment Framework. CCE, Diagnostic tests, remedial/enrichment measures and monitoring learner's progress, Learner's record in biological sciences: Laboratory investigation, reports of field visits and excursions, projects work, portfolio, Assessment through participation in colLaborative learning: peer interaction, group discussions, seminars and presentations, Assessment through creative expression: Essays, posters, Drama, poetry, riddles etc. Assessment as a reflected process and as a reflecting process, Recording and reporting of learning evidences/outcome: measurement of student's achievement- marks and grading.

References Books and Readings

1. CBSE (2009). Teacher's manual on CCE. New Delhi: CBSE.
2. Chikara, M.S. and S. Sarma (1985). *Teaching Biology*. Ludhiana: Prakash Brothers.
3. Das, R.C. (1985). *Science teaching in Schools.* New Delhi: Sterling Publications Private Ltd.
4. Krathwohl, D.R., Bloom B.S. and Maria B.B. (1964). *Taxonomy of Educational Objectives, Handbook II, Affective Domain,* New York: David McKay.
5. L. Steffe and J. Gale (Eds.) 1995). *Constructivism in Education*, New Jersey: Lawrence Erlbaum Associates Inc.
6. Lindfors, J. (1984). *How do children learn or how do teachers teach? A Profound confusion*: Language Arts, 61 (6), 600-606.
7. National Curriculum Framework 2005, NCERT, New Delhi.
8. Ramakrishna, A. (2012). *Methodology of Teaching Life Sciences*. New Delhi: Pearson.

Course Title/Code	Pedagogy of Biological Science Lab (EDH109-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To focus on the practical aspects of learning the pedagogy of biological science such as preparing instructional objectives as per Bloom's Taxonomy, develop micro lesson plans for various micro teaching skills, prepare lesson plan for teaching biological science, preparing concept maps, and constructing a test for students' evaluation and assessment.
Course Outcomes (COs)	
CO1	Understand the Bloom's Taxonomy of Instructional Objectives and design learning objectives for content related to Biological Sciences.
CO2	Understand the micro teaching skills and prepare the micro lesson plans for each skill.
CO3	Learn about the Herbartian lesson plan and prepare the lesson plans for teaching Biological Science.
CO4	Apply different pedagogical approaches to design lesson plans.
CO5	Learn about the test construction and construct a test paper for students' assessment.
Prerequisites (if any)	Basic knowledge of Biological Science

a) Critical review of a Textbook of Science/ Biology.
b) Planning and conducting awareness programs/ camps.

c) Diagnosis and preventive measures of Epidemics.
d) Report of one Action Research carried out in the practicing school.
e) Concept mapping in selected units in Biological Sciences Planning learning situations for constructing knowledge in Biological Sciences.
f) Group Discussion on pedagogical issues.
g) *Hands-on experience through visits to botanical gardens/ flower shows/ garden of five senses/Department of Science Education at NCERT/SCERT.
h) Report on measures being taken for inclusive teaching-learning in practicing schools.
i) Exploration of alternative conceptions held commonly by students and planning of approaches towards re-conceptualizations – Project
j) *Field activity

Course Title/Code	Pedagogy of Mathematics (EDH110-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-0-0-0
Credits	3
Course Objective	To enable the students, acquire desirable knowledge and skills pertaining to various pedagogical aspects concerning teaching of Mathematics.
Course Outcomes (COs)	
CO1	To appreciate the role and contribution of eminent mathematicians.
CO2	To develop correlation of mathematics with other subjects
CO3	To design instructional objectives for chosen content.

CO4	Apply innovative methods of teachings to teach mathematics at middle school level.
CO5	Create content appropriate evaluation tools in mathematics.
CO6	To reflect the skill set of an effective mathematics teacher in the classroom.
Prerequisites (if any)	NA

SECTION A

NATURE OF MATHEMATICS

Meaning, Nature, Importance and Value of Mathematics. Axioms, Theorem, Postulates, Assumptions and Hypothesis in Mathematics. Historical Development of Notations and Number Systems. Contribution of Mathematicians (Ramanujam, Aryabhatta, Bhaskaracharya, Euclid, Pythagoras). Perspectives on Psychology of Teaching and Learning of Mathematics- Constructivism, Enactivism, Vygotskyian Perspectives, and Zone of Proximal Development

OBJECTIVES AND INSTRUCTIONAL PLANNING IN MATHEMATICS

Aims and Objectives of Teaching Mathematics in Elementary and Secondary Schools. Bloom's Taxonomy of Educational Objectives and Writing Objectives in Behavioural Terms. Lesson Planning– Importance and Basic Steps. Planning Lesson of Arithmetic, Algebra and Geometry. Unit Planning – Format of A Unit Plan Pedagogical Analysis: Meaning and Need and Procedure for Conducting Pedagogical Analysis. Classification of Content, Objective, Evaluation, etc.

SECTION B

STRATEGIES FOR LEARNING AND TEACHING MATHEMATICS

Concept Formation and Concept Attainment: Concept Attainment Model for Learning and Teaching of Concepts. Learning By Exposition: Advance Organizer Model. Methods of Teaching- Lecture, Discussion, Demonstration, Inductive-Deductive, Analytic-Synthetic, Problem-Solving, Heuristic and Project. Techniques of Teaching Mathematics: Oral Work, Written Work, Drill-Work, Brain- Storming and Computer Assisted Instruction (CAI)Creating Different Situations of Learning Engagement: Group Learning, Individual Learning, Small-Group, Cooperative (Peer-Tutoring, Jigsaw, etc.), and Situational/ Contextual Learning.

SECTION C

TEACHING-LEARNING RESOURCES IN MATHEMATICS FOR STUDENTS WITH DISABILITIES

Mathematics Laboratory- Concept, Need, and Equipment for Setting up a Mathematics
Laboratory. Utilization of Learning Resources in Mathematics: Charts and Pictures, Weighing and Measuring Instruments, Drawing Instruments, Models, Concrete Materials, Surveying Instruments with Reference to Diverse Learners. Bulletin Boards and Mathematics Club Abacus, Cussionaire Rods, Fractional Discs, Napier Strips, Calculators, Computers, Smart Boards, Multimedia Presentations, and Special Aids and Appliances for Diverse Learners.

SECTION D

ASSESSMENT AND EVALUATION FOR MATHEMATICS LEARNING

Assessment and Evaluation- Concept, Importance and Purpose. Error Analysis, Diagnostic Tests, Identification of Hard Spots and Remedial Measures. Tools and Techniques for Formative and Summative Assessments of Learner Achievement in Mathematics, Comprehensive and Continuous Evaluation in Mathematics. Preparation of Diagnostic and Achievement Test.

Action Research- Meaning, Steps, Its difference with Fundamental Research, Critical evaluation of the curriculum in use in Mathematics at the secondary stage according to NCF. Adaptations in Evaluation Procedure for Students with Diverse Learning Styles.

Reference Books and Readings

- Carey, L.M. (1988). Measuring and Evaluating School Learning, Boston: Allyn and Bacon.
- Chambers, P. (2010).Teaching Mathematics, Sage Publication, New Delhi.
- Chapman, L.R. (1970). The Process of Learning Mathematics, New York: Pregamon Press.
- David, A.H., Maggie, M.K., & Louann, H.L. (2007). Teaching Mathematics
- Meaningfully: Solutions for Reaching Struggling Learners, Canada: Amazon Books.
- David, W. (1988). How Children Think and Learn, New York: Blackwell Publishers Ltd.
- Gupta, H. N., & Shankaran, V. (Ed.), (1984). Content-Cum-Methodology of Teaching Mathematics. NCERT, New Delhi.
- James, A. (2005). Teaching of Mathematics, New Delhi: Neelkamal Publication.

- Kumar, S. (2009). Teaching of Mathematics, New Delhi: Anmol Publications.
- Mangal, S.K. (1993). Teaching of Mathematics, New Delhi: Arya Book Depot.

Course Title/Code	Pedagogy of Mathematics Lab (EDH110-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To enable the students acquire desirable knowledge and skills pertaining to various pedagogical aspects concerning teaching of Mathematics.
Course Outcomes (COs)	
CO1	Develop Lesson Plan incorporating the core components.
CO2	Make use of innovative methods of teachings to teach mathematics at middle school level.
CO3	Design appropriate evaluation tools for effective evaluation of learning of Mathematical concepts.
CO4	To demonstrate skill set of an effective Mathematics teacher in the classroom.
Prerequisites (if any)	NA

Practical Activities

- Pedagogical analysis of a unit of content from secondary school Mathematics Syllabus

- Critically evaluate the present curriculum in mathematics at the secondary stage according to NCF
- Preparation of a multimedia presentation on a topic with special reference to students with disabilities
- Construction of a question paper based on current CBSE format/concerned State Board of education, preparing its Scoring key, and marking scheme
- Analysing errors committed by school children in Mathematics and preparing a remedial plan
- Developing an Action Research proposal for a problem related to teaching and learning of Mathematics with reference to students with disabilities
- Prepare an achievement test of mathematics
- Develop a multimedia lesson plan using appropriate ICT resources and transactingthe same in class
- Prepare teaching aid for teaching of mathematics at secondary school level
- NTeQ Model in Mathematics

Reference Books and Readings

1. Mani, M. N. G. (1992). Techniques of Teaching Blind Children, New Delhi: Sterling Publishers.
2. Mukhopadhyaya, S., Jangira, N. K., Mani, M.N. G., & Raychaudhary, N. (1987).
3. Sourcebook for Training Teachers of Visually Handicapped, New Delhi: NCERT.
4. Nemeth, A. (1973). Nemeth Code for Mathematics and Scientific Notation,
5. Loviseville K: American Printing House.
6. Siddhu, K.S. (1990). Teaching of Mathematics, New Delhi: Sterling Publishers Keeley, P. K., & Cheryl, T. R. (2011). Mathematics Formative Assessment, Canada: Sage Publications.
7. National Curriculum Framework. (2005). NCERT, New Delhi: NCERT.
8. National Curriculum Framework for Teacher Education. (2009). NCTE, New Delhi.
9. Teaching of Mathematics (ES-342), Blocks 1-4. (2000). IGNOU, New Delhi.
10. Text Books of Mathematics for Class-VI to X. (2006). NCERT, New Delhi.

SECTION A

Basic of e-learning

- Concept of e-learning
- Types of e-learning
- Terminology related to e-learning

Activity

- Learners create mind map of e-learning

SECTION B

Use of ICT for learning management

- Record keeping and scheduling tools
- Communicative tools
- Learning management system- Introduction

Activity

- Use Google classroom, create classroom, create assignment
- Use google drive and drop box for storing document

SECTION C

ICT for teaching learning process

Blended learning approach for e-learning

- Tools for conducting online classes
- Digital tools for collaborative & constructive learning-Google doc, Discussion forum,

Activity:

- Prepare a week plan of teaching using blended learning approach
- Analyse online platforms for online classes

- Conduct a seminar using online platform
- Discuss any ICT related issue using any mode of online discussion forum.

SECTION D

ICT inAssessment

- Computerassistedassessment
- Useofe-portfolios,Rubricsinassessment
- Useofinnovativestrategies forformative assessment

Activity

- Createeportfolioof thisworkshop
- Createrubrictoassessgroupdiscussion
- Generateatest

Create crosswords puzzles etc.

Course Title/Code	Yoga & Health Education (EDW304)
Course Type	Core
Course Nature	Workshop
L-T-P-O Structure	0-0-3-0
Credits	1.5
Course Objective	Student Readiness regarding Yoga and its benefits
Course Outcomes (COs)	
CO1	Acquire knowledge of theoretical concepts of Yoga and Meditation inrelation to holistic health
CO2	Apply knowledge of Yogic and meditation-based practices indeveloping sound physical and mental wellbeing
CO3	Develop their personality with a sense of identity and meaning throughthe practice of Meditation
CO4	Build awareness of the importance of Yoga and Meditation ineducational context
Prerequisites (if any)	

SECTION A

YOGA – THEORETICAL FRAMEWORK

Yoga – History, Meaning, Need and Importance. The two schools of Yoga: Rāja Yoga and Haṭha Yoga. The streams of Yoga: Karma Yoga, Bhakti Yoga and Jñāna Yoga –main features and educational implications. Eight limbs of Yoga: Eyama, Niyama, Asana, Pranayama, Prathiyagara, Dharana, Dhiyana and Samathi. Meditation – Origin, Meaning and Types with focus on Mindfulness Meditation. Pranayama: Correct Breathing Exercise, Anulome-vilom,Surya-bhedhan and Bhramari.

SECTION B

YOGA AND HEALTH – EDUCATIONAL IMPLICATIONS

Holistic Health – Yogic Concept of Holistic Health and its Components. Yoga for developing concentration, creativity, coping with

stress and anxiety. Meditation in classrooms for positive Mental Health, Role of Meditation and Spirituality in developing Identity, Sense of Meaning andValue in students' life

Reference Books and Readings

- Anantharaman, T.R. (1996). Ancient Yoga and Modern Science. New Delhi: MunshiramManoharlal Publishers Pvt Ltd.
- Besant, A. (2005). An introduction to yoga, New Delhi: Cosmo.
- Bhogal, R.S. (2010). Yoga & Mental Health & Beyond. Lonavla: Kaivalyadhama SMYMSamiti
- Goel, A. (2007). Yoga Education, Philosophy and Practice. New Delhi: Deep and DeepPublications.
- Nath, S.P. (2005). Speaking of Yoga. New Delhi: Sterling Publishers.
- NCERT. 2015. Yoga: A Healthy Way of Living, Secondary Stage, New Delhi.
- NCTE. 2015. Yoga Education-Bachelor of Education Programme, New Delhi.
- MDNIY. 2010. "Yoga Teachers Manual for School Teachers‖, New Delhi
- Mangal, S.K., Mangal,U.and Mana, S. K.(2009). Yoga education, New Delhi: AryaPublication.
- Nagendra, H.R. (1993). Yoga in Education. Banglore, Vivekananda Kendra.
- Taimini, I.K. (1979). The Science of Yoga. Madras, Adyar Publication.

Course Title/Code	Colloquium (EDN305)
Course Type	Core
Course Nature	NTCC
L-T-P-O Structure	0-0-0-0
Credits	2
Course Objective	The course aims at developing skill related to Communicative English
Course Outcomes (COs)	
CO1	Identify the contemporary problems existing in society.
CO2	Categorize the identified problem and relate it to different research genre.
CO3	Analyse the problem by reviewing the concepts.
CO4	Suggest best possible solution to the identified problems
Prerequisites (if any)	

Course Title/Code	Phase-1 Field Engagement (EDO209)
Course Type	Core
Course NAture	Outcome
L-T-P-O Structure	0-0-0-0
Credits	2
Course Objective	The purpose of the internship programme is to provide the students with the opportunity of undergoing a meaningful experience as practitioner. Student is able to test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period
Course Outcomes (COs)	
CO1	Recognise the contribution of psychological, philosophical and socio - economic factors in optimizing teaching and learning

CO2	Articulate experiences of observing various components of the particular school set up as part of internship including the aspects of Infrastructure and Human Resources
CO3	Present the observations of internship period in a systematic and structured manner in the form of individual and/or Group Tasks
CO4	Appreciate importance of school engagement program as a integral component of teacher training programme
CO5	Demonstrate an understanding of the differences between government and private school settings and ways of functioning.
Prerequisites (if any)	NA

Section A

Component 1- Observation of School Infrastructure (through schools' website) in light of policy recommendations with special focus on NEP 2020 in context of provisions for School Education

This will include visiting websites of selected schools to observe school infrastructure including Classrooms, Sports facilities, Assembly hall, Laboratories, Auditorium etc..

Component 2 - Observation of the Schools teaching sessions (Mode- Videos uploaded on Govt. platforms)

Section B

Component 3 - Survey Study (Questionnaire and Interview of Schools teachers) pertaining to various dimensions of teaching learning process

Component 4 – Detailed presentation and viva based on above components

SEMESTER - 6										
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/Workshop/ NTCC)**	**COURSE TYPE (Core/ Elective /University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH 314-T	**Electrochemistry and Photochemistry**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
CHH 314-P	**Electrochemistry and Photochemistry Lab**				**0**	**0**	**2**	**0**		
PHH 331-T	**Relativity and Quantum Mechanics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
PHH 331-P	**Relativity and Quantum Mechanics Lab**				**0**	**0**	**2**	**0**		
EDH 310-T	**Plant Physiology and Metabolism**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH 310-P	**Plant Physiology and Metabolism Lab**				**0**	**0**	**2**	**0**		
MAH 320B	**GROUPS AND RINGS**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**4**	**4**
MAH 321B-T	**COMPLEX ANALYSIS & NUMERICAL ANALYSIS**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
MAH 321B-P	**COMPLEX ANALYSIS & NUMERICAL ANALYSIS Lab**				**0**	**0**	**2**	**0**		
EDH 311-T	**Developmental Biology and Applied Zoology**	**EDU**			**3**	**0**	**0**	**0**	**5**	
EDH 311-P	**Developmental Biology and Applied Zoology Lab**				**0**	**0**	**2**	**0**		

PHH 432-T	**Atomic and Molecular Physics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
PHH 432-P	**Atomic and Molecular Physics Lab**				**0**	**0**	**2**	**0**		
EDH 128-T	**Pedagogy of Physical Sciences**	**EDU**	**HARD**	**CORE**	**3**	**0**	**0**	**0**	**5**	**4**
EDH 128-P	**Pedagogy of Physical Sciences Lab**				**0**	**0**	**2**	**0**		
EDW 104	**Reading And Reflection On Texts**	**EDU**	**WORKSHOP**	**CORE**	**0**	**0**	**3**	**0**	**3**	**1.5**
EDO 314	**Phase-II Field Engagement**	**EDU**	**OUTCOME**	**CORE**	**0**	**0**	**0**	**2**	**0**	**2**
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**15(PCM)/12(ZBC)**	**4(PCM)/1(ZBC)**	**13(PCM)/11(ZBC)**	**2(PCM/ZBC)**	**34(PCM)/26(ZBC)**	**27.5 (PCM)/19.5 (ZBC)**

Course Title/Code	Electrochemistry and Photochemistry (CHH314-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	3
Course Objective	To give an in-depth exposure of Electrochemistry and familiarize the students with basic concepts of Photochemistry
Course Outcomes (COs)	
CO1	Explain the nature of Electrolytic conduction involving theories of electrolytes.
CO2	Understand the processes that occur at electrodes and in electrolytes and to apply emf methods to study different types of reactions.
CO3	Describe the basic principles of battery design and understand the chemical reactions used in a lead-acid battery.
CO4	Explain and discuss theories for photoinduced electron transfer and excitation energy transfer, and apply these methods in quantitative calculations
Prerequisites	

SECTION A

ELECTROCHEMISTRY – I

To study the behaviour and reactions of ions in a variety of environments through the laws that govern them. Electrical transport – conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method.

SECTION B

ELECTROCHEMISTRY – II

Different types of reversible electrodes ,Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen,sign conventions, electrochemical series and its significance.

To draw up a scheme for discussing the equilibrium position for an ionic reaction in terms of the electrode potential. Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells.

SECTION C

ELECTROCHEMISTRY – III

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.
Definition of pH and pK_a determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Lead Battery,Ni-Cd cells, Fuel Cells, Hydrogen – Oxygen cell.

SECTION D

PHOTOCHEMISTRY

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

Course Title/Code	Electrochemistry and Photochemistry Lab (CHH314-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To give an in-depth exposure of Electrochemistry and familiarize the students with basic concepts of Photochemistry
Course Outcomes (COs)	
CO1	Explain the nature of Electrolytic conduction using different electrolytes
CO2	Understand the calculation of free energy change for an electrochemical cell using the measured cell potential value.
CO3	To be able to Measure the cell potential for an electrochemical cell.
CO4	Able to explain theory and practice of common photochemical and photophysical methods, and be able to execute these experimentally
Prerequisites	

Laboratory Techniques:

1. To study the effect of dilution on Molar Conductivity of weak and strong electrolytes.
2. Conductometric titrations
3. Construction and measurement of EMF of Cells,Potentiometric Titrations
4. To measure the absorbance of $KMnO_4$ solution using Colorimeter
5. To measure the absorbance of $K_2Cr_2O_7$ solution using Colorimeter
6. To measure the absorbance of $K_2Cr_2O_7$ unknown solution using Colorimeter
7. To measure the absorbance of $KMnO_4$ unknown solution using Colorimeter
8. Crystallization: Benzoic acid from hot water, naphthalene from ethanol
9. Sublimation of camphor / phthalic acid/succinic acid

Course Title/Code	**Relativity and Quantum Mechanics (PHH331-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-1-0-0**
Credits	**3**
Course Objective	To enable students to understand the essentials of relativity and quantum mechanics, the two theories of 20th century.
Course Outcomes (COs)	
CO1	Discuss and interpret the experiments that reveal the relativistic properties of matter.
CO2	Discuss and interpret the experiments that reveal the wave properties and particle properties of matter.
CO3	Understand the central concepts and principles in quantum mechanics, such as the Schrödinger wave equation, the wave function and their statistical interpretation.
CO4	Understand the basic building blocks of quantum behavior by correlating the classical statistical mechanics and various distributions.
CO5	Demonstrate an ability to conduct investigations of practical/technical issues consistent with their level of knowledge.
Prerequisites (if any)	Mathematical knowledge is required

Section A

Theory of Relativity

Galilean transformation and Newtonian relativity, Earth as an inertial frame of reference, Ether hypothesis, speed of light, Michelson-Morley experiment, Einstein's principle of relativity, Lorentz transformations - derivation, time dilation and length contraction, velocity addition

theorem, variation of mass with velocity, relativistic momentum, energy and momentum conservation, relativistic energy, mass energy equivalence, examples from chemical and nuclear reactions, fission and fusion, Doppler effect in light.

Section B

Particles and Waves

Inadequacies in Classical Physics, Blackbody Radiation: Quantum Theory of Light, Photoelectric Effect, Compton Effect; Wave Nature of Matter : de Broglie Hypothesis, Wave-Particle Duality, Davisson-Germer Experiment, Wave description of Particles by Wave Packets, Group and Phase Velocities and Relation between them, Heisenberg's Uncertainty Principle: Derivation from Wave Packets.

Section C

Quantum Mechanics

Basic Postulates and Formalism: Energy, Momentum and Hamiltonian Operators, Time dependent and Time-independent Schrödinger Wave Equation, Properties of Wave Function, Interpretation of Wave Function, Probability Density and Probability, Normalization, Linearity and Superposition Principles, Eigen values and Eigen functions, Expectation Values, Wave Function of a Free Particle, Particle in a 1-Dimensional Box, 1-Dimensional Simple Harmonic Oscillator: Energy Levels and Wave Functions, Zero Point Energy

Section D

Quantum Statistics

Limitations of Classical Statistics, Phase Space, Phase Cells, Postulates of quantum statistics, indistinguishability, Bose-Einstein statistics – Derivation of distribution function, Application to Photon concept, Derivation of Planck's Radiation Formula. Elementary idea of Bose-Einstein condensation. Fermi Dirac statistics – derivation of distribution function, Application of FD statistics to free electrons in metals – Fermi energy.

Text books:

1. Mechanics, by Prof. D.S. Mathur, P.S. Hemne, S. Chand and Company Ltd.
2. Perspectives of Modern Physics, Arthur Beiser.
3. Introduction to Quantum Mechanics,Pauling and Wilson.
4. Statistical Mechanics, K Huang.
5. David Griffiths, Introduction to Quantum Physics.

6. Quantum Physics by Ishwar Singh Tyagi (Pearson Publication)

Reference books:

1. Halliday and Resnick, Physics
2. Introduction to Quantum Mechanics, 2nd Ed. by David J. Griffiths, Cambridge India, 2016.
3. Quantum Mechanics: Concepts and Applications, 2nd Ed. by Nouredine Zettili, Wiley India, 2016.
4. Quantum Mechanics for Engineers by J.J. Sakurai

Course Title/Code	Relativity and Quantum Mechanics (PHH331-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	- To develop the ability to set up apparatus, collect data and to analyze the data for determining the desired physical quantity.
Course Outcomes (COs)	
CO1	Demonstrate an ability to conduct investigations of practical/technical issues.
Prerequisites (if any)	Mathematical knowledge and experimental understanding of electronics components and their behaviour is required

The list of experiments are*:*

1. To determine the Planck's constant and work function of cathode material.
2. To determine the work function of cathode using thyratron valve.
3. To determine the energy band gap of a PN junction diode.
4. To determine the Hall coefficient and hence carrier concentration of a material.
5. To find the ionization potential and to verify the quantization of energy values.
6. To study the variation of magnetic field along the axis of a current carrying coil and hence to estimate the radius of the coil.
7. To study the V-I characteristics of a solar cell hence to find the fill factor.
8. To determine the wavelength of laser light using Plane transmission diffraction grating.

References:

1. Advanced Practical Physics- B. L. Worsnop and Flint.
2. Practical Physics- S. L. Gupta and V. Kumar
3. B. Sc. Practical Physics- Harnam Singh and P. S. Hemine
4. Advanced Practical Physics- Chauhan and Singh

Course Title/Code	**Plant Physiology and Metabolism (EDH310-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	This course aims to educate students about the mechanism and physiological life processes in plants. It focuses on the plant nutrient uptake and translocation, photosynthesis, respiration and nitrogen metabolism.
Course Outcomes (COs)	
CO1	Recognise the water relationships of plants and transpiration
CO2	Understand the ascent of sap and transpiration.
CO3	Comprehend the process of absorption and mineral nutrition
CO4	Explain the process of photosynthesis and its significance.
Prerequisites (if any)	Basic understanding of plant physiological processes

SECTION A

Water relations in plants
Importance of water to plant life, properties of water.
Review of diffusion, osmosis, and imbibition – definitions, concept of water potential, osmotic potential, pressure potential, solute potential, role of aquaporins (AQP).

Absorption of water: Root as an absorbing organ, mechanism, and pathways of water movement from root hair to root xylem - symplast, apoplast and trans-membrane pathways.
Ascent of sap: Vertical pathway of water in plants, structural properties of xylem, root pressure theory, cohesion – tension hypothesis.
Transpiration: Definition, types, mechanism of stomatal opening and closing (role of K^+ and Abscisic acid), anti-transpirants, factors and significance of transpiration, guttation.

SECTION B

Nutrition-Transport and Assimilation
Transport of Organic Substances: Ultrastructure and functions of phloem, (sieve tube), mechanism of phloem transport, source – sink relationship, theories and factors affecting photosynthesis.
Mineral Nutrition and Assimilation: Major and micro-nutrients, absorption of mineral salts, mechanism, and theories of mineral uptake; passive absorption – mass flow, Donnan's equilibrium: active absorption –carrier concept, cytochrome pump hypothesis.
Role of N, P, K, Ca, Mg, Fe, N & Zn in metabolism.

SECTION C

Physiology of plant growth and development
Growth and Development: Definitions, phases of growth and development, photomorphogenesis, brief account of phytochromes– discovery, physiological role and mechanism of action.
Plant growth regulators: General account, discovery, chemical nature, physiological effects and applications of auxins, kinins, gibberellins, ethylene and abscisic acid. Brief account of plant movements.
Physiology of flowering and fruit ripening: (i) Brief account of photoperiodism, short day, long day and day-neutral plants, night interruption phenomenon, florigen concept, role of phytochromes, vernalization, role of growth hormones in flowering; Ripening of fruit.

SECTION D

Metabolism in Plants
Cellular Respiration: Introduction, respiratory quotient, aerobic and anaerobic respiration, structure of mitochondrion, glycolysis, synthesis of Acetyl CoA, Krebs cycle, oxidative phosphorylation, electron carrier complexes, chemiosmotic hypothesis, proton pump theory, synthesis of ATP (Paul Boyer's hypothesis), pentose phosphate pathway.
Photosynthesis: Introduction, ultrastructure of chloroplast, photosynthetic pigments, absorption and action spectra, photochemical (light) reaction, photophosphorylation, Z- scheme, Calvin cycle, C_4 pathway, CAM pathway, photorespiration, factors and significance of photosynthesis.

References Books and Readings:

1. John, J.L. (1994). *Fundamentals of Biochemistry*. New Delhi: Sultan Chand & Co.
2. Srivastava, H.S. (2005). *Plant Physiology, Biochemistry and Biotechnology*. Meerut: Rastogi Publications.

3. Srivastava H.S. and N Shankar, N. (2006). *Plant Physiology and Biochemistry*. Meerut: Rastogi Publications.
4. Taiz, L. and Zeiger, E. (1998). *Plant Physiology (2nd Ed.)*. USA: Sinauer Associates Inc.
5. Salisbury, F.B. and Ross, C.W. (1992). *Plant Physiology (4th Ed.)*. USA: Wadsworth Publishing Co.
6. Leo, P.J. and R.C. Leegood, R.C. (1999). *Plant Biochemistry and Molecular Biology*. England: John Wiley & Sons.
7. Hopkins, W.J. (1995). *Introduction to Plant Physiology*. New York: John Wiley and Sons, Inc.
8. Lehninger, A.B. (1982). *Principles of Biochemistry*. New Delhi: CBS Publishers and Distributo

Course Title/Code	Plant Physiology and Metabolism (EDH310-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	The course will give knowledge about the various uptake and transport mechanisms in plants and coordinate the various processes, the role of various hormones, signalling compounds, thermodynamics and enzyme kinetics.
Course Outcomes (COs)	
CO1	To understand the functioning of a plant from the physiological point of view.
CO2	To enable students to handle glassware and equipment for setting up physiology experiments.
CO3	To study responses of plants by manipulating the variables.
CO4	To study the role of N, P, K, Ca, Mg, Fe, N & Zn in plant metabolism.
Prerequisites (if any)	Basic understanding of plant physiological processes

Practical

1. Preparation of different types of solutions – molal, molar, percent and normal solutions.
2. Determination of osmotic potential by plasmolytic method
3. Determination of water potential of potato tuber
4. Calculation of stomatal index, frequency and area of stomatal aperture in the 2 surfaces of

leaves.

5. Determination the mechanism of stomatal opening and closing.
6. Demonstration of transpiration pull.
7. To study the impact of environmental factors on transpiration.
8. Demonstration of necessity of light, CO2 and Chlorophyll for photosynthesis
9. Separation of photosynthetic pigment using paper chromatography
10. Determination of osmotic potential by plasmolytic method
11. Determination the mechanism of stomatal opening and closing.
12. To study the impact of environmental factors on transpiration.

Course Title/Code	Group Theory (MAH320B)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	4
Course Objective	To equip the students with the concepts of advanced group theory and ring structure with their properties.
Course Outcomes (COs)	
CO1	Recognize the mathematical objects called groups & rings and apply the fundamental concepts of these algebraic structures
CO2	Explain the significance of the notions of cosets, normal subgroups, and factor groups and analyze consequences of Lagrange's theorem.
CO3	Illustrate structure preserving maps between different algebraic structures & its consequences.
CO4	Apply the basic concepts of ring of polynomials and irreducibility tests for polynomials over ring of integers.
CO5	Appreciate the significance of unique factorization in rings and integral domains
Prerequisites (if any)	

SECTION – A

Group Theory I: Groups, Examples, Properties and types, Sub-groups. Cyclic groups and properties, Cosets, Lagrange's theorem and its Consequences, Dihedral groups, Normal subgroups, Quotient groups.

SECTION B

Group Theory II: Homomorphism and Isomorphism of groups, Kernel of a Homomorphism, Fundamental theorem of Homomorphism, Cauchy's theorem for abelian groups, Permutation group, Alternating Group, Cayley's Theorem.

SECTION C

Ring Theory I: Rings, Integral Domains, Division Rings, Fields, Properties, Field of quotients. Ideals, Quotient rings Maximal, Prime and Principal ideals, Principal ideal ring, Divisibility in an Integral domain, Units and Associates.

SECTION D

Ring Theory II: Homomorphism of a ring, Kernel, Isomorphism, Fundamental theorem of Homomorphism, Polynomial rings, Divisibility, Irreducible polynomials, Division Algorithm, Greatest Common Divisor, Euclidean Algorithm, Unique Factorization Theorem, Eisenstein's Criterion of irreducibility.

References:

1. Topics in Algebra by Herstein, Vikas.
2. A First Course in Abstract Algebra by Fraleigh, Addison-Wesley.
3. Modern Algebra by Vasishtha, Krishna Prakashan Media Pvt. Ltd.
4. Contemporary Abstract Algebra by Joseph A. Gallian, Narosa Publishing House.
5. Basic Abstract Algebra, 2nd Edition by P.B.Bhattacharya, S K Jain and S R Nagpaul, Cambridge University Press.
6. Modern Algebra – An Introduction by Durban, 5th Edition, Wiley.
7. Algebra by Michael Artin, Prentice Hall of India Pvt. Ltd.
8. A Brief Survey of Modern Algebra by Birkhoff and Maclane, IBH.

Course Title/Code	Group Theory (MAH320-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-2-0-0
Credits	4
Course Objective	To equip the students with the concepts of advanced group theory and ring structure with their properties.
Course Outcomes (COs)	
CO1	Recognize the mathematical objects called groups & rings and apply the fundamental concepts of these algebraic structures
CO2	Explain the significance of the notions of cosets, normal subgroups, and factor groups and analyze consequences of Lagrange's theorem.
CO3	Illustrate structure preserving maps between different algebraic structures & its consequences.
CO4	Apply the basic concepts of ring of polynomials and irreducibility tests for polynomials over ring of integers.
CO5	Appreciate the significance of unique factorization in rings and integral domains
Prerequisites (if any)	

1. Linear Algebra using Maple.
2. Plots – 1 using Maple.
3. Plots – 2 using Maple.
4. Animations using Maple.
5. Creating Mathematical Documents – 1 using Maple.
6. Creating Mathematical Documents – 2 using Maple.
7. Listing elements of a permutation group using MAPLE's functions.
9. Listing elements of permutation groups without the cosets command.
10. Embedded Subgroups of a Symmetric Group and Cayley's Theorem
11. Cayley's Group Table.

LAB EXERCISE:

RECOMMENDED BOOKS:

1. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House.
2. M.K. Singhal& Asha Rani Singhal, Algebra, R. Chand & Co.
3. Surjeet Singh &QaziZameeruddin, Modern Algebra, Vikas publishing house.

List of Programs:

1. Introduction to Conditional statements –if and else using Octave
2. Introduction to iteration-based programming – for loop using Octave
3. To find roots of an equation using Bisection method.
4. To find roots of an equation using Regula Falsi method.
5. To find roots of an equation using Newton Raphson method.
6. To find the value of a dependent variable for a given value of an independent variable using Lagrange's interpolation method for a given set of data.
7. To find the value of a dependent variable for a given value of an independent variable using
8. Newton divided difference interpolation for a given set of data.
9. To find the value of a definite integral using Trapezoidal rule of integration.
10. To find the value of a definite integral using Simpson's 1/3 rule of integration.
11. To find the value of a definite integral using Simpson's 3/8 rule of integration.
12. To find the solution of an ordinary differential equation of first order by Euler's modified method.
13. To find the solution of an ordinary differential equation of first order by R-K method.

Course Title/Code	**Developmental Biology and Applied Zoology (EDH311-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	To enable students to comprehend the modern concepts of physiological aspects on various organs and systems of animals and human being; to comprehend chemical nature, biological molecules and physiological roles.
Course Outcomes (COs)	
CO1	Explain the process of the development, organization and functions of developmental steps in mammals
CO2	To conceptualize the concept of the diversity and systemic complexity in neurulation and gastrulation
CO3	Analyze the developmental stages of chick embryo
CO4	To have the Knowledge of mechanism of regeneration
CO5	To have the knowledge of harmful animals and critically analyze the IPM
CO6	To have the knowledge of harmful animals and critically analyze the IPM
Prerequisites (if any)	------

SECTION A

GAME TO GENESIS AND EARLY DEVELOPMENT

Historical perspective, aim and scope of developmental biology
Gametogenesis – Differentiation of spermatozoa and oocyte in mammals' different types of eggs, classification based on amount and distribution of yolk(deutoplasm)
Fertilization– approach and interaction of gametes, monospermy, polyspermy;
Parthenogenesis and its significance
Types of cleavage and fate map – Types of cleavages – holoblastic,meroblastic, radial, spiral, discoidal, superficial; planes of cleavages – m
SECTION B

DEVELOPMENT OF FROG AND REGENERATION

Gastrulation – Morphogenetic movement of cells, mechanism of gastrulation and change in cell shape
Neurulation– Formation, position and fate of three germinal layers, role of microtubules and microfilaments in neurulation
Primary organizer in frog – Organizer concept of Spemann, chemical nature and distribution of inductors – competence, determination and differentiation; Outline of organogenesis; metamorphosis of tadpole.
c) Gastrulation in frog and chick up to the formation of three germ layers.

SECTION C

DEVELOPMENT OF CHICK AND MAMMAL

Development of Chick: Overview of early development; formation of primitive streak and germinal layers ; Salient features of chick embryos of 13 hrs, 19 hrs, 24 hrs, 33 hrs and 48 hrs of incubation ;
Foetal membranes – Development, structure and functions of a) amnion, b) chorion, c) yolk sac, d) allantois. Placenta in mammals – Structure, classification, physiology.
Concept of competence, determination and differentiation.
Regeneration: morpholaxis and epimorphosis; regeneration in Dugesia and salamander; Factors influencing regeneration .

SECTION D

APPLIED ZOOLOGY

Beneficial animals: Basic principles of practices in culturing of i) silkworms (Sericulture), ii) bees (Apiculture), iii) Aquaculture – fish, prawn and shell fish
Harmful animals: Pests -morphology, life cycle, damages caused and control measures of common insect pests of stored food grains and crops, nematode pests of crops, insect vectors (each two) ; Control – biological control and integrated pest management (IPM) .

References Books and Readings:

1. Developmental Biology by K.V.Sastry& Vinita Shukla – (Rastogi Publications, 2008).
2. Introduction to Embryology by B.I. Balinsky – (W.B. Saunders, Philadelphia,1976).
3. Foundations of Embryology by B.M Paten and B.M.Carison.
4. Foundations of Animal Development by A.F.Hopper and N.H.Hart (OxfordUniversity Press, New York, 1980).
5. eridional,vertical, equatorial, latitudinal.
6. Vertebrate Embryology by R.S.McEwen (Oxford & IBM Publishing CO.,New Delhi)
7. C.S.I.R. Wealth of India (Supplement) on Fish and Fisheries. (CSIR, NewDelhi).
8. Bee keeping by J.E.Eckert and F.R.Shaw.
9. Developmental Biology by J.W.Brookbank.
10. Patterns and Principles of Animal Development by J.W. Saunders. Jr.
11. Fish and Fisheries of India by V.G.Jhingran (Hindustan Publishing Corpn;New Delhi)
12. Economic Zoology by G.S. Shukla& V.B. Upadhyay.Elements of Entomology by Rajendra Singh.
13. Embryology by Barth IG (1966) – Holt Rinehart & Winston.
14. Development by Berril N & Karp G (1978) – Tata McGraw Hill Publ. Co.
15. Modern Embryology by Bodemer CW (1960) - Holt Rinehart & Winston.
16. Fundamentals of Comparative Embryology of Vertebrates by Huettner AF(1967) –
17. McMillan Co.
18. Chordate Embryology by Mohan Arora (1985) – Atma Ram & Sons.
19. Laboratory manual of Vertebrate Embryology by Rugh R – Allied Pacific Pvt.Ltd.
20. Chordate Embryology by Verma PS &Agarwal VK – Chand & C

Course Title/Code	Atomic and Molecular Physics (PHH432-T)
Course Type	Core
Course Nature	**Hard**
L-T-P-O Structure	3-1-0-0
Credits	3
Course Objective	-To enable students to apply the basic knowledge of classical and quantum mechanics at the atomic and molecular level
Course Outcomes (COs)	
CO1	Students would be able to understand the basic knowledge of atomic structure, and its interpretation based on different models.
CO2	Students would be able to learn about atomic spectra in presence of magnetic field and electric field. Students would be able to understand different quantum numbers and the selection rules, electronic configuration and L-S coupling.
CO3	Students would be able to understand about the molecule structure and associated spectra. Diatomic molecule and associated energy levels will be discussed.
CO4	Students would be able to understand the basic concept in electromagnetic theory & Maxwell equations.
Prerequisites (if any)	

SECTION A

Atomic Spectra: Bohr atomic model & its inadequacy correction due to finite mass of the nucleus, Rydberg's constant in terms of reduced mass, Excitation and Ionization potentials, Franck-Hertz experiment, vector model of an atom, Electron spin, space quantization, magnetic moment of an electron due to its orbital motion. Stern-Gerlach experiment and its theory. [16 L]

SECTION B

Spin-orbit interaction and Fine structure of spectral lines. Quantum numbers and selection rules. Pauli's exclusion principle. Electronic configuration of atoms. Valence electron and a brief mention of L-S and J-J coupling.

Zeeman effect: Explanation of Zeeman effect on the basis of vector model of atom, Expression for Zeeman shift and experimental details. Anomalous Zeeman effect, A qualitative mention of Paschen – Back effect. [12 L]

SECTION C

Molecular Spectra

Molecular formation, the H_2 molecular ion, H_2 – molecule. Magnetic Moment of the Electron, Lande g-Factor, Pauli Exclusion Principle, Shell Structure. Hund's Rule, Spectroscopic Terms of Many Electron Atoms in the Ground State Diatomic Molecules– Rotational and Vibrational Energy Levels, Basic Ideas About Molecular Spectra, Raman Effect and Its Application to Molecular Spectroscopy (Qualitatively). [12L]

SECTION D

Electromagnetic Theory and Maxwell's Equations

Displacement current, Setting up of Maxwell's equations in SI units, Hertz experiment, Travelling electromagnetic wave, Wave equations (qualitative and quantitative) – Energy transport and Poynting vector, Poynting theorem. A radiation pressure (Normal and Oblique incidence). Concept of electric dipole, magnetic dipole, expression for energy radiated by a dipole (No derivation) [12 L]

References Books and Readings:

1. Introduction to Modern Physics, Mani and Mehta.
2. Perspectives of Modern Physics Beiser.
3. Electromagnetism, Reitz and Milford

Course Title/Code	Atomic and Molecular Physics Lab (PHH432-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To develop the ability to set up apparatus, to collect and analyse the data to determine the desired physical quantity.
Course Outcomes (COs)	
CO1	Understand of the fundamental concepts used in Optics, and atomic molecular physics.
CO2	Analyze and design various conceptual based AMP experiments and verify the fundamental laws.
CO3	Identify basic requirements for a design application and propose a cost-effective solution.
CO4	Find a new cost-effective experiments in Atomic and molecular Physics
Prerequisites (if any)	

Experiments on

A. Biprism

B. Spectrometer

C. Series and Parallel Resonance

D. Current balance-magnetic induction

E. Coupled oscillations

F. Polarimeter

G. Interference – air wedge

H. Resolving power

I. Michelson interferometer

References

1.Practical Physics, E. Armitage, John Murray.
2.Advanced Practical Physics, Workshop and Flint.

Course Title/Code	Pedagogy of Physical Sciences (EDH128-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-0-0-0
Credits	3
Course Objective	To focus on the various aspects of physical science like knowledge, understanding, nurturance of process skills, development of scientific attitude, scientific temper, nurturance of curiosity, creativity, and aesthetic sense, imbibing values, developing problem solving and relating physical science education with nature, social environment, technology, and society common at all educational processes.
Course Outcomes (COs)	
CO1	To understand the epistemology of science as a school subject in the school curriculum.
CO2	To implement various pedagogical approaches to teaching of science at different stages of school.
CO3	To plan units and lessons through thematic approach in a holistic manner.
CO4	To critically examine teaching-learning processes that incorporate enquiry, discovery, activity-based learning, problem solving situations and investigatory projects etc. within the classroom.
CO5	To integrate knowledge of science with other school subjects.
CO6	To integrate knowledge of science in day-to-day life.
Prerequisites (if any)	Basic Knowledge of Physical Science

SECTION A

NATURE AND SCOPE OF SCIENCE

Definition of Science, Nature of Science. Concept, facts, theories, and generalizations. Contributions of Indian and International Physicists and Chemists (Isaac Newton, John Dalton, J.C. Bose, Albert Einstein, Niel Bohr, C.V. Raman to name a few) to the knowledge domain of Physical Science with special reference to the methods of discovery/ Investigation adopted.
Science as a process of constructing knowledge; Scientific methods: A critical view, how science works; role of science teacher. Integration and Application of knowledge of Physical Sciences with other school subjects and in daily life.

SECTION B

PLANNING, DESIGNING AND TRANSACTION

Aims and objectives of teaching physical science, Development of scientific attitude and temper, Development of Unit plan, Lesson Plan, Concept maps using a variety of approaches. Developing and writing Learning Objectives: Anderson and Krathwohl's Taxonomy.
Teaching Learning Process with a focus on: Lecture cum demonstration method, Heuristic/ Inquiry approach, Problem solving approach, Project method, Constructivist approach, peer learning/ group learning, team teaching, Experiential learning, Cognitive conflict, Analogy strategy.
Appreciating every child's natural curiosity of observation and drawing conclusions, facilitating lifelong learning in students with special educational needs.
Science Laboratory: Organization and Management, Using Laboratory as a learning resource approaches to Laboratory work, safety in Laboratory, handling hurdles in utilization of resources.

SECTION C

PEDAGOGICAL SHIFT IN PHYSICAL SCIENCES

Each learner is Unique, Pedagogical shift from science as a fixed body of knowledge to the process of constructing Knowledge. Content cum methodology, Pedagogical Analysis (any three topics from physics and chemistry)
Need of Inclusion in all aspects of teaching-learning of Physical sciences-science curriculum, approaches, ICT and professional development of teachers. Improvisation of Apparatus, identifying some inexpensive sources of chemicals

SECTION D

ASSESSMENT OF LEARNING

Continuous and Comprehensive Evaluation (CCE): need and importance; Assessment and evaluation as intertwined process of classroom experience. Learning Indicators (LIs) and its types, developing LIs for activity, presentation, group work, assignments etc.

Tools and techniques of Assessment: assessment of written and oral work, project work, Laboratory work, field trips, journal writing, concept map; Assessment of learners with special needs.
Recording and reporting of learning evidence- measurement of achievement, process skills and aptitude of learners; Portfolio- its role in evaluating students' performances. Role of reflection in students' achievement.

Reference Books and Readings:

- spo.

Course Title/Code	**Pedagogy of Physical Sciences (EDH128-P)**
Course Type	**Core**
Course NAture	**Hard**
L-T-P O Structure	**0-0-2-0**
Credits	**1**
Course Objective	To focus on the practical aspects of learning the pedagogy of physical science such as preparing instructional objectives as per Bloom's Taxonomy, develop micro lesson plans for various micro teaching skills, prepare lesson plan for teaching physical science, preparing concept maps, and constructing a test for students' evaluation and assessment.
Course Outcomes (COs)	
CO1	Understand the Bloom's Taxonomy of Instructional Objectives and design learning objectives for content related to Physical Sciences.
CO2	Understand the micro teaching skills and prepare the micro lesson plans for each skill.
CO3	Learn about the Herbartian lesson plan and prepare the lesson plans for teaching Physical Science.
CO4	Apply different pedagogical approaches to design lesson plans.
CO5	Learn about the test construction and construct a test paper for students' assessment.
Prerequisites (If any)	Basic knowledge of Physical Science

1. Designing Laboratory experiences for use in the teaching-learning process in classroom situations- two innovative activities and two improvised apparatus.
2. Prepare a First Aid box equipped with all the essential things in it.
3. Report of one Action Research carried out in the practicing school.
4. Report on measures being taken for inclusive teaching-learning in practicing schools.
5. Concept mapping in selected units in Physical Science Planning learning situations for constructing knowledge in Physical Science.
6. Group Discussion on pedagogical issues.

Course Title/Code	Reading and Reflecting on Texts (EDW104)
Course Type	Core
Course Nature	Workshop
L-T-P-O Structure	0-0-3-0
Credits	1.5
Course Objective	Comprehend and think reflectively on spoken or written texts
Course Outcomes (COs)	
CO1	Explain the concept and importance of Reflection through reading especially in the context of the teaching profession.
CO2	Read and respond to a variety of texts in different ways as reader and writer.
CO3	Engage in Interactive groups discussions with respect to reading and reflection activities.

CO4	Explore different ways of developing reflective and critical thinking in personal and professional spaces.

SECTION A

Acquisition of reading skills, reading as resource; Reading a wide variety of texts such as Descriptive, Narrative, Literary, Factual, Expository, Historical work, Policy documents, Ethnographies. Process of critical and reflective reading

SECTION B

Concept and distinguishing features of reflective writing, writing with a sense of purpose; Writing Skills for Teachers: writing letters, applications, reports, minutes, and essays; writing about research; writing annotations, references and bibliography; writing journals and reflective diaries, etc.

Reference Books and Readings:

1. Badheka, G. (2006). Divasvapan. National Book Trust. Retrieved from http://www.arvindguptatoys.com/
2. Bhatt, H. (n.d).The diary of a school teacher. An Azim Premji University Publication. Retrieved from www.arvindguptstoys.com/arvindgupta/diary-school-teacher-eng.pdf
3. Butler, A. and Turbill, J. (1984). Towards Reading-Writing Classroom. New York: Primary English Teaching Association Cornell University.
4. California Yule, G. (2006).The study of language. Delhi: Cambridge University Press.
5. Grellet, F. (1981). Developing reading skills: A practical guide to reading comprehension exercises. Cambridge University Press.
6. Reading Development Cell, NCERT (2008).Reading for meaning. New Delhi: NCERT.
7. Watton, P., Collings, J. and Moon, J. (2001). Reflective Writing- Guidance notes for students. University of Exeter. Retrieved from www.exeter.ac.uk/fch/work-experience/reflective-writing-guidance.pdf
8. 32 Ways to Use Google Apps in the Classroom - Google Slides. Retrieved fromhttps://docs.google.com/presentation/d/1_6fh7wXkugHQbbA2ILrjsFqysvclJCbul2I3Oc912D8/present#slide=id.i0

1. Engaging with narrative and descriptive accounts in stories or chapters.
2. Re-telling the account (in one's own words) from different points of view after reading a specified content given by the teacher.
3. Writing based on text e.g. summary of any given text, extrapolation of a story, converting a situation into a dialogue etc.
4. Read a journal article, newspaper article or a chapter and write personal responses and summary.

5. Assessment of reading comprehension based on a given passage. The chosen text should befrom different genres like story, description, conversation, poem etc.
6. GROUP ACTIVITY-Take two reference books on any one topic of your choice and conduct a comparative study.
7. Prepare presentations on literary (Autobiography/ ethnographic) text.
8. Prepare a Vocabulary Book (50 words) with Meanings and Usage.
9. Make a report based on reflection & analysis of any one Educational Policy/Document like Kothari commission, NPE 1986, POA – 1992, RTE Act, NCF 2005 etc.
10. Make your students read and then write a reflective summary of a text given by you. After assessing their reflective abilities submit a brief account of the same.

Course Title/Code	Phase-II Field Engagement (EDO314)
Course Type	Core
Course Nature	NTCC
L-T-P-O Structure	0-0-0-0
Credits	2
Course Objective	The purpose of the internship programme is to provide the students with the opportunity of undergoing a meaningful experience as practioner. Student is able to test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period
Course Outcomes (COs)	
CO1	Recognise the contribution of psychological, philosophical and socio - economic factors in optimizing teaching and learning
CO2	Articulate experiences of observing the teaching of mentor teacher/ teachers and peers
CO3	Present the observations of internship period in a systematic and structured manner in the form of individual and/or Group Tasks
CO4	Provide constructive feedback to the peers and accept feedback from them with respect to their teaching

CO5	Appreciate importance of school engagement program as a integral component of teacher training programme
CO 6	Demonstrate an understanding of the differences between government and private school settings and ways of functioning.
Prerequisites (if any)	NA

Mode - Simulated teaching by trainee teachers and peer observation

- Online Simulated Teaching by trainee teachers (one lesson each by one pupil teacher according to the pedagogy subject)
- Extensive Mentor and Peer Feedback from both institutions
- Daily engagement of six hours including presentation and observation of lessons
- ColLaborative learning and sharing of best practices of both institutions

SEMESTER - 7										
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	***COURSE NATURE (Hard/Soft/Workshop/ NTCC)**	**COURSE TYPE (Core /Elective /University Compulsory)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH315-T	**Spectroscopy, Natural Products and Heterocyclics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
CHH315-P	**Spectroscopy, Natural Products and Heterocyclics Lab**				**0**	**0**	**2**	**0**		
PHH433-T	**Nuclear and Solid State Physics**	**APPLIED SCIENCE**	**HARD**	**CORE**	**3**	**1**	**0**	**0**	**6**	**4**
PHH433-P	**Nuclear and Solid State Physics Lab**				**0**	**0**	**2**	**0**		
EDH410-T	**Biochemistry , Plant Tissue culture and Biotechnology**	**EDU**	**HARD**	**CORE**	**3**	**0**	**0**	**0**	**5**	
EDH410-P	**Biochemistry , Plant Tissue culture and Biotechnology Lab**				**0**	**0**	**2**	**0**		
EDH411-T	**Genetics and Palentology**	**EDU**	**HARD**	**CORE**	**3**	**0**	**0**	**0**	**5**	**4**
EDH411-P	**Genetics and Palentology Lab**				**0**	**0**	**2**	**0**		

MAH401B	Linear Algebra	APPLIED SCIENCE	HARD	CORE	3	1	0	0	4	4
EDH402-T	Molecular Biology and Immunology	EDU			3	0	0	0	5	
EDH402-P	Molecular Biology and Immunology Lab				0	0	2	0		
EDN412	Seminar	EDU	NTCC	CORE	0	0	0	2	0	2
EDS236	School leadership and Management	EDU	SOFT	ELECTIVE	1	0	2	0	3	2
MOOC-21O-EDS-401	Educational Leadership									
EDS220	Peace and Value Education									
EDS221	Guidance and Counselling									
EDS222	Human Rights in Education									
EDS223	Environment and Education									
TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				0	0	0	0	0	0	16 (PCM)/20 (ZBC)

Course Title/Code	Spectroscopy, Natural Products and Heterocycles (CHH 315-T)
Course Type	**Core**
Course Nature	**Hard**
L-T-P Structure	**3-1-0-0**
Credits	**4**
Course Objective	**To give an in-depth exposure of Natural Products and familiarize the students with basic concepts of Spectroscopic techniques**
Course Outcomes (COs)	
CO1	To develop an understanding of basic principles of Spectroscopy and be able to apply the principles in the structural elucidation of simple organic compounds
CO2	Learn the different types of alkaloids and terpenoids, their chemistry and medicinal importance and be able to apply knowledge of natural compounds as lead molecules for new drug discovery.
CO3	Describe the chemistry of biomolecules like carbohydrates, lipids, proteins and amino acids
CO4	Use fundamental polymer chemistry to explain and predict the synthesis of polymers as well as the resultant structure and properties.
CO5	To understand the chemistry of drugs with respect to their pharmacological activity. To understand the fundamentals of Dyes.
CO6	To understand the fundamental theoretical understanding of heterocyclic chemistry, including alternative general methods for ring synthesis and application of such methods for the preparation of specific groups of heterocyclic systems.
Prerequisites	

SECTION A

Drugs and Macromolecules

Drugs: Introduction, classification, structure and synthesis of sulpha drugs-sulphapyridine, sulphathiozole, sulphadiazine and sulphaguanidine, mechanism of action. Antimalarials – plasmaquin, mepacrine and chloroquin.

Macromolecules: Introduction, Classification, Types of polymerization–chain polymerization, step polymerization, free radical polymerization, co-polymerisation, Ionic polymerization, Coordination polymerization. Natural and synthetic rubbers – buna S, butyl rubber and neoprene. Synthetic fibres – nylon 6, nylon 6,6, terylene. Conducting polymers – polypropylenes and polyanilines.Bio-degradable polymers.

SECTION B

NATURAL PRODUCTS

Carbohydrates: Introduction, classification and nomenclature. Configuration of monosaccharides. Erythro and threo diastereomers. Interconversions in carbohydrates– glucose to fructose, fructose to glucose, aldopentose to aldohexose and aldohexose to aldopentose. Epimerisation, mechanism of osazone formation, Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Structural elucidation of D(+) glucose. Mechanism of Mutarotation. Constitution of disaccharides - maltose, sucrose and lactose. Introduction to polysaccharides (starch and cellulose) without involving structure determination.
Alkaloids : Introduction, general methods of structural determination, structural elucidation of Conine, Nicotine and piperine
Terpinoids: Introduction, isoprene rule, structural elucidation of Citral and Menthol **(10 L)**

Section C

Analytical Spectroscopy

UV and Visible spectroscopy: Introduction, absorption laws, instrumentation, formation of absorption bands, types of electronic transitions, chromophores, auxochromes, absorption and intensity shifts, solvent effects, Woodward – Fieser rules for calculating absorption maximum in dienes and α,β-unsaturated carbonyl compounds.
IR spectroscopy: Introduction, theory of molecular vibrations, vibrational frequency, factors influencing vibrational frequencies, finger print region and applications of ir spectroscopy.
NMR spectroscopy: Introduction, instrumentation, number of signals, position of signals (Chemical shift), shielding and deshielding effects, factors influencing chemical shifts- inductive effect, anisotropic effect and hydrogen bonding. Splitting of signals, spin-spin coupling, chemical exchange and coupling constant.
Structural determination of simple organic compounds using uv, ir and nmr spectral data.

SECTION D

DYES and amino acids

Dyes: Introduction, Classification of dyes, Colour and constitution (electronic concept), synthesis and uses of Methyl orange, Phenolphthalein, Fluorescein and Indigo.
Amino acids, Peptides, Proteins and Nucleic acids
Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and - amino acids. Classification of proteins. Peptide structure determination - end group analysis, selective hydrolysis of peptides. Solid-phase peptide synthesis. Primary and secondary structures of proteins. Protein denaturation. reactions of □

Course Title/Code	Spectroscopy, Natural Products and Heterocycles (CHH315-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**0-0-2-0**
Credits	1
Course Objective	To give an in-depth exposure of Natural products and familiarize the students with basic concepts of Spectroscopic techniques
Course Outcomes (COs)	
CO1	Study and understand the working of instrumentation techniques like UV, FTIR and NMR
CO2	Hands-on-training on the synthesis and structure elucidation of natural products
CO3	Synthesis of drug and macromolecules
CO4	Experimental understanding of heterocyclic compounds with structure elucidation
Prerequisites	

Laboratory Synthesis

1. To synthesize Urea Formaldehyde Resin
2. To synthesize Phenol Formaldehyde
3. To Detect the presence of Carbohydrate- Glucose, Fructose, Sucrose
4. To Synthesize Osazone

Isolation and extraction of natural products.

1. Limonene from Orange peel
2. Nicotine from Tobacco
3. Lactose from Milk

Spectroscopic Experiments

1. To calculate the maximum wavelength of organic compounds using UV spectroscopy
2. To study the Effects of sample concentration Dependence of Absorbance (Beer Law)

Course Title/Code	Nuclear and Solid State Physics (PHH433-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	3
Course Objective	Students will be introduced to the basic knowledge of nuclear and solid state physics for an understanding of physics of nuclei and of solids and will have the ability to determine the desired physical quantity.
Course Outcomes (COs)	
CO1	Students would be able to describe the nuclear structure on the basis of different nuclear model.
CO2	Students would be able to describe radioactive elements and half-life of the elements and familiar with nuclear Reactors/ Detectors
CO3	Students would be able to explain and analyze the different crystal structures and different models for thermal properties of solids
CO4	Students would be able to determine the electrical, magnetic and superconducting properties of materials
Prerequisites (if any)	Basic Knowledge of atomic and nuclear Physics

SECTION A

ATOMIC NUCLEUS

Nuclear structure; Neutron, its discovery and properties; Basic properties of nucleus-charge, spin, radii, mass, magnetic moment; Nuclear forces and their characteristics; Yukawa's Theory (Qualitative); Packing fraction and Binding energy; Nuclear stability, Nuclear Models-Liquid drop model; Semi-empirical mass formula; Shell model and magic numbers (qualitative).

SECTION B

RADIOACTIVITY AND PARTICLE PHYSICS

Radioactive decay: Half-life, mean life, Decay constant, Radioactive displacement laws, Theory of □ decay (qualitative); Geiger-Nuttal law; Beta decay, Beta spectra, Neutrino hypothesis, Gamma decay, pair production; successive disintegration, units of radio activity, radioactive dating, uncontrolled and controlled chain reactions; nuclear fission and fusion, Nuclear reactors, Quarks and gluons, GM counter.

SECTION C

CRYSTAL STRUCTURE AND THERMAL PROPERTIES OF SOLIDS

Crystal Structure: Concepts of a lattice, unit cell and Bravais lattice, Fundamental lattice systems and their types, Miller indices, Coordination number, packing fraction for cubic crystals (sc, bcc and fcc),Various types of bonding, cohesive energy and compressibility of ionic crystals, Madelung constant, Thermal Properties: Specific heat of solids, Einstein and Debye theories.

SECTION D

ELECTRICAL AND MAGNETIC PROPERTIES OF SOLIDS

Electrical Properties: Free electron model of a metal, Distinction between metals, semiconductors and insulators, Hall effect, Expression for Hall coefficients, Magnetic Properties: Langevin's theory of Dia and Para magnetism, Curie-Weiss Law, Qualitative description of Ferromagnetism, Superconductivity: Qualitative description, critical temperature and Meissner Effect, Applications of High temperature superconductors.

References Books and Readings:

- Perspectives of Modern Physics, Beiser
- Nuclear Physics, Kaplan.
- Nuclear Physics, Subramanyam and Brijlal.
- Concepts of Nuclear Physics, Cohen.
- Solid State Physics, A J Dekker.
- Introduction to Solid State Physics, C Kittel.
- Modern Physics, Kiein

Course Title/Code	Nuclear and Solid-State Physics Lab (PHH433-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To develop learners' self-assessment skills of nuclear reactions and solid-state properties on atomic and subatomic level and will have the ability to determine the desired physical quantity.
Course Outcomes (COs)	
CO1	Students would be able to understand of the fundamental concepts and techniques used in Nuclear Physics.
CO2	Students would be able to examine the electronic charge and specific charge of electron, i.e. charge mass ratio
CO3	Students would be able to measure of energy band gap of semi-conductor materials and charge carrier concentrations
CO4	Students would be able to verify the value of various Physical constant like Rydburg constant, Planck constant, Hall coefficient etc.
Prerequisites (if any)	-----

1. Magnetic susceptibility
2. e/m of electrons
3. Rutherford model

4. G M tube
5. Millikan oil drop
6. Planck's constant
7. Energy gap of a semiconductor
8. Fermi energy
9. Rydberg constant
10. Hall effect

References Books:

1. Advanced Practical Physics- B. L. Worsnop and Flint.
2. Practical Physics- S. L. Gupta and V. Kumar
3. B. Sc. Practical Physics- Harnam Singh and P. S. Hemine
4. Advanced Practical Physics- Chauhan and Singh
5. Physics Laboratory Instructions, RIE, Mysore.

Course Title/Code	**Biochemistry, Plant tissue culture and Biotechnology (EDH410-T)**
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**(3-0-0-0)**
Credit	**3**
Objectives	After going through this course, the learner will be able to understand the structure and functions of biological macromolecules.
Course Outcomes (COs)	
CO1	understand the structure and functions of biological macromolecules
CO2	get acquainted with the techniques, branches and applications of plant tissue culture
CO3	get acquainted with the tools and techniques of biotechnology, the processes involving gene manipulation and their applications
Prerequisites (if any)	----------

SECTION A

BIOCHEMISTRY

Carbohydrates: Introduction, classification, chemical structures of mono, oligo and polysaccharides, synthesis and breakdown of sucrose and starch.

Lipids: Introduction, classification, chemical structures, saturated and unsaturated fatty acids, synthesis and breakdown of fatty acids, □- oxidation.

Enzymology: Discovery, nature, nomenclature and classification, mechanism of enzyme action, lock and key hypothesis, induce-fit hypothesis, regulation of enzyme action, inhibitors, prosthetic groups and coenzymes, factors affecting enzyme action

SECTION B

Plant Tissue Culture

Brief history, cellular totipotency, culture media and techniques

Brief account of anther/ pollen culture, endosperm, embryo and protoplast culture.

Applications of tissue culture.

SECTION C

BIOTECHNOLOGY

Tools and techniques, cloning vectors,

Brief account of genomics and c-DNA library,

Interferons, transposable elements

PCR, Bio-Informatics.

SECTION D

Applications of Biotechnology – functional definition and applications.

Brief account of DNA finger printing

Agrobacterium – mediated gene transfer

Achievements in crop improvement, transgenic plants.

References Books and Readings:

1. Lodish, H., Berk,A., Zipursky,S.L., Matsudaiva, P., Baltimoe, D. and Darnell, J. (2000). *Molecular Cell biology*. New York: W.H. Freeman & Co.
2. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., and Watson, I.O.

(1999).*Molecular Biology of Cell*. New York: Garland Publishing Co., Inc.

3. Malacinski, G.M., (2005).*Essentials of Microbiology (4th Ed.)*. New Delhi: Narosa Publishing House.
4. Lea, P.J. and Leegood,R.C.(1999). *Plant Biochemistry and Molecular Biology*. England: John Wiley & Sons.
5. Srivastava, H.S. (2005).*Plant Physiology, Biochemistry and Biotechnology*. Meerut: Rastogi Publications.
6. Jain.J.L. (1994). Fundamentals of Biochemistry, New Delhi: Vikas Publishing House.

Course Title/Code	Biochemistry, Plant tissue culture and Biotechnology Lab (EDH410-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	(0-0-2-0)
Credits	1
Objectives	To familiarize with techniques in biochemistry and biotechnology.
Course Outcomes (COs)	
CO1	To understand the molecular mechanisms operating in cells.
CO2	To familiarize with techniques in biochemistry and biotechnology.
CO3	To develop in the students the understanding of biochemical pathways inside an organism
CO4	To demonstrate effect of environmental factors such as pH and temperature on various biomolecules.
Prerequisites (if any)	------

1. To test for the presence of carbohydrates, proteins and lipids

2. Isolation of DNA from coconut endosperm.

3. Effect of pH and temperature on activity of amylase in germinating seeds.
4. Effect of pH and temperature on activity of catalase and peroxidase.
5. Separation of amino acids by paper chromatography.
6. Study of root nodules in leguminous plants.

Course Title/Code	**Genetics and Palentology/EDH411-T**
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-0-0-0
Credits	3
Course Objective	To enable students to comprehend the modern concepts of genetics.
Course Outcomes (COs)	
CO1	To understand the genetic composition of drosophila, Human population and learn method of genetic mapping
CO2	To understand the diversity of human genetic diseases.
CO3	To learn transgenic animal techniques
CO4	To develop the understanding of molecular bases of various genetic diseases.
CO5	To develop the understanding of Palentology
CO6	To understand Zoogeography
Prerequisites (if any)	NA

SECTION A

General Genetics

a) Sex determination – Chromosomal basis of sex determinations (XX–XO, XX–XY, ZZ– ZW types); multiple sex chromosomes; Genic balance theory;Gynandromorphs and sex mosaic; Sex determining genes; Barr body .

b) Linkage and crossing over: Linkage and crossing over in Drosophila;Cytological evidences for crossing over; Linkage maps.

c)Karyotype, banding, nomenclature of chromosome subdivisions and genetic map. Study of Human and Phlox/ Allium Karyotype (normal and abnormal)

SECTION B

a) Human Genetics: Pedigree of Mendelian human traits ; Eugenics, Euthenics,Euphenics; Inborn error of metabolism – Phenylketoneuria, Galactosemia;

b) Genetic disorders, Chromosomal aneuploidy (Down, Turner and Klinefelter syndromes), Chromosome translocation (chronic myeloid leukemia) and deletion ("cry of cat" syndrome), Gene mutation (cystic fibrosis)Genetic screening and counselling; Introduction to applications of genetic engineering, Molecular diagnosis of genetic disorders and gene therapy, Crop and livestock improvement

c)ransgenic Animal Technology Production of transgenic animals-nuclear transplantation, Retroviral method, DNA microinjection method, Applications of transgenic mice, sheep, goat, pig, birds and fish, Dolly and Polly, Scientific significance, Therapeutic applications, Human cloning, Ethical issues of transgenic animals.

SECTION C

Molecular diagnosis of genetic diseases (Cystic fibrosis, Huntington's disease, Sickle cell anemia), RFLP, RAPD and DNA fingerprinting, Vaccines and therapeutic agents, Recombinant DNA in medicines (recombinant insulin and human growth hormone), Gene therapy, Enzymes in detergents and leather industries, Heterologous protein production, Bioremediation.

SECTION D

PALEONTOLOGY AND ZOOGEOGRAPHY

Geological time and its significance in evolution

Fossils – Fossils and fossilization; Living Fossils – Latemaria and Sphenodon the emergence and disappearance of invertebrates and vertebrates (Trilobites,Fishes and Reptiles) ; Paleontological history of man

Zoogeography, with emphasis to oriental region and fauna

References Books and Readings:

1. Genetics by Stricksberger – (MacMillan).
2. Principles of Genetics by Sinnott, Dunn and Dobzhansky – (McGraw Hill).
3. Genetics by E. Altenberg – (Holt, Rinehart & Winston, New York).
4. Principles of Genetics by Gardner – (John Willey).
5. Principles of Genetics by Irwin H. Herskowitz – (Little Brown &Co.,Boston).
6. Elementary Genetics by Singleton WR – (Van Nostrand).
7. Basic Human Genetics by Elain J. Mange & Arthur P. Mange – (RastogiPublications, 2008).
8. Cytogenetics by P.K. Gupta – (Rastogi Publications, 2008)
9. Evolutionary Biology by B.S. Tomar& S.P. Singh – (Rastogi Publications,2008).
10. The origin of life by K.John – (Reinhold Publishing Corpn).
11. The evolution of Man by G.W.Lasker – (Holt, Rinehart & Winston).
12. Organic Evolution by R.S.Lull – (MacMillan).
13. Evolution by J.M.Savage (Holt, Rinehart and Winston)
14. Genetics and Evolution by RL Kochhar (S.Nagin& Co, New Delhi 1970)
15. Evolution in Action by J.Huxley (New American Library, New S.Nagin& Co,New Delhi 1970).
16. The Origin of Species by D.I.Charles (Collier Book, New York, 1966).
17. Evolution by Ayala F.G, Stebbins G.L & Valentine J. (1965) – SinauerAssociates.
18. Animal Evolution by Carter GS (1960) – Sedgenick& Johnson Ltd.
19. Zoogeography by Hubbs CL (1962) – AAAAS Washington
20. Evolution & Genetics by Morrel DJ (1962) – Holt Rinehart and Winston.
21. Vertebrate Paleontology by Romer AS (1966) – University Chicago Press.
22. The Process of Organic Evolution by Stebbins GL (1970) – Prentice HallPublication.
23. Genetics by Winchester AM (1966) – Oxford & IBH Publis

Course Title/Code	Genetics and Palentology Lab /EDH411-P
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Credits	1
Course Objective	To enable the students to identify and study drosophila and various fossils
Course Outcomes (COs)	
CO1	To identify and study drosophila
CO2	To identify blood groups and Rh factor in man
CO3	To study various fossils models and living fossils

Section A

General Genetics

a) Sex determination – Chromosomal basis of sex determinations (XX–XO, XX–XY, ZZ– ZW types); multiple sex chromosomes; Genic balance theory;Gynandromorphs and sex mosaic; Sex determining genes; Barr body .

b) Linkage and crossing over: Linkage and crossing over in Drosophila;Cytological evidences for crossing over; Linkage maps.

c) Karyotype, banding, nomenclature of chromosome subdivisions and genetic map. Study of Human and Phlox/ Allium Karyotype (normal and abnormal)

SECTION B

c) Human Genetics: Pedigree of Mendelian human traits; Eugenics, Euthenics,Euphenics; Inborn error of metabolism – Phenylketoneuria, Galactosemia;

d) Genetic disorders, Chromosomal aneuploidy (Down, Turner and Klinefelter syndromes), Chromosome translocation (chronic myeloid leukemia) and deletion ("cry of cat" syndrome), Gene mutation (cystic fibrosis)

Genetic screening and counselling; Introduction to applications of genetic engineering
Molecular diagnosis of genetic disorders and gene therapy, Crop and livestock improvement

SECTION C

a) Transgenic Animal Technology Production of transgenic animals-nuclear transplantation, Retroviral method, DNA microinjection method, Applications of transgenic mice, sheep, goat, pig, birds and fish, Dolly and Polly, Scientific significance, Therapeutic applications, Human cloning, Ethical issues of transgenic animals.

b) Molecular diagnosis of genetic diseases (Cystic fibrosis, Huntington's disease, Sickle cell anemia), RFLP, RAPD and DNA fingerprinting, Vaccines and therapeutic agents, Recombinant DNA in medicines (recombinant insulin and human growth hormone), Gene therapy, Enzymes in detergents and leather industries, Heterologous protein production, Bioremediation.

SECTION D

PALEONTOLOGY AND ZOOGEOGRAPHY

Geological time and its significance in evolution , Fossils – Fossils and fossilization; Living Fossils – Latemaria and Sphenodon the emergence and disappearance of invertebrates and vertebrates (Trilobites,Fishes and Reptiles) ; Paleontological history of man ,Zoogeography, with emphasis to oriental region and fauna

References Books and Readings:

24. Genetics by Stricksberger – (MacMillan).
25. Principles of Genetics by Sinnott, Dunn and Dobzhansky – (McGraw Hill).
26. Genetics by E. Altenberg – (Holt, Rinehart & Winston, New York).

27. Principles of Genetics by Gardner – (John Willey).
28. Principles of Genetics by Irwin H. Herskowitz – (Little Brown &Co.,Boston).
29. Elementary Genetics by Singleton WR – (Van Nostrand).
30. Basic Human Genetics by Elain J. Mange & Arthur P. Mange – (RastogiPublications, 2008).
31. Cytogenetics by P.K. Gupta – (Rastogi Publications, 2008)
32. Evolutionary Biology by B.S. Tomar& S.P. Singh – (Rastogi Publications,2008).
33. The origin of life by K.John – (Reinhold Publishing Corpn).
34. The evolution of Man by G.W.Lasker – (Holt, Rinehart & Winston).
35. Organic Evolution by R.S.Lull – (MacMillan).
36. Evolution by J.M.Savage (Holt, Rinehart and Winston)
37. Genetics and Evolution by RL Kochhar (S.Nagin& Co, New Delhi 1970)
38. Evolution in Action by J.Huxley (New American Library, New S.Nagin& Co,New Delhi 1970).
39. The Origin of Species by D.I.Charles (Collier Book, New York, 1966).
40. Evolution by Ayala F.G, Stebbins G.L & Valentine J. (1965) – SinauerAssociates.
41. Animal Evolution by Carter GS (1960) – Sedgenick& Johnson Ltd.
42. Zoogeography by Hubbs CL (1962) – AAAAS Washington
43. Evolution & Genetics by Morrel DJ (1962) – Holt Rinehart and Winston.
44. Vertebrate Paleontology by Romer AS (1966) – University Chicago Press.
45. The Process of Organic Evolution by Stebbins GL (1970) – Prentice HallPublicati

Course Title/Code	Linear Algebra (MAH401B)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Credits	4
Course Objective	The students would be able to apply the concepts of Vector Space, Linear Transformation and inner product Space required for solving the mathematical problems and their applications.
Course Outcomes (COs)	
CO1	Apply the concepts of vector spaces, subspaces, bases, dimension and their properties in related mathematical problems and spaces.
CO2	Find Relationship between matrices and linear transformations apply the same in real world problems.
CO3	Understand and apply the properties of inner product spaces and orthogonality in inner product spaces in related mathematical problems and spaces.
CO4	Recognize importance of adjoint of a linear transformation and its canonical form.
Prerequisites (if any)	Basic knowledge of sets and Matrices.

SECTION A

Vector Spaces – I

Vector spaces, Subspaces, Linear Combinations, Linear span, Linear dependence and Linear independence of vectors, Basis and Dimension, Finite dimensional vector space – some properties.

SECTION B

Vector Spaces - II

Quotient spaces, Homomorphisms of vector spaces, Isomorphism of vector spaces, Direct sums, Inner product spaces, Euclidean vector spaces, Distance, Length, Properties, Orthogonal vectors, Gram Schmidt Orthogonalisation Process, Orthogonal complement.

SECTION C

Linear Transforms – I

Linear maps as matrices, Change of basis and the effect of associated matrices, Kernel and Image of a linear transformation, Rank and Nullity theorems.

SECTION D

Linear Transforms - II

Singular and non-singular linear transformations, Elementary matrices and transformations, Similarity, Eigen values and Eigen vectors, Diagonalisation and Eigen vectors, Characteristic polynomial, Cayley, Hamilton Theorem, Minimal Polynomial.

References :

Theory and Problems of Linear Algebra, SaymourLipschitz, Schaum Outline Series.

Introduction to Linear Algebra by Stewart, Van Nostrand Co. Ltd.

Modern Algebra, Vol.II, by Narayanan and ManicavachagamPillay, S. Vishwanathan and Co.

Brief Survey of Modern Algebra, Brikhoff and Maclane, IBH

Linear Algebra by Sergr Lang, Addison Wesley Publishing company Inc. Vector Algebra, Shantinarayan and P K Mittal, S Chand and Co. Ltd.

Linear Algebra by Larry Smith, SpingerVerlag.

Elementary Linear Algebra with Applications, Keith Nicholson, PWS – Kent Publishing Company

Linear Algebra, SurjithSinth, Vikas Publishing House Pvt. Ltd. Modern Algebra by Vasishta, Krishna Prakashan Media Ltd.

Course Title/Code	Molecular Biology and Immunology EDH402-T
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**3-0-0-0**
Credits	**3**
Course Objective	To enable students to comprehend the modern concepts and applied aspects of molecular biology and immunology.
Course Outcomes (COs)	
CO1	. To Understand the development, organization and functions of genes
CO2	. To develop understanding of transcription and translation
CO3	To develop an understanding of techniques of immunology
CO4	To develop the skills required for designing the immune techniques
CO5	. To analyze and apply third generation vaccine
CO6	To analyze and apply skills and tools to design the drugs against cancer
Prerequisites (if any)	----------

SECTION A

Genome Structure, Chromatin and the Nucleosome

Genome Sequence and Chromosome Diversity, Chromosome Duplication and Segregation, The Nucleosome Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin. Regulation of Chromatin Structure and Nucleosome Assembly.

The Replication of DNA (Prokaryotes and Eukaryotes) Chemistry of DNA synthesis, general principles - bidirectional replication, Semi- conservative, semi discontinuous, RNA priming, Various models of DNA replication including rolling circle, D-loop (mitochondrial), Θ (theta) mode of replication, Enzyme involved in DNA replication – DNA polymerases, DNA ligase, Primase, Telomerase and other accessory proteins

SECTION B

Mechanism of Transcription- RNA Polymerase and the transcription unit Transcription in Prokaryotes Transcription in Eukaryotes Unit 2. RNA Modifications, Split genes, concept of introns and exons, removal of Introns, spliceosome machinery, splicing pathways, alternative splicing, exon shuffling, RNA editing, and mRNA transport.

Transcription Regulation in Prokaryotes (Ch 16 Watson) Principles of transcriptional regulation, regulation at initiation with examples from lac and trp operons , Gene Silencing

Translation (Prokaryotes and Eukaryotes) Assembly line of polypeptide synthesis - ribosome structure and assembly, various steps in protein synthesis. Charging of tRNA, aminoacyl tRNA synthetases. Proteins involved in initiation, elongation and termination of polypeptides. Regulation of translation.

SECTION C

Components of immune system

Innate, Adaptive (cell mediated and humoral) - Immunity. Cells and Organs of the Immune System, Primaryand Secondary lymphoid organs, Lymphatic system.

Antigens- Antigenicity and immunogenicity, Immunogens, Adjuvants and Haptens,

Factors influencing immunogenicity,B and T-cell epitopes.Immunoglobulins- Structure and Functions, Basic structure, deducing antibody structure, classes and function, Antigenic determinants on immunoglobulins, Antigen-antibody interactions, Polyclonal sera, Monoclonal antibodies,

SECTION D

Major Histocompatibility Complex- Structure, polymorphism and functions, MHC and immune responsiveness. Cytokines:

properties and functions, Complement system: components, activation and functions.

Hypersensitivity, Immune System in Health & Disease, Vaccines: bacterial, viral, toxoid and III generation vaccines, Immunodeficiency, Autoimmunity.Cytology of Cancer – Characteristics of cancer cell, hypothesis about cancer; somatic mutation, viral mutation; types and causes of cancer, treatment.

References Books and Readings:

1. Cell and Developmental Biology by Sastry, Singh &Tomar – (RastogiPublications, 2008).
2. Cell and Molocular Biology by P.K. Gupta – (Rastogi Publications, 2008).
3. Cell Biology by C.B.Powar – (Himalya Publishing House, Bombay).
4. Cell Biology by De Robertiset.al – (W.B. Saunders, Philadelphia).
5. A Textbook of Cytology by R.C.Dalela&S.R.Verma – (Jaiprashnath& Co.,Meerut).
6. Cell Biology by J.D. Burke – (Scientific Book Agency, Calcutta).
7. Cell Biology: A molecular approach by R.D. Dyson – (Allyn& Bacon,Boston).
8. Cell Biology by R.M.Dowben – (Harper & Row, New York).
9. Cell function by L.L.Langley – (Affiliated East West Press, New Delhi).
10. Cytology by C.D. Darlington.
11. Immunology by S.S. Lal&Sanjeev Kumar – (Rastogi Publications, 2008).
12. Immunology by Janis Kuby.
13. Genes (Vol. I – VII) by Levin B. – CBS Publishers.
14. Cell and Molecular Biology by De Robertis EDP & De Robertis EMI. Jr(1996) – Holt WBSaunders International.
15. Essentials of Molecular Biology by Feirfelder I (1997) – Narosa Publ. NewDelhi.
16. Cytology, Genetics & Evolution by Gupta PK (1992) – Rastogi Publications.
17. Molecular Cell Biology by Harvey L, Baltimore D, Berk A. et al., (1999) –Scientific American Source Book.
18. Principles of Biochemistry by Lehninger AL, Nelson DL & MM Cor (1993) –Kalyani Publishers, New Delhi.
19. Cytology &Cytogenetics by Swanson CP (1972) – MacMillan Co.
20. Animal Cytology and Evolution by MJD White – Cambridge University Pre

Course Title/Code	Molecular biology and immunology Lab (EDH402-P)
Course Type	**Core**
Course Nature	**Hard**
L-T-P-O Structure	**0-0-2-0**
Credits	**1**
Course Objective	To enable students to comprehend the modern concepts and applied aspects of molecular biology and immunology.
Course Outcomes (COs)	
CO1	To study the staining of Mitochondria
CO2	Study of slides of grasshopper
CO3	Study of Karyotype of man
CO4	Study of antigen antibody reaction
Prerequisites (if any)	-----

1. Staining of mitochondria in the buccal epithelial cells of man and ovary of earthworm using vital stain.
2. Study of mitosis in onion root tips.
3. Micrometry: Use of ocular and stage micrometres to measure cell and nuclear dimensions of human buccal epithelial cells.
4. Study of slides of grasshopper (Poecilocerapicta) testis for the various stages of meiosis.
5. Study of salivary gland chromosomes of Drosophila for banding patterns.
6. Study of salivary gland chromosomes of Chironomus larva.
7. Study of Karyotype and idiogram of man.
8. Isolation of DNA from kidney/spleen of rat (demonstration).
9. Demonstration of antigen-antibody reaction in gels.
10. Cytological characterization of DNA by Feulgen staining (demonstration)

Course Title/Code	SEMINAR (EDN412)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	(0-0-2-0)
Credits	2
Course Objective	Give the student the ability to analyse problems, create a hypothesis, assess and validate outcomes, and make logical conclusions from those results.
CO1	To enable interest in a theme and structure thoughts for a presentation.
CO2	To understand annotated bibliography with an outline that demonstrates scholastic abilities
CO3	To develop analysis and understanding of conceptual data.
CO4	To develop soft skills and employ cutting-edge technology to create proposal reports, such as Trello, Zotero, Jasper ai, and Ref-n-write

SECTION A

Introduction to the research process

Survey of the subject area of research. Search and selection of a personal area of interest.
Review of sources in the subject area of research. Presentation of the results of the analytical review in the selected area of interest. Collective discussion of the research topic.

SECTION B

Development of a research plan.

Discussion of the main idea for the practical implementation of the research results. Collective brainstorming to shape the proposed scientific novelty of the research. Review of presentation of the results of the primary/secondary data search.

SECTION C

Thesis Report Preparation

Preparation of the theses of the report and overview presentation of the project. Development and filling of the projects

SECTION D

Research project/proposal Development

Development of a research plan, formation of a list of the main sources used, and design of the first section of the research project. Preparation of an article based on the results of the work. Project presentation for collective discussion.

Reference Books:

The Craft of Research, Third Edition, by Wayne C. Booth, Gregory G. Colombo, Joseph M. Williams , 2016
The Research Methods Knowledge Base, 3rd Edition, By William M.K. Trochim and James P. Donnelly, 2008

Course Title/Code	**School Leadership and Management (EDH236)**	
Course Type	**Elective**	
Course Nature	**Soft**	
L-T-P Structure	**1-0-2-0**	
Credits	**2**	
Course Objective	To enable students to understand key leadership theories and ideas and develop their own leadership and able to undertake practice-based tasks enabling self-evaluation of their leadership in action.	
Course Outcomes (COs)		
CO1	understand key leadership theories and ideas, from inside and outside education, and apply these to thinking about their own practice	
CO2	draw on evidence from research and practice to develop knowledge with an understanding of what is known about effective leadership	
CO3	relate these to their own leadership context in planning actions	
CO4	undertake practice-based tasks enabling self-evaluation of their leadership in action.	
CO5	develop their reflective practice skills to help them to evaluate and improve their own leadership practice	
CO6	learn colLaboratively, supported by a mentor, to share insights, and develop knowledge and skills.	
Prerequisites		

(if any)	

Section A

Leadership: Concept and Dynamics

- Concept and functions of Leadership and management
- Theories of leadership (Trait Theory, Behavioural Theory, Situational Theory), Theories of Management (Taylor, Fayol, Max Weber) and its application in Educational organizations
- Models of educational leadership (Educational Leadership Model, Instructional Leadership Model)

Section B

Leadership Styles

- Authoritative Leadership v/s Participatory Leadership
- Transactional Leadership v/s Transformational Leadership
- Contemporary Leadership Styles: Situational leadership, Visionary Leadership, Ethical Leadership, Gender Leadership

Section C

Human Resource Management

- Concept of Human Resource Management, Process of Recruitment and Selection
- Types and Methods of Training
- Appraisal System and Grievance Handling

Section D

Team Building and Conflict management

- Concept of Group dynamics, types of groups, stages of group formation
- Conflict management: Concept and Strategies
- Stress management: Concept and Strategies

-

Course Title/Code	Educational leadership (MOOC-210-EDS-402)
Course Type	Elective
Course Nature	Soft
L-T-P Structure	1-0-2-0
Credits	2
Course Objective	Student Readiness in leadership skills
Course Outcomes (COs)	
CO1	understand key leadership theories and ideas, from inside and outsideeducation, and apply these to thinking about their own practice
CO2	draw on evidence from research and practice to develop knowledge with anunderstanding of what is known about effective leadership
CO3	relate these to their own leadership context in planning actions
CO4	undertake practice-based tasks enabling self-evaluation of their leadership inaction
Prerequisites (if any)	

Week 1: Educational Management & Leadership: Issues & challenges
Week 2: Professional Development & the Reflective Practitioner
Week 3: Professional Ethics & Values in Teaching
Week 4: Key Challenges for Educational Leaders: Grooming Capable & Authentic Educational Leaders
Week 5: Emotional Intelligence & Educational Leadership
Week 6: Leadership for Managing Diversity & Inclusion in Education
Week 7: Educational Leadership in a changing World: 21st Century Challenges
Week 8: Innovative Pedagogy, Technology & Turnaround Leadership: The Stakeholders' Perspectives

Reference Books and Readings

1) Educational Leadership: Key Challenges and Ethical Tensions; Author-Patrick Duignan, Cambridge University Press2) Educational Leadership: Context, Strategy and Collaboration; Author- Margaret Preedy, Nigel Bennett and Christine Wise, SAGE publication

Course Title/Code	Peace and Value Education (EDS220)	
Course Type	Elective	
Course Nature	Soft	
L-T-P Structure	1-0-2-0	
Credits	2	
Course Objective	Student Readiness for value education	
Course Outcomes (COs)		
CO1	To understand the nature of values and importance of value education inpresent day Indian society	
CO2	-To get oriented with the need and role of yoga and meditation for innerharmony	
CO3	-To understand impact of social processes on moral development	
CO4	-To get oriented with various strategies of value orientation	
Prerequisites (if any)		

SECTION A

VALUES: CONCEPTUAL FRAMEWORK

Values - Nature, Sources, Determinants, Social malaise and need for value inculcation, Classification of values, Nature and need of family values, social values, moral values, religious values, environmental values

SECTION B

ESSENTIALS OF VALUE DEVELOPMENT

Value development – a lifelong process, Development of right attitude through introspection and self-control, Human values in relation to Religious Pluralism, Role of Yoga and Meditation

SECTION C

UNDERLYING PERSONAL-SOCIAL PROCESSES

Role of family and community in preservation of culture and value development, Impact of electronic media on value inculcation in children, Value Conflict and Resolution

SECTION D

VALUE EDUCATION: TRANSACTIONAL ASPECTS

Value Education: Meaning and need, Direct approach and integrated approach to Value Education, Co-curricular approach to Value Development, Methods and techniques for inculcation of values, Role of a teacher and institute climate

Reference Books and Readings

- CBSE (2012). *Values Education A Handbook for Teachers.* Retrieved from http://cbseacademic.in/web_material/ValueEdu/Value%20Education%20Kits.pdf
- Goel, A. & Goel S. L. (2005). *Human values and Education*. New Delhi: Deep and DeepPublications Pvt. Ltd.
- Kulshrestha, S.P. (1979), Emerging Value Pattern of Teachers & Value Pattern ofTeachers & New Trends, Education in India, New Delhi: Light & Life Pub.
- Passi, B.K. & Singh, P. (1987). *Value Education*. Agra: National PsychologicalCorporation.
- NCERT (2012). *Education for Values in Schools – A Framework.* NCERT: Departmentof Educational Psychology and Foundations of Education. Retrieved from http://www.ncert.nic.in/departments/nie/depfe/Final.pdf
- Rokeach, M. (1973). *The nature of human values*. New York: Free Press.
- Ruhela, S. P. & Bhargava, V. *Dimensions of Value education*.Agra: H.P. Bhargava Book House
- Singh, Samporn (1979) Human Values, Jodhpur: Faith

Course Title/Code	**Guidance and Counselling** EDS**221**	
Course Type	**Elective**	
Course Nature	**Soft**	
L-T-P Structure	**1-0-2-0**	
Credits	**2**	
Course Objective	To enable a learner to	
Course Outcomes (COs)		
CO1	The students will apply the knowledge of guidance and counselling in real life situations	
CO2	The student will imbibe and demonstrate qualities of an effective counsellor	
CO3	The student will demonstrate various approaches of guidance and counselling	
CO4	The student will effectively use tools for testing and evaluating different techniques for assessment	
Prerequisites (if any)		

SECTION A

GUIDANCE AND COUNSELLING: OVERVIEW

Difference between Guidance and Counselling, Purpose and assumptions of Guidance and Counselling in Education, Types of guidance- Educational, Vocational, and Personal, Types of Counselling: Directive, Non-directive and Eclectic.

SECTION B

GUIDANCE AND COUNSELLING: FUNDAMENTALS

Essentials of a teacher as a Counsellor: Commitment, Confidentiality, Congruence, Empathy, Genuineness, Interpersonal skills, Mental and physical wellbeing, Objectivity, Pace, Positive regard, Understanding Self, Warmth.

Basic counselling skills: Observing, Listening, Rapport building, History taking, Questioning, Responding, Maintaining records/portfolios.

SECTION C

GUIDANCE AND COUNSELLING: INTERVENTIONS

Approaches to Counselling: Humanistic approach, Cognitive behavioral approach, Social learning approach, Integrative approach.

Issues in school requiring Counselling: Abuse, Anxiety, Behavioral problems, Bullying, Career choices, Peer pressure, Reproductive health, Self-image, Stress, Study habits, Substance abuse.
Counselling Exceptional children: Gifted, Talented, Creative; Differently abled.
Career Guidance and Counselling; Factors affecting Vocational choice; Strategies of disseminating Career Information (Individual, group-talks, orientations, workshops, internships, exhibitions); Steps of career counselling (Attending to the need, enabling self-understanding, exploring options, forming strategies and plans).

SECTION D

GUIDANCE AND COUNSELLING: OPTIMIZING OUTCOMES

Provisions for Guidance and Counselling in schools: Manpower provisions-Teachers, Counsellors/ psychologists, social workers; Physical provisions -Space, Testing tools (Aptitude Test, Personality Inventories and Interest Inventory), Print material.
Role of a teacher in Guidance and Counselling, Enhancing Guidance and Counselling outcomes through Parent-School partnership.

Reference Books and Readings

- Bhatnagar,Asha&Gupta,Nirmala. (2000). *Guidance & Counselling -Vol. 1.* New Delhi:Vikas Publishing House.
- Chandra,Ramesh. (2002). *Guidance &Counselling.* Delhi: Kalpaz Publications.
- Dave,Indu. (1983).*The Basic Essentials of Counselling.* New Delhi: Sterling Publishers.
- Chauhan,S.S. (2001). *Principles & Techniques of Guidance*. New Delhi: Vikas Publishing House.
- Gibson,Robert. (2008). *Introduction to Counselling & Guidance*. New Delhi:Prentice Hall of India.
- Kalia,H.L. (2006). *Counselling in Schools*. New Delhi: ICON.
- Nugent, Frank A. (1990). *An Introduction to the Profession of Counselling*. Columbus: Merrill publishing Co.
- Panda,N.P. *Education & Exceptional Children*. New Delhi: Deep & Deep Publisher.
- Pietrofesa, J.J, Bernstein, B.& Stanford, S. (1980). *Guidance: An Introduction*. Chicago: Rand McNally.
- Rao,Narayana. (2004). *Counselling Guidance*.New Delhi: Tata McGraw-Hill.
- Rao,S.N. (2014).*Guidance &Counselling*. New Delhi: Discovery Publishing House.
- Shrivastava, K.K. (2006). *Principles of Guidance &Counselling.* New Delhi: Kanishka Publishers and Distributors.
- Singh,Raj. (1994).*Educational & Vocational Guidance*. New Delhi: Commonwealth.
- Steffler & Stewart (2008). As in Kinra, A.K. *Guidance and Counselling.* Delhi: Pearson Education.
- Vashist,S.R. (2001). *Methods of Guidance.*New Delhi: Anmol Publications.

Course Title/Code	Human Rights in Education (EDS222)
Course Type	**Elective**
Course Nature	**Soft**
L-T-P-O Structure	1-0-2-0
Credits	2
Course Objective	Student Readiness for Human Rights Values
Course Outcomes (COs)	
CO1	To inculcate the knowledge of the Human Rights.
CO2	To Realize the importance and need of human rights -
CO3	To Comprehend the role of the Constitution in human rights -
CO4	To Comprehend the role of human rights in their life
Prerequisites (if any)	

SECTION A

HISTORICAL BACKGROUND OF HUMAN RIGHTS

Human Rights: Concept, Foundations, and Historical Background; Universal declaration ofHuman Rights and Indian Constitution Provisions
Constitutional and Institutional safeguards to Human Rights, National Human RightsCommission (NHRC) and its role·

SECTION B

HUMAN RIGHTS EDUCATION

Human Rights Education: Meaning, Objectives, Strategies. Role of Education towards duty- consciousness, Methods of Teaching Human Values, Human Rights Education at Secondary Level Curriculum

SECTION C

VIOLATION AND PROTECTION OF HUMAN RIGHTS

Human Rights Violation: Meaning and factors affecting human rights violationHuman Rights Organizations: UN, UNESCO and Indian constitution

SECTION D

TRENDS OF HUMAN RIGHTS

Growing Advocacy and Declining Trends of Human Rights Role of Media, School and NGOs in protecting Human rights

Reference Books and Readings:

1. Arjun Dev, Source Book on Human Rights, NCERT, New Delhi
2. Bipan Chandra, India after Independence. Roopa, New Delhi 2000.
3. Borgohain, Bani, Human Rights: Social Justice and political challenge, New Delhi:Kanishka Publishers, 1999
4. Chandra, Ashish, Human Rights and Conflict Resolution, New Delhi: Rajat, 2000.
5. Dev, Arjun and India Arjun Dev and Others, Ed. Human Rights: A source Book, NewDelhi: NCERT, 1996.
6. Dhand, Harry, Teaching Human Rights: A handbook, Bhopal: Ashian Institute of HumanRights, 2000.
7. Human Rights in India: Theory and Practice, National Book Trust, 2001
8. Jois, M. Rana, Human Rights and Indian Values, New Delhi: NCTE, 1998.
9. Khanna, S.K., Children and Human Rights, New Delhi: Commonwealth, 1998.
10. Mohanty, Jagannath Ed., Human Rights Education, New Delhi: Deep and Deep Pub.,2000.
11. Pachami, S.K., Children and Human Rights, new Delhi, APH Publishing, 1999.
12. Palai, Arun Kumar, National Human Rights Commission of India: Formation,Functioning and Future Prospects, New Delhi: Atlantic Pub., 1999.Paul, R.C., Protection of Human Rights, New Delhi: Commonwealth, 2000

Course Title/Code	**Environment and Education (EDS223)**
Course Type	**Elective**
Course Nature	**Soft**
L-T-P-O Structure	**1-0-2-0**
Credits	**2**
Course Objective	To develop student Awareness Regarding Environment
Course Outcomes (COs)	
CO1	To understand about the concept of environmental education.
CO2	-To develop sense of awareness about the environmental pollution, and possible hazards and its causes and remedies.
CO3	-To build up a sense of responsibility towards conservation of environment, bio-diversity, and sustainable development.
CO4	-To widen reasonable understanding about the role of school and education in fostering the idea and learning to live in harmony with nature.
Prerequisites (if any)	

SECTION A

Multidisciplinary nature of environmental studies

Definition, scope and importanc(2 lectures)Need for public awareness.

SECTION B

Natural Resources: Renewable and non-renewable resources

Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies.Timber extraction, mining, dams and their effects on forest and tribal people.
Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects ofextracting and using mineral resources, case studies.Food resources: World food problems, changes caused by agriculture andovergrazing, effects of modern agriculture, fertilizer-pesticide problems, water

logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Casestudies, Land resources: Land as a resource, land degradation, maninduced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

SECTION C

ECOSYSTEM

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 ofthe following ecosystem: -Forest ecosystem, Grassland, ecosystem, Desert ecosystem ,Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

SECTION D

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-sports 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.

Reference Books and Readings:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd.Bikaner.
- BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, Email:mapin@icenet.net(R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
- Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T.2001,
- Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
- De A.K., *Environmental Chemistry*, Wiley EasternLtd.
- *Down to Earth*, Centre for Science and Environment(R)

- Visit to a local area to document environmentalassets- 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 lecturehours)

SEMESTER - 8										
EDN403	**Reflective Journal**	**EDU**	**NTCC**	**CORE**	**0**	**0**	**0**	**2**	**0**	**2**
EDO404	**Phase-III School Internship-Pedagogy-I**	**EDU**	**OUTCOME**	**CORE**	**0**	**0**	**0**	**8**	**0**	**8**
EDO405	**Phase-III School Internship-Pedagogy-II**	**EDU**	**OUTCOME**	**CORE**	**0**	**0**	**0**	**8**	**0**	**8**
EDO415	**Action Research**	**EDU**	**OUTCOME**	**CORE**	**0**	**0**	**0**	**2**	**0**	**2**
EDO416	**Case Study**	**EDU**	**OUTCOME**	**CORE**	**0**	**0**	**0**	**2**	**0**	**2**
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**0**	**0**	**0**	**22**	**0**	**22**

Career Development Centre Modules will be offered

***COURSE NATURE**	**Hard course (H)**: A course having L-T-P and/or O component ; L(Lecture), T(Tutorial), P(Practical) and O(Outcome)
	Soft Course (S): A course aimed at development of a person's emotional, social, ethical, professional and creative potentials. The course shall have L-P and/or O component
	Workshop course(W): A completely 'hands on' course conducted in Laboratory, aimed at developing application/ implementation/ designing skills of a person. The course shall have P component
	Non Teaching Credit Course(N): The course involves no teaching and has P and O component. Shall include projects, seminars, dissertations etc.

****OFFERING DEPARTMENT NAMES**		**A course shall be assigned credits as under:**
EDU	**DEPARTMENT OF EDUCATION**	One credit for each lecture hour; One credit for each tutorial hour ; One credit for each Outcome hour; Two credits for each workshop/ Laboratory/practical/project session of 3 hours; One credit for each Laboratory or practical or project session of 2 hours
MRCFL	**MANAV RACHNA CENTRE OF FOREIGN LANGUAGES**	
CH	**CHEMISTRY**	
	MANAGEMENT	
CS	COMPUTER SCIENCE	

*** Electives are subject to change according to expertise avaiLable/ required.

Course Title/Code	EDN403 Reflective Journal
Course Type	Core
Course Nature	NTCC
L-T-P-O Structure	0-0-0-0
Credits	2
Course Objective	The course aims at developing skill related to Reflective Journal
Course Outcomes (COs)	
CO1	Introspect one's strength and weakness during classroom teaching
CO2	Develop a plan of action to channelize one's strength and improve upon the area of concerns
CO3	Envision himself/ herself as an effective prospective teacher
CO4	Imbibe the values essential for becoming the reflective and humane practitioner
Prerequisites (if any)	

Course Title/Code	EDO404 Phase III School Internship Pedagogy 1
Course Type	Core
Course Nature	NTCC
L-T-P-O Structure	0-0-0-0
Credits	8
Course Objective	The course aims at developing skill related to Pedagogy 1
Course Outcomes (COs)	
CO1	Prepare mega lesson plan incorporating essential maxims and principles of teaching
CO2	Deliver the lesson plan in the classroom demonstrating desired pedagogical skills and competencies
CO3	Prepare and utilize the appropriate TLM to facilitate effective teaching
CO4	Make appropriate use of tools and techniques for effective evaluation of students learning
CO5	Make appropriate use of tools and techniques for effective evaluation of students learning
CO6	Utilize peer feedback as a tool to enhance the teaching effectiveness
Prerequisites (if any)	

Course Title/Code	Phase III School Internship Pedagogy 2 (EDO405)
Course Type	Core
Course Nature	NTCC
L-T-P-O Structure	0-0-0-0
Credits	8
Course Objective	The course aims at developing skill related to Pedagogy 2
Course Outcomes (COs)	
CO1	Prepare mega lesson plan incorporating essential maxims and principles of teaching
CO2	Deliver the lesson plan in the classroom demonstrating desired pedagogical skills and competencies
CO3	Prepare and utilize the appropriate TLM to facilitate effective teaching
CO4	Demonstrate effective use of ICT in transacting the curriculum
CO5	Make appropriate use of tools and techniques for effective evaluation of students learning
CO6	Utilize peer feedback as a tool to enhance the teaching effectiveness
Prerequisites (if any)	

Course Title/Code	Case Study (EDO416)
Course Type	Core
Course Nature	NTCC
L-T-P-O Structure	0-0-0-0
Credits	2
Course Objective	The course aims at developing skill related to Case Study
Course Outcomes (COs)	
CO1	Execute and evaluate the effectiveness of the solution
CO2	Collect relevant information about the case identified
CO3	Explore the probable causes for the present conditions of the identified case
CO4	Propose a plan of action for the improvement/ restoration of the subject
Prerequisites (if any)	

Course Title/Code	EDO415 Action Research
Course Type	Core
Course Nature	NTCC
L-T-P-O Structure	0-0-0-0
Credits	2
Course Objective	The course aims at developing skill related to Action Research
Course Outcomes (COs)	
CO1	Identity problems faced during the real classroom situation
CO2	Offer tentative solutions for the identified problems
CO3	Develop a research based systematic plan of action to solve the problem
CO4	Execute and evaluate the effectiveness of the solution
Prerequisites (if any)	