MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

PROGRAMME BOOKLET

Bachelor of Education (B.Sc. B.Ed.) (EDU02)
(Academic Session: 2022-2026)

Department of Education and Humanities
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.

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

Programme Educational Objectives (PEOs)

1. To groom professional and humane teachers with key competencies pertinent to local and global scenario.
2. 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)

1. Demonstrate core values: Commitment to profession; honour diversity and ensure inclusion; ethical integrity.
2. Demonstrate competencies such as; Communication skills; working effectively with students and parents; drive for achieving improved student learning outcome.
3. Demonstrate professional/technical knowledge of the physical, social and intellectual development of students.
4. Demonstrate knowledge and understanding of: differentiating teaching to meet specific learning needs of students; both school education and teacher education-related subjects.
5. Demonstrate knowledge required to design lesson plan learning sequences, implement teaching strategies using ICT, set explicit, challenging and achievable learning goals for all students.
6. Demonstrate professional competencies/practice that is required to manage classroom activities by establishing and maintaining orderly and workable routines.
7. 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.
8. Demonstrate competencies and actions required for keeping oneself professionally engaged independently and participate in learning to update knowledge and practice.
9. Demonstrate the ability to conduct research in related thrust areas.
10. Demonstrate an ability to connect with the community and provide solutions at educational, environmental, and social level.
11. Demonstrate an attitude of reflection, social entrepreneurship and innovation.

Programme Specific Outcomes (PSOs)

1. Demonstrate the practical and theoretical understanding of core social science courses: History/English/political Science/economics
2. Demonstrate an ability to develop inter and trans disciplinary approaches to connect with community and to provide solutions to emerging problems.
3. Demonstrate bridging of the gap between academia, industry and society through field based projects and social engagements.

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

Program Structure (PCM)

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH135-T	Atomic Structure and Bonding	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH135-P	Atomic Structure and Bonding Lab			0	0	2		
PHH121-T	Physics-I	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH121-P	Physics-I Lab			0	0	2		
MAH121B	Geometry and Calculus	APPLIED SCIENCE	CORE	3	1	0	4	4
EDH102B	Foundation of Education	EDU	CORE	4	0	0	4	4
EDW168	ICT in Education	EDU	CORE	0	0	3	3	1.5
CDO105	Professional Competency I	CDC		2	0	0	2	2
CHH137	Environmental Science	APPLIED SCIENCE	UNIVERSITY COMPULSORY	2	0	4	2	4
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			17	2	11	26	24.5
SEMESTER - 2								

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH238B-T	Thermodynamics, Equilibrium and Solutions	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH238B-P	Thermodynamics, Equilibrium and Solutions Lab			0	0	2		
PHH122-T	Elasticity, Waves, and Heat	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH122-P	Elasticity, Waves, and Heat Lab			0	0	2		
MAH122B	Number Theory and Real Analysis	APPLIED SCIENCE	CORE	3	1	0	4	4
MAH120BP	MATHS Lab	APPLIED SCIENCE	CORE	0	0	2	2	1
EDH167B	Creating An Inclusive Classroom	EDU	CORE	4	0	0	4	4
EDH133-T	Learner and Learning Process	EDU	CORE	3	0	0	5	4
EDH133-P	Learner and Learning Process Lab			0	0	2		
CDO109	Professional Competency II	CDC		2	0	0	2	2
EDW125	Drama and Arts in Education	EDU	CORE	0	0	3	3	1.5
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			18	3	11	32	26.5
POST SECOND SEMESTER SUMMER TRAINING (EDO165) (1.5 Credits)								

SEMESTER - 3								
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH237B-T	Organic Chemistry I	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH237B-P	Organic Chemistry I Lab			0	0	2		
PHH226-T	Electricity and Electromagnetism	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH226-P	Electricity and Electromagnetism Lab			0	0	2		
MAH220B	Multivariate Calculus & Vector Calculus	APPLIED SCIENCE	CORE	3	1	0	4	4
MAH221B-T	Probability & Statistics	APPLIED SCIENCE	CORE	3	0	0	5	4
MAH221B-P	Probability & Statistics Lab			0	0	2		
EDH216B	Knowledge and Curriculum	EDU	CORE	4	0	0	4	4
EDS222B	Gender, School and Society	EDU	CORE	2	0	0	2	2
EDW217	Understanding the Self	EDU	Elective CORE Workshop	0	0	2	2	1.5
EDW304	Yoga & Health Education							
TOTAL (LTP-O/CONTACT HOURS/CREDITS)				18	2	8	28	24.5
Under Choice based Credit system, a basket of electives will be offered from which one electives will taken by the student								
SEMESTER - 4								

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH313B-T	Organic Chemistry II	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH313B-P	Organic Chemistry II Lab			0	0	2		
PHH227-T	Optics	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH227-P	Optics Lab			0	0	2		
MAH320B	GROUPS AND RINGS	APPLIED SCIENCE	CORE	3	1	0	4	4
EDH122-T	Assessment For Learning	EDU	CORE	3	0	0	5	4
EDH122-P	Assessment For Learning Lab			0	0	2		
EDS227B	School Organization & Management	EDU	CORE	2	0	0	2	2
MOOC-22E-EDS-201	Principles of Human Resource Management	MGT	Elective	2	0	0	2	2
MOOC-19E-EDS-202	Design Thinking- A Primer							
MOOC-22E-EDS-201	Principles of Management							
MCS231	Basics of Economics							

MCS232	Introduction to Finance							
MCS368	Basics of Entrepreneurship							
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			16	2	6	24	21

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

SEMESTER - 5

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH312B-T	Transition Elements and Coordination Compounds	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH312B-P	Transition Elements and Coordination Compounds Lab			0	0	2		
PHH330-T	Basic Electronics	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH330-P	Basic Electronics Lab			0	0	2		
MAH319B	DIFFERENTIAL EQUATIONS	APPLIED SCIENCE	CORE	3	1	0	4	4
EDH214B	Education in Contemporary India	EDU	CORE	4	0	0	4	4
EDH110-T	Pedagogy of Mathematics	EDU	CORE	3	0	0	5	4
EDH110-P	Pedagogy of Mathematics Lab			0	0	2		
EDW228	e-learning	EDU	CORE	0	0	3	3	1.5
EDO209	Phase I (Field Engagement)	EDU	CORE					2

	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			16	2	9	28	25.5

SEMESTER - 6								
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH314B-T	Electrochemistry and Chemical Kinetics	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH314B-P	Electrochemistry and Chemical Kinetics Lab			0	0	2		
MAH321B-T	COMPLEX ANALYSIS & NUMERICAL ANALYSIS	APPLIED SCIENCE	CORE	3	0	0	5	4
MAH321B-P	COMPLEX ANALYSIS & NUMERICAL ANALYSIS Lab			0	0	2		
PHH433-T	Solid State Physics	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH433-P	Solid State Physics Lab			0	0	2		
EDH128-T	Pedagogy of Physical Sciences	EDU	CORE	3	0	0	5	4
EDH128-P	Pedagogy of Physical Sciences Lab			0	0	2		
EDW254	Basic Research and Statistics (EPC)	EDU	CORE	0	0	3	3	1.5
EDW104	Reading And Reflection On Texts	EDU	CORE	0	0	3	3	1.5
EDO258	Phase-II Field Engagement	EDU	CORE					2
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			12	1	14	27	22

SEMESTER - 7								
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH315B-T	Spectroscopy and Natural Products	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH315B-P	Spectroscopy and Natural Products Lab			0	0	2		
PHH331-T	Relativity and Quantum Mechanics	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH331-P	Relativity and Quantum Mechanics Lab			0	0	2		
MAH401B	Linear Algebra	APPLIED SCIENCE	ELECTIVE CORE	3	1	0	4	4
LWS121	General Laws for Educators	LAW/NPTEL	Elective	2	0	0	2	2
LWS125	Women and Child Laws							
CDO432	Professional Competency Education			2	0	0	2	2
EDS236B	School Leadership and Management	EDU	ELECTIVE CORE	1	0	2	3	2
EDS207B	Peace and Value Education							
EDS220B	Human Rights in Education							
EDS221B	Guidance and Counselling							
EDS223B	Environmental Education							
MOOC-210-EDS-401	Educational Leadership							

	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			**14**	**3**	**6**	**23**	**20**

SEMESTER - 8

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
EDN403	Reflective Journal	EDU	CORE					2
EDO404B	School Internship Pedagogy-I	EDU	CORE					12
EDO405B	School Internship Pedagogy-II	EDU	CORE					12
EDO415	Action Research	EDU	CORE					2
EDO416	Case Study	EDU	CORE					2
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			**0**	**0**	**0**	**0**	**30**

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

***COURSE NATURE**	**Hard course (H): A course having LTP 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 LP 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	

Program Structure (CBZ)

SEMESTER - 1								
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH135-T	Atomic Structure and Bonding	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH135-P	Atomic Structure and Bonding Lab			0	0	2		
EDH113-T	Diversity of Microbes and Thallophytes	EDU	CORE	3	0	0	5	4
EDH113-P	Diversity of Microbes and Thallophytes Lab			0	0	2		
EDH114-T	Animal Diversity-I	EDU	CORE	3	0	0	5	4
EDH114-P	Animal Diversity-I Lab			0	0	2		
EDH102B	Foundation of Education	EDU	CORE	4	0	0	4	4
EDW168	ICT in Education	EDU	CORE	0	0	3	3	1.5
CDO105	Professional Communication I	CDC		2	0	0	2	2
CHH137	Environmental Science	APPLIED SCIENCE	UNIVERSITY COMPULSORY	2	0	4	2	4
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			17	0	13	26	23.5

	SEMESTER - 2							
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS

CHH238B-T	Thermodynamics, Equilibrium and Solutions	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH238B-P	Thermodynamics, Equilibrium and Solutions Lab			0	0	2		
EDH132-T	Bryophytes and Pteridophytes	EDU	CORE	3	0	0	5	4
EDH132-P	Bryophytes and Pteridophytes Lab			0	0	2		
EDH131-T	Animal Diversity-II	EDU	CORE	3	0	0	5	4
EDH131-P	Animal Diversity-II Lab			0	0	2		
EDH167B	Creating An Inclusive Classroom	EDU	CORE	4	0	0	4	4
EDH133-T	Learner and Learning Process	EDU	CORE	3	0	2	5	4
EDH133-P	Learner and Learning Process Lab			0	0	2		
CDO109	Professional Communication II	CDC		2	0	0	2	2
EDW125	Drama and Arts in Education	EDU	CORE	0	0	3	3	1.5
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			18	1	13	30	24.5
POST SECOND SEMESTER SUMMER TRAINING (EDO165) (1.5 Credits)								

SEMESTER - 3

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH237B-T	Organic Chemistry I	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH237B-P	Organic Chemistry I Lab			0	0	2		
EDH204-T	Gymnosperms and Angiosperms	EDU		3	0	0	5	4
EDH204-P	Gymnosperms and Angiosperms Lab			0	0	2		
EDH205-T	Animal Diversity-III and Comparitive Anatomy of Vertebrates	EDU	CORE	3	0	0	5	4

EDH205-P	Animal Diversity-III and Comparitive Anatomy of Vertebrates Lab			0	0	2		
EDH224-T	Angiosperm Anatomy and Ecology	EDU	CORE	3	0	0	5	4
EDH224-P	Angiosperm Anatomy and Ecology Lab			0	0	2		
EDH216B	Knowledge and Curriculum	EDU	CORE	4	0	0	4	4
EDS222B	Gender, School and Society	EDU	CORE	2	0	0	2	2
EDW217	Understanding the Self	EDU	Elective CORE	0	0	3	3	1.5
EDW304	Yoga & Health Education							
TOTAL (LTP-O/CONTACT HOURS/CREDITS)				16	1	11	29	23.5

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

SEMESTER - 4

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH313B-T	Organic Chemistry II	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH313B-P	Organic Chemistry II Lab			0	0	2		
EDH301T	Plant Systematics and Angiosperm Phylogeny	EDU	CORE	3	0	0	5	4
EDH301P	Plant Systematics and Angiosperm Phylogeny Lab			0	0	2		
EDH303-T	Cell Biology and Genetics	EDU	CORE	3	0	0	5	4
EDH303-P	Cell Biology and Genetics Lab			0	0	2		
EDH225-T	Animal Physiology and Endocrinology	EDU	CORE	3	0	0	5	4
EDH225-P	Animal Physiology and Endocrinology Lab			0	0	2		
EDH122-T	Assessment For Learning	EDU	CORE	3	0	0	5	4
EDH122-P	Assessment For Learning Lab			0	0	2		
EDS227B	School Organization & Management	EDU	CORE	2	0	0	2	2
MOOC22EEDS204	Principles of Human Resource Management	MGT	Elective	2	0	0	2	2

MOOC-19E-EDS-202	Design Thinking- A Primer							
MOOC-22E-EDS-201	Principles of Management							
MCS231	Basics of Economics							
MCS232	Introduction to Finance							
MCS368	Basics of Entrepreneurship							
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			19	0	10	29	24

	Two weeks Community Connect internship (1.5 credits) ED0 239

SEMESTER - 5

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH312B-T	Transition Elements and Coordination Compounds	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH312B-P	Transition Elements and Coordination Compounds Lab			0	0	2		
EDH310-T	Plant Physiology and Metabolism	EDU	CORE	3	0	0	5	4
EDH310-P	Plant Physiology and Metabolism Lab			0	0	2		
EDH302-T	Ecology and Animal Behaviour	EDU	CORE	3	0	0	5	4
EDH302-P	Ecology and Animal Behaviour Lab			0	0	2		
EDH214B	Education in Contemporary India	EDU	CORE	4	0	0	4	4
EDH109-T	Pedagogy of Biological Sciences	EDU	CORE ELECTIVE	3	0	0	5	4
EDH109-P	Pedagogy of Biological Sciences Lab			0	0	2		
EDW228	e-learning	EDU	CORE	0	0	3	3	1.5
EDO209	Phase I (Field Engagement)	EDU	CORE					2
TOTAL (LTP-O/CONTACT HOURS/CREDITS)				16	1	11	28	24.5
Under Choice based Credit system, a basket of electives will be offered from which two electives will taken by the student								

	SEMESTER - 6							
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH314BT	Electrochemistry and Chemical Kinetics	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH314BP	Electrochemistry and Chemical Kinetics Lab			0	0	2		
EDH402-T	Molecular biology, immunology and cancer	EDU	CORE	3	0	0	5	4
EDH402-P	Molecular biology, immunology and cancer Lab			0	0	2		
EDH311-T	Developmental Biology and Applied Zoology	EDU	CORE	3	0	0	5	4
EDH311-P	Developmental Biology and Applied Zoology Lab			0	0	2		
EDH128-T	Pedagogy of Physical Sciences	EDU	CORE	3	0	0	5	4
EDH128-P	Pedagogy of Physical Sciences Lab			0	0	2		
EDW254	Basic Research and Statistics (EPC)	EDU	CORE	0	0	3	3	1.5
EDW104	Reading And Reflection On Texts	EDU	CORE	0	0	3	3	1.5
EDO258	Phase-II Field Engagement	EDU	CORE	0	0	0	0	2
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			18	0	12	26	21

SEMESTER - 7								
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH315B-T	Spectroscopy and Natural Products	APPLIED SCIENCE	CORE	3	1	0	5	5
CHH315B-P	Spectroscopy and Natural Products Lab			0	0	2		
EDH410-T	Biochemistry , Plant Tissue culture and Biotechnology	EDU	CORE	3	0	0	5	4

EDH410-P	Biochemistry , Plant Tissue culture and Biotechnology Lab			0	0	2		
EDH 411-T	Genetics and Palentology	EDU	CORE	3	0	0	5	4
EDH 411-P	Genetics and Palentology Lab			0	0	2		
LWS121	General Laws for Educators	LAW/NPTEL	Elective	2	0	0	2	2
LWS125	Women and Child Laws							
CDO432	Professional Competency Education			2	0	0	2	2
EDS236B	School Leadership and Management	EDU	CORE	2	0	0	2	2
EDS221B	Guidance and Counselling							
EDS207B	Peace and Value Education							
EDS220B	Human Rights in Education							
EDS223B	Environmental Education							
MOOC-20O-EDS402	Educational Leadership							
				15	1	6	21	19

	SEMESTER - 8							
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
EDN403	Reflective Journal	EDU	CORE					2
EDO404B	School Internship Pedagogy-I	EDU	CORE					12
EDO405B	School Internship Pedagogy-II	EDU	CORE					12
EDO415	Action Research	EDU	CORE					2
EDO416	Case Study	EDU	CORE					2
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			0	0	0	0	30

***COURSE NATURE**	**Hard course (H): A course having LTP 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 LP 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.		

Total Credit Scheme (PCM)

S. No.	Semester	Contact Hours	Credits
1	1	**24**	**24.5**
2	2	**31**	**26.5**
3	Summer Training (Post II Sem)	**0**	**1.5**
4	3	**32**	**24.5**
5	4	**29**	**21**
6	Community Connect (Post IV Sem)	**0**	**1.5**
7	5	**27**	**25.5**
8	6	**29**	**22**
9	7	**18**	**20**
10	8 (School Internship)	**0**	**30**
Total		**190**	**197**

Total Credit Scheme(CBZ)

S. No.	Semester	Contact Hours	Credits
1	1	**26**	**23.5**
2	2	**30**	**24.5**
3	Summer Training (Post II Sem)	**0**	**1.5**
4	3	**29**	**23.5**
5	4	**30**	**24**
6	Community Connect (Post IV Sem)	**0**	**1.5**
7	5	**28**	**24.5**
8	6	**30**	**21**
9	7 (School Internship)	**24**	**19**
10	8	**0**	**30**
	Total	**197**	**193**

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	----	3	----	----	----	----	2	1	----	3	1	----
CO2	1	1	----	3	----	----	----	----	2	1	----	3	1	----
CO3	1	1	----	3	----	----	----	----	2	1	----	3	1	----
CO4	1	1	----	3	----	----	----	----	2	1	----	3	1	----
CO5	1	1	----	3	----	----	----	----	2	1	----	3	1	----

Course Title/Code	**Atomic Structure & Bonding Lab (CHH135-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	Learn to run simulation experiment to understand the physical and chemical parameters determination for water	Employability
CO2	To develop understanding of Acid Base titration	Skill Development
CO3	To analyze the concept behind the formation of some organic compounds.	Skill Development
CO4	To familiarize students with various spectroscopic instruments, their principle and applications like UV-VIS, IR, NMR and fluoresecence spectroscopy.	Employability
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.

References:

- A Text Book of Quantitative Inorganic Analysis, A I Vogel

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	----	3	----	----	----	----	2	1	----	3	1	----
CO2	1	1	----	3	----	----	----	----	2	1	----	3	1	----
CO3	1	1	----	3	----	----	----	----	2	1	----	3	1	----
CO4	1	1	----	3	----	----	----	----	2	1	----	3	1	----

Course Title/Code	**Physics-I (PHH121-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To enable students to understand Newtonian mechanics and apply Newton's laws to explain natural physical phenomena.	
Course Outcomes (COs)		Mapping
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.	Skill Development
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.	Skill Development
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.	Skill Development
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.	Skill Development
Prerequisites (if any)	**NA**	

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, linearmomentum 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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	2	----	1	2	2	3	----	1	3	1	1
CO2	1	2	3	2	----	1	2	2	3	----	1	3	1	1
CO3	1	2	3	2	----	1	2	2	3	----	1	3	3	3
CO4	1	2	3	2	----	1	2	2	3	----	1	3	1	1

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

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:

- PSSC Physics Laboratory Guide.
- Practical Physics, E Armitage, John Murray.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	3	-	3	3	-	-	3	-	-	2	-
CO2	3	-	-	3	-	3	3	-	-	3	-	1	-	-
CO3	3	-	-	3	-	3	3	-	-	3	-	-	2	-

Course Title/Code	**Diversity of Microbes and Thallophytes (EDH113-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	(3-0-0)	
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)		Mapping
CO1	Understand the basis and principles of classification of living organisms.	Skill Development
CO2	Understand the diversity that exists in microorganisms.	Skill Development
CO3	Understand the organization, morphological features and various modes of reproduction in Viruses, Bacteria, Algae and Fungi.	Skill Development
CO4	Understand the structural diversity in Lichens and their ecological and economic importance.	Employability
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.	Employability
Prerequisites (if any)	NA	

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 Mosaicof 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

General account, distribution, types, structure, reproduction, ecological and economic importance: Lichens (Crustose, Foliose, Fruticose) Role of microorganisms in human welfare with respect to Environment, Agriculture, Pharmaceuticals and Industry.

References:

- Alexopoulos.C.J. *Introductory Mycology.*
- Chopra.*A Class book of Fungi*. Jullandar: S. Nagin& Co.
- Dubey H.D. *A Text book of Fungi, Bacteria and Viruses.*

- Kumar, H.D., *A Textbook of Algae.*
- Pandey, B.P. *A Text book of Algae*.New Delhi: Sultanchand & Co.
- Sharma, P.D. (2005). *The Fungi*.Meerut: Rastogi Publications.
- Sharma, O.P. (1992). *Text book of Thallophytes*, New Delhi: TMH Publishing House.
- Singh, V., Pande, P.C. &Jain, D.K. (2006). *A Text book of Botany*. Meerut: Rastogi Publications.
- Singh, V., Pande, P.C. &Jain, D.K. (2007). *Diversity of Microbes and Cryptogams*. Meerut:Rastogi Publications.
- Smith, G.M. (1971). *Cryptogamic Botany Vol.I, Algae & Fungi*. New Delhi: TMH Publishing Co.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	--	--	--	--	2	1	1	1	3	1	1
CO2	2	2	2	-----	---	----	---	2	1	1	1	3	1	2
CO3	2	1	2	-----	---	----	---	2	3	1	1	3	3	2
CO4	2	1	2	-----	---	----	---	2	3	1	1	3	1	2
CO5	2	1	2	-----	---	----	---	2	3	2	2	3	3	3

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

- 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.
- Study of crustose, foliose and fruticose lichens.

References:

- Alexopoulos.C.J. *Introductory Mycology.*
- Chopra. *A Class book of Fungi*. Jullandar: S.Nagin& Co.
- Dubey H.D. *A Text book of Fungi, Bacteria and Viruses.*
- Kumar, H.D., *A Textbook of Algae.*

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	2	3	-	-	2	1	-	-	-	-	3	--	3
CO2	1	1	2	-	-	-	2	-	-	--	-	3	-	3
CO3	1	-	2	--	-	2	1	-	-	-	-	3	-	3
CO4	-	2	3	-	-	1	2	--	-	3	-	1	-	-

Course Title/Code	**Geometry and Calculus (MAH121B)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To equip the students with the notion of geometry of 2D & 3D for analyzing and solving mathematical problems and concepts of calculus to understand the application of derivatives & integrals	
Course Outcomes (COs)		Mapping
CO1	Understand and apply the notion of conics and confocal conics to solve various mathematical problems.	**Skill Development**
CO2	Apply the concept of limit, continuity and differentiability of the function of one variable to solve mathematical problems	**Skill Development**
CO3	Demonstrate the applications of single integrals.	**Skill Development**
Prerequisites (If any)	Basic knowledge of sets and number system.	

Section A

Analytical Geometry – I: General equation of second degree: Introduction, Condition for a pair of straight line, Condition for general equation of second degree to be a circle, parabola, hyperbola and ellipse.
Tracing of conics: Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic.

Section B

Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres. Co-axial system of spheres. Cones. Right circular cone, enveloping cone and reciprocal cone.
Cylinder: Right circular cylinder and enveloping cylinder.

Section C

Continuity and Differentiation – I: Limits and Continuity. Differentiation, Higher derivatives, Leibnitz's theorem, Maxima and Minima. 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.

Section D

Integration: Reduction formulae: Derivations and illustrations of reduction formulae. Rectification: Length of arc of curves (cartesian, parametric and polar form). Quadrature: Area enclosed by curves (cartesian, parametric and polar form). Solids of Revolution: Volume and surface area of solids of revolution

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. Differential Calculus by Gorakh Prasad, Pothishala Ltd.
5. Elements of Analytical Solid Geometry by Shanti Narayan

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	----	2	3	----	3	2	3	2	----	----	----	----	----	1
CO2	----	2	3	----	2	2	2	1	----	----	----	----	----	2
CO3	----	1	2	----	2	2	1	3	----	----	----	----	----	1

Course Title/Code	**Animal Diversity-I (EDH114-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	Explain the basis and principles of classification of living organisms.	Skill Development
CO2	Evaluate and understand the diversity that exists in Protozoa and Porifera.	Skill Development
CO3	Remember the organization, morphological features and various modes of reproduction in Cnidaria and Acnidaria.	Employability
CO4	Explain the morphology and various mode of reproduction in Helminthes.	Skill Development
CO5	Able to identify some of the diseases caused by Helminthes and study their symptoms	Entrepreneurship & Skill Development
CO6	Analyse and understand the diversity of phylum Annelida	Skill Development
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 andpathogenicity 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:

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO2	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO3	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO4	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO5	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO6	2	1	2	--------	--------	-------	--------	2	1	1	1	3	1	1

Course Title/Code	**Animal Diversity-I Lab (EDH114-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	To familiarize the students with the basic knowledge and working of microscope	Skill Development
CO2	To develop in the students the ability to spot the specimens of various organisms belonging to different phyla.	Skill Development
CO3	To study the permanent slides of the lower invertebrate phyla	Skill Development
CO4	To prepare the temporary mount slides of amoeba and paramecium.	Skill Development & Employability
Prerequisites (if any)	NA	

TITRATIONS

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.

References:

- Modern Textbook of Zoology Invertebrates by R.L. Kotpal – (Rastogi Publications, Meerut, 10th Revised Edition).
- Invertebrate Zoology series (Protozoa to Echinodermata) by R.L. Kotpal – (Rastogi Publications, Meerut).
- Invertebrate Zoology by E.L. Jordon and P.S. Verma – S. Chand & Co., Delhi).
- Invertebrate Zoology by J.K. Dhami and P.S. Dhami – S. Chand & Co., Delhi).

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO2	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO3	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO4	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO5	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO6	2	1	2	--------	--------	-------	--------	2	1	1	1	3	1	1

Course Title/Code	**Foundations of Education (EDH102B)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	4-0-0	
Credits	4	
Course Objective	To orient the students about the philosophical and sociological foundation of Education.	
Course Outcomes (COs)		Mapping
CO1	Assimilate the concept of Education and Its philosophical aspects	Employability
CO2	Comprehend the Socio-Cultural aspect of Education	Employability
CO3	Discuss the Inter-disciplinary nature of Education	Skill Development
CO4	Analyze the contribution of various Indian and western Educationists to Indian Education System.	Entrepreneurship
CO5	Reflect on the Educational concerns and Issues in the Indian context.	Entrepreneurship
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.

References:

- Anand, C L and et al (1993). *Teacher and Education in the Emerging Indian Society*. New Delhi: NCERT.
- Bhatia, K. & Bhatia, B. (1974) *The Philosophical and Sociological Foundations of Education*. Delhi: Doaba House.
- Delors, Jacques (1996). *Learning the Treasure Within*. Report to UNESCO of the International Commission on Education for the Twenty-first Century. UNESCO.
- Dewey J (1966). *Democracy in Education*, New York: Macmillan.
- Gandhi M K (1956). *Basic Education*. Ahmedabad, Navajivan.
- Goel, A. & Goel S.L. (2005). *Human values and Education*. New Delhi: Deep and Deep Publications Pvt. Ltd.
- Govt. of India (1952). *Report of the Secondary Education Commission*. New Delhi.
- Govt. of India. MHRD (1986, Revised 1992) *National Policy of Education*, New Delhi.
- NCERT (2014*). Basics of Education*. NCERT: Publication Division.
- R. S. Peters (Ed.) (1967) *The concept of education*. London: Routledge & Kegan Paul.
- Rajput, J.S. (2006). *Human Values and Education*. New Delhi: Pragun Publications.
- Saraswathi T S (1999). *Culture, Socialization and Human Development*. Sage Publication.
- Sharma, A. P. (2010). *Indian and Western Educational Philosophy*. New Delhi: Unicorn Books.
- Walia, J.S. (2011). *Philosophical, Sociological and Economic Bases of Education.* Jalandhar: Ahim Paul Publishers.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	---	---	2	3	---	2	----	2	3	3	3	---	3	---
CO2	3	1	2	3	---	3	----	2	3	3	1	---	1	1
CO3	3	3	3	----	---	3	----	2	3	3	---	---	---	3
CO4	2	----	1	2	3	3	----	2	3	3	3	---	2	2
CO5	1	----	2	3	---	3	---	2	3	2	3	---	1	2

Course Title/Code	**ICT in Education (EDW168)**	
Course Type	Core	
Course Nature	Workshop	
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		Course Mapping
CO1	Demonstrate an awareness of the main processes and components used in ICT systems.	Skill development
CO2	Describe and apply emerging technologies in teaching and learning environments	Employability
CO3	Create/Develop technology-enabled assessment and evaluation strategies	Employability
CO4	Describe the role of information and communication technology (ICT) in educational administration and management	Employability
Prerequisites (if any)	NA	

SECTION A

Introduction to ICT
Meaning, concept of ICT in education
Concept of Information Technology, Communication Technology, Educational Technology in Education

Components of ICT: - Hardware (Input Devices, Output Devices, Secondary Storage Devices, (Internal Components), Software (System Software, Application Software)
Introduction to office applications (MS-Office, MS-Word, MS-Excel, MS-Powerpoint)

SECTION B

ICT based teaching -learning approaches: -
Concept, Importance, Use of ICT in teaching and learning
Multimedia: - Add Text, Images, Graphics, Audio, Video, Multimedia Presentation tools:- Google Slides, Slides Go, Adobe Premiere Pro, Intuiface, Zoho Show
Web-conferencing tools for teaching: - Zoom, Google meet, Teams, Webex, Skype
Web 2.0 Tools: - Blogs, Podcast

Open Educational Resources (OER): - Meaning, Importance, Creation, Sharing, OER Repositories, Creative Commons License

SECTION C

ICT for evaluations
Digital assessment tools –E-Portfolios, Rubrics, survey tools, puzzle makers, test generators, question bank

SECTION D
ICT for educational administration and Management: -
ICT for personal management: e-mail, task, events, diary, networking
ICT for educational administration: Scheduling, record keeping, student information, electronic grade book, connecting with parents and community
LMS: - Concept and features

PRACTICAL SESSIONS
Using word processor, spread sheet, and presentation software to produce various teaching learning resources
Create Students Grade Card using spreadsheet
Developing a lesson plan using Multimedia Package
Create an academic blog on WordPress or Blogger and post different types of content on topics in

your Subject.
Create a Podcast and share it on Podcasting sites
Create and Share OER materials
Developing Online Portfolio
Creating Digital Rubrics on any topic
Constructing and Implementing Tests/quizzes using ICT Resources
Use google calendar to schedule events/Meetings/activities and set reminders
Creating online groups (Google Groups) and sharing ideas/discussion
LMS experience- hands on various features of LMS

REFRENCE BOOKS AND READINGS:

1. Bharihok Deepak. (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.
4. 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
5. Roblyer, M.D. (2008). Integrating Educational Technology into Teaching. New Delhi: Pearson Education, South Asia, India.
6. Shiksha Mein Computer (2001). Available on website of Indira Gandhi National Open University, Delhi: http://www.ignou.ac.in
7. Singh, Kamal Deep. (2012). Lesson through Multimedia. N. Delhi: Arya Book Depot.
8. Singh, Kamal. D., & Kaur, D. (2008). Using Computers in Education. New Delhi: Dhanpat Rai Publishing Company (Pvt.) Limited.
9. Varanasi, L., Sudhakar, V. & Mrunalini, T. (2004). Computer Education. New Delhi: Neelkamal Publications Pvt. Ltd.
10. Walia, J.S. (2008). Foundations of Computer Education and Applications. Punjab: Ahim Paul Publishers.

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	2	3	-	3	2	3	2	-	3	-	-	-	1
CO2	-	2	3	-	2	2	2	1	-	2	-	-	-	2
CO3	-	1	2	-	2	2	1	3	-	1	-	-	-	1
CO4	-	1	1	-	2	2	2	2	-	1	-	-	-	1

Course Title/Code	Professional Communication I (CDO105)	
Course Type/ Semester	Core	
Course Nature	Outcome	
L-P-O Structure	2-0-0	
Credits	2	
Course Objective	To familiarize students with the effective knowledge of Communication & Presentation.	
Course Outcomes (COs)		Mapping
CO1	Students will be able to develop all-round personality by mastering interpersonal skills to function effectively in different circumstances.	Skill Development
CO2	Students will be able to demonstrate effective communication through grammatically correct language.	Skill Development
CO3	Students will be able to apply effective listening and speaking skills in real life scenarios.	Skill Development
Prerequisites (if any)	N.A	

Section A

Unit I: Developing Communication Skills- II (Reading & Writing), Reading Comprehension, Writing Skills: Specific to AMCAT. Introduction to Writing: Organizing Principles of Paragraph, Precise Writing, Punctuations, Report Writing, Note Taking

Section B

Unit II: Syntactical English II, Indianism & Localism, Conditionals, Preposition of Time & Place

Section C

Unit III: Effective Communication, Concepts of Chronemics: Interpretation of time with business environment, Monochromic vs. Polychromic Cultures, Non- Verbal Communication: Kinesics & Proxemics, Acing virtual (video) interviews

Section D

Unit IV: Presentation Skills, Opening & closing of Presentations, Audience Analysis, Structuring the Presentation, Best Practice in Presentations

CO PO Mapping

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
C01	-	3	1	-	-	-	-	-	-	-	-	1	-	-	-
CO2	-	3	2		-	-	-	-	-	2	-	1	-	-	-
CO3	2	3	-	-	-	-	-	-	-	2	-	1	-	-	-

Course Title/Code	**Environmental Science (CHH137)**	
Course Type	University Compulsory	
Course Nature	Hard	
L-T-P Structure	(2-0-4)	
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	Explain the multidisciplinary dimensions of environmental issues and suggest potential solutions	Employability, Skill development, Entrepreneurship
CO2	Discuss about the various types of organisms and draw inferences about their interactions in different e systems	Employability, Skill development, Entrepreneurship
Prerequisites (if any)	NA	

SECTION-A

Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness (OC)
Renewable and Non-Renewable Resources: 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.

SECTION-B

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies (OC). Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources. (OC) Equitable use of resources for sustainable lifestyle
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) (OC)

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 (OC), Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity: habitat loss, poaching ofwildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity (OC).

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. (OC), Role of an individual in prevention of pollution. (OC), Pollution case studies. (OC), Disaster management: floods, earthquake, cyclone and landslides.
Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Case Studies, Environmental ethics: Issues and possible solutions.

SECTION-D

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies (OC): Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act (OC), Water (Prevention and control of Pollution) Act (OC), Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation (OC), Public awareness (OC).

Human Population and the Environment: Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights (OC), Value Education (OC), HIV/AIDS (OC), Women and Child Welfare (OC), Role of Information Technology in Environment and human health, Case Studies (OC).

*OC = Outcome component

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.
- Any socially relevant problem identification and proposing its possible solution

NOTE: Manav Rachna has adopted five villages, where students would be visiting, will identify the socially relevant issues and work on to provide possible solution.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	2	2	2	----	----	2	2	1	3
CO2	2	2	2	3	2	2	1	2	----	----	2	2	1	3

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

SEMESTER - 2								
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH238B-T	Thermodynamics, Equilibrium and Solutions	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH238B-P	Thermodynamics, Equilibrium and Solutions Lab			0	0	2		
PHH122-T	Elasticity, Waves, and Heat	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH122-P	Elasticity, Waves, and Heat Lab			0	0	2		
MAH122B	Number Theory and Real Analysis	APPLIED SCIENCE	CORE	3	1	0	4	4
MAH120BP	MATHS Lab	APPLIED SCIENCE	CORE	0	0	2	2	1
EDH167B	Creating An Inclusive Classroom	EDU	CORE	4	0	0	4	4
EDH133-T	Learner and Learning Process	EDU	CORE	3	0	0	5	4
EDH133-P	Learner and Learning Process Lab			0	0	2		
CDO109	Professional Communication II	CDC		2	0	0	2	2
EDW125	Drama and Arts in Education	EDU	CORE	0	0	3	3	1.5
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			18	3	11	32	26.5
POST SECOND SEMESTER SUMMER TRAINING (EDO165) (1.5 Credits)								

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

	SEMESTER - 2							
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH238B-T	Thermodynamics, Equilibrium and Solutions	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH238B-P	Thermodynamics, Equilibrium and Solutions Lab			0	0	2		
EDH132-T	Bryophytes and Pteridophytes	EDU	CORE	3	0	0	5	4
EDH132-P	Bryophytes and Pteridophytes Lab			0	0	2		
EDH131-T	Animal Diversity-II	EDU	CORE	3	0	0	5	4
EDH131-P	Animal Diversity-II Lab			0	0	2		
EDH167B	Creating An Inclusive Classroom	EDU	CORE	4	0	0	4	4
EDH133-T	Learner and Learning Process	EDU	CORE	3	0	2	5	4
EDH133-P	Learner and Learning Process Lab			0	0	2		
CDO109	Professional Communication II	CDC		2	0	0	2	2
EDW125	Drama and Arts in Education	EDU	CORE	0	0	3	3	1.5
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			18	1	13	30	24.5
POST SECOND SEMESTER SUMMER TRAINING (EDO165) (1.5 Credits)								

Course Title/Code	**Thermodynamics, Equilibrium & Solutions (CHH238B-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
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	**NA**	

SECTION A

Thermodyanamic -1

Concept of Energy, Historical perspectives, Generalisation 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 offormation. 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

THERMODYNAMICS – II

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 changes in ideal gases and mixing of gases. Gibbs and Helmholtz functions: Gibbs function (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. **(10 L)**

SECTION C

CHEMICAL EQUILIBRIUM AND PHASE QUILIBRIA

Recognising a system at Chemical Equilibrium. Attributes of Chemical Equilibrium, Thermodynamic derivation of law of mass

action, Equilibrium constant and free energy.Factors that affect the chemical equilibrium and Le Chatelier's principle.
Calculations involving equilibrium constant Ionic equilibria in aqueous solutions, sparingly soluble salts, solubility product common ion effect, selective precipitation, applications in qualitative analysis.
Ionisation of water, pH scale, weak acids and bases, hydrolysis, buffer solutions, acid Base indicators, acid base titrations and multi stage equilibria.Reaction isotherm and reaction isochore.
To establish a systematic way of discussing the changes systems undergo when they are heated and cooled and when their composition is changed. Clapeyron equation and Clausius.
Phase equilibria of two component system – solid-liquid equilibria – simple eutectic – Bi – Cd. Pb-Ag. Systems, desilverisation of lead.Simple eutectics, systems forming compounds with congruent melting points.**(8 L)**

SECTION D

SOLUTIONS

To unify the equilibrium properties of simple mixtures on the basis of chemical potential.Solutions ofGases in liquids. Henry's law and its applications, solutions of solids in liquids.Distribution law, application of distribution law to association, dissociation and extraction. 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.(8 L)

Reference Books and Readings:

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	---	---	---	---	---	---	---	1	---	1	---
CO2	1	1	2	---	---	2	---	---	---	---	1	---	1	---
CO3	1	1	---	---	1	---	---	---	1	---	1	---	1	---
CO4	1	1	1	---	3	1	---	---	1	---	1	---	1	---

Course Title/Code	**Thermodynamics, Equilibrium & Solutions (CHH238B-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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	NA	

List of Experiments:

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 phthalin/methyl orange by colorimeter.

References:

- A Text Book of Qualitative organic Analysis, A I Vogel

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	---	1	---	---	---	---	---	---	---	1	---	1	---
CO2	1	---	2	---	---	2	---	---	---	---	1	---	1	---
CO3	1	---	-	---	1	---	---	---	1	---	1	---	1	---
CO4	1	---	1	---	3	1	---	---	1	---	1	---	1	---

Course Title/Code	**Elasticity Waves, and Heat (PHH122-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
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)		Mapping
CO1	Students would be able to explain, demonstrate the concepts of elasticity, oscillations and waves and solve problems related	Skill Development
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.	Skill Development
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	Skill Development
CO4	Students would be able to compare and apply the concepts of entropy and hypothesize problems related to entropy	Skill Development
Prerequisites (if any)	**NA**	

SECTION A

ELASTICITY AND WAVES

Hooke's law, Modulii 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-partitionof 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:

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

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	---	---	2	1	2	1	---	1	3	3	1	3	3	2
CO2	---	---	2	1	2	1	---	1	3	3	1	3	3	2
CO3	---	---	2	1	2	1	---	1	3	3	1	3	3	2
CO4	---	---	2	1	2	1	---	1	3	3	1	3	3	2

Course Title/Code	**Elasticity Waves, and Heat (PHH122-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	Students will be able to demonstrate an ability to conduct investigations of practical/technical issues.	Skill Development
CO2	They will demonstrate an ability to analyze data and reach a valid conclusion.	Skill Development
Prerequisites (if any)	NA	

PHYSICS-II Elasticity, Waves, Heat and Thermodynamics Practical (PHH125-P)

(A minimum of TEN experiments out of the following).

1. Study of velocity of waves on a slinky under tension.
2. Study of the oscillations of a column of water as a function of its length and study of damped oscillation.
3. To determine the velocity of sound at 0o C and the end correction by setting up a resonance column (first resonance length).
4. Study of the variation of the time period of a bar pendulum with different length and determination of 'g' at the given place.
5. Study of torsional oscillations of a loaded wire and determination of the rigidity modulus of the material of the wire.
6. Study of the motion of a steel sphere in a viscous liquid and determination of the coefficient of viscosity of the liquid.
7. Study of transverse vibrations on a sonometer. To determine the frequency by (i) absolute method, (ii) Comparison method.
8. Study of Newton's law of cooling.
9. Melde's experiment – determination of frequency.
10. Determination of solar constant.
11. Study of variation of pressure and temperature of a gas at constant volume.

12. J by Joules Calorimeter.
13. Lees and Charlton disc – Thermal conductivity of a bad conductor.
14. Specific heat of a solid by the method of mixtures.

References :

1. PSSC Physics Laboratory Guide.
2. Physics Department Instruction Sheets, RIE, Mysore.
3. Practical Physics, E. Armitage, John Murray.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	---	---	3	---	3	3	---	---	3	---	3	---	1
CO2	3	---	---	3	---	3	3	---	---	3	---	---	2	1

Course Title/Code	**Number Theory and Real Analysis (MAH122B)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To equip the students with the concept of numbers, sequence and series & it's nature.	
Course Outcomes (COs)		Mapping
CO1	Understand the concept of the number system and axioms defined	**Skill Development**
CO2	Understand the properties of the real line $\mathbb{R}$ and lit's topology	**Skill Development**
CO3	Recognize different types of sequences & calculate the limit of a sequence.	**Skill Development**
CO4	Examine the convergence or divergence of infinite series through application of various tests.	**Skill Development**
Prerequisites (if any)	NA	

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

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 C

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 D

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.

References:

1. Elementary Number Theory by David M. Burton.
2. Principal of Real Analysis by Malik, Wiley Eastern.
3. Mathematical Analysis by Shanti Narayan, S. Chand and Co. Ltd.
4. Principles of Mathematical Analysis by Walter Rudin, 2nd Edition, McGraw Hill Book Company, 1984.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	----	2	3	----	3	2	3	2	----	----	----	----	----	1
CO2	----	2	3	----	2	2	2	1	----	----	----	----	----	2
CO3	----	1	2	----	2	2	1	3	----	----	----	----	----	1
CO4	----	1	1	----	2	2	2	2	----	----	----	----	----	1

-Course Title/Code	**MATHS Lab (MAH120BP)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	Students would be able to understand and apply Mathematical software for solving mathematical problems and its applications.	
Course Outcomes (COs)		Mapping
CO1	Get the basic understanding of Mathematical software	Skill Development
CO2	Use various commands available in Mathematical software to find limit continuity and differentiability	Skill Development
CO3	Implement the commands in Mathematical problems.to compute differentiation, integration	Skill Development
CO4	Implement the commands in finding maxima, minima, application of integrals	Skill Development
Prerequisites (if any)	Basic knowledge of sets and number system.	

Practicals:

1. Introduction to Mathematical Software and use of some simple Mathematical Software commands.
2. To define matrices and compute matrix operations.
3. Introduction to graphics: Basic Two-Dimensional Graphs, Labels, Multiple plots on the same axes, Line styles, Markers and color, Axis limits and Subplots.
4. To find limit & continuity of function of single variable.
5. To find differentiability of function of single variable.
6. Perform advanced operation on Matrices.
7. To find limit & continuity of function of several variables.
8. To find differentiability of function of several variables.
9. Compute differentiation of a function of single and several variables.
10. To find maxima and minima of function of several variables.
11. To find integral of a given function.
12. Multiple Integrals

References:

- GNU Octave Beginner's Guide -by Jesper Schmidt Hansen (Author)
- Introduction to GNU Octave -by Jason Lachniet (Author)

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	----	2	1	----	2	3	----	3	----	3	3	----	2
CO2	2	----	2	1	----	2	3	----	2	----	2	3	----	3
CO3	3	----	2	1	----	3	2	----	3	----	2	3	----	1
CO4	2	----	2	1	----	3	2	----	2	----	2	3	----	3

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)		Mapping
CO1	To get acquainted with the structure, classification, and life history of Bryophytes.	Skill Development
CO2	To understand the Geological time scale and the importance of fossils.	Employability
CO3	To get acquainted with the structure, classification, and life history of Pteridophytes.	Skill Development
CO4	To analyse the evolutionary trends among Pteridophytes.	Entrepreneurship
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
tudy 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:

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	---	----	----	---	2	1	1	1	3	1	1
CO2	2	1	2	---	----	----	---	2	1	1	1	3	1	1
CO3	2	1	2	---	----	----	---	2	1	1	1	3	1	1
CO4	2	1	2	---	----	----	---	2	1	1	1	3	1	1

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

Practical

2. To observe and identify temporary micro-preparations and permanent slides
3. Study of the taxa included under Bryophytes and Pteridophytes by observing temporary micro-preparations and permanent slides.
4. To develop the skill of freehand sectioning, staining, and mounting, Bryophytes and Pteridophytes.
5. To prepare temporary, double-stained micro-preparations.
6. Study of the morphology, thallus organization and reproductive structures of taxa studied in Bryophytes and Pteridophytes through permanent slides.
7. Preparation and submission of 2 double-stained slides

References:

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	---	2	2	---	---	2	3	---	3	---	2
CO2	3	3	3	---	3	3	---	---	2	3	---	3	---	---
CO3	3	2	2	---	3	3	---	---	2	2	---	2	2	---
CO4	2	2	3	---	2	2	---	---	2	3	---	3	2	---

Course Title/Code	**Animal Diversity-II (EDH131-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	Critically analyse the basic structure, classification and life history of Arthropoda, Mollusca and Echinodermata	Skill Development
CO2	Comprehend the systemic position and phylogeny of Onycophora	Skill Development
CO3	Reflect upon the classification of Mollusca and to gain the knowledge of formation of the pearl	Employability
CO4	To have the Knowledge of the evolutionary trends among arthropoda, mollusca and echinodermata	Skill Development
CO5	Critically analyze the classification Of Protochordata	Skill Development
CO6	Critically analyze the classification and life history of Cylostomata	Skill Development
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 of shells 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 orders with examples; Type study: Petromyzon– External morphology, digestive system and respiratory system (2); Structure and metamorphosis of Ammocoetes larva ; Comparison of organ systems between Petromyzon and Myxine.

References:

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

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-----	3	1	-----	2	1	1	1	3	3	3
CO2	2	1	1	-----	3	1	-----	2	1	1	1	3	3	3
CO3	2	1	1	-----	3	1	-----	2	1	1	3	3	3	3
CO4	2	1	1	-----	3	1	-----	2	1	1	1	3	3	3
CO5	2	1	1	-----	2	1	-----	2	1	1	3	3	3	3
CO6	2	1	1	-----	2	1	-----	2	1	1	1	3	3	3

Course Title/Code	**Animal Diversity-II Lab (EDH131-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	To develop in the students the skills of staining and mounting of materials (temporary and permanent); ofdissection, display and Labelling	Skill Development
CO2	To develop in the students the skills of collection, preservation, mounting of specimens	Skill Development
CO3	To develop in the students the skills of identification and labelling of collected specimens	Skill Development
CO4	To develop in the students the skills of field observation of animals	Skill Development & Employability
Prerequisites (If any)	NA	

Practicals

1. Dissection of Palaemon and flag Labelling: a) Digestive system b) Nervous system ii) Mounting of appendages.
2. Study of specimens of Arthropoda and Onychophora: a) Lepas b) Balanus c) Hippad d)Cancer e) Limulus f) Scolopendra g) Spirobolush) Peripatus.
3. Study of mouth parts: a) Culex/Anopheles b) Periplaneta c) Apisd) butterfly.
4. Study of Crustacean larvae: a) Nauplius b) Zoaeac) Mysis d) Megalopa. Preparation of permanent slides of fresh water and marine crustacean specimens.
5. Identification and classification of Anopheles, Culex and Aedes mosquitoes.
6. Study of specimens and permanent slides of Mollusca: a) Pila b) Unio c) Sepia d) Octopuse) Chitonf) Dentalium g) Radula of Pila i) T.S. of Ctenidiu j) Glochidium.
7. Dissection and mounting of Pila (Study of dissected specimen): Nervous system b) radula
8. Study of specimens and permanent slides of Echinodermata: a) Astropecten/ Asterias b) Ophiothrix c) Echinus d) Holothuria e) Antedon f) Bipinnaria larva g) Ophiopluteuslarvah) Echinopluteuslarva i) Pedicellaria
9. Study of specimens and permanent slides of Protochordata: Balanoglossus: a) Entire b) T.S. through proboscis c) T.S. through collar d) T.S. through trunk region Ascidia Doliolum Salpa Amphioxus: a) Entire b) T.S. through oral cirri c) T.S. through pharynx d) T.S. through intestinee) T.S. through tail Study of specimens of Cyclostomata: a) Petromyzonb) Myxine

   Field Visit- Zoo

References:

- Invertebrate Zoology by E.L. Jordon and P.S. Verma – S. Chand & Co., Delhi).
- Invertebrate Zoology by J.K. Dhami and P.S. Dhami – S. Chand & Co., Delhi).
- Invertebrate Zoology series (Protozoa to Echinodermata) by R.L. Kotpal – (Rastogi Publications, Meerut, 2008).
- A Textbook of Invertebrate Zoology by S.N. Prasad – (Kitab Mahal, Allahabad).

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	---	2	3	---	---	2	1	---	---	---	---	1	3	2
CO2	1	1	2	---	---	---	2	---	---	---	---	1	3	3
CO3	1	---	2	---	---	2	1	---	---	---	---	1	3	3
CO4	--	2	3	---	---	1	2	---	---	3	--	--	2	3

Course Title/Code	**Creating An Inclusive Classroom (EDH167B)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	4-0-0	
Credits	4	
Course Objective	Student Readiness for Future Teaching in an Inclusive Classroom	
Course Outcomes (COs)		Mapping
CO1	To understand the meaning and need of inclusion in education	Employability
CO2	To get familiarized with various policies, programmes and schemes promoting inclusive education	Skill Development
CO3	To identify the social, economic, and physical diversity that exists amongst learners	Entrepreneurship
CO4	To recognize the challenges in Inclusive Education	Entrepreneurship
Prerequisites (if any)	NA	

SECTION A

INTRODUCTION TO INCLUSIVE EDUCATION

Marginalisation vs. Inclusion: Meaning & Definitions
Changing Practices in Education of Children with Disabilities: Segregation, Integration & Inclusion
Diversity in Classrooms: Learning Styles, Linguistic & Socio-Cultural Multiplicity
Principles of Inclusive Education: Access, Equity, Relevance, Participation & Empowerment
Barriers to Inclusive Education: Attitudinal, Physical & Instructional

SECTION B

POLICES & FRAMEWORKS FACILITATING INCLUSIVE EDUCATION

International Declarations: Universal Declaration of Human Rights (1948), World Declaration for Education for All (1990)
International Conventions: Convention against Discrimination (1960), Convention on Rights of a Child (1989), United Nations Convention of Rights of Persons with Disabilities (UNCRPD) (2006)
International Frameworks: Salamanca Framework (1994), Biwako Millennium Framework of Action (2002)
National Commissions & Policies: Kothari Commission (1964), National Education
Policy (1968), National Policy on Education (1986), Revised National Policy of Education (1992), National Curricular Framework (2005), National Policy for Persons with Disabilities (2006) National Acts & Programs: IEDC (1974), RCI Act (1992), PWD Act (1995), NationalTrust Act (1999), SSA (2000), RTE (2006), RMSA (2009), IEDSS (2013)

SECTION C

ADAPTATIONS ACCOMODATIONS AND MODIFICATIONS

Meaning, Difference, Need & Steps
Specifics for Children with Sensory Disabilities
Specifics for Children with Neuro-Developmental Disabilities
Specifics for Children with Loco Motor & Multiple Disabilities
Engaging Gifted Children

SECTION D

INCLUSIVE ACADEMIC INSTRUCTIONS

Universal Design for Learning: Multiple Means of Access, Expression, Engagement & Assessment
Co-Teaching Methods: One Teach One Assist, Station-Teaching, Parallel Teaching, Alternate Teaching & Team Teaching
Differentiated Instructions: Content, Process & Product
Peer Mediated Instructions: Class Wide Peer Tutoring, Peer Assisted Learning Strategies
ICT for Instructions

SECTION D

SUPPORTS AND COLLABORATIONS FOR INCLUSIVE EDUCATION

Stakeholders of Inclusive Education & Their Responsibilities
Advocacy & Leadership for Inclusion in Education
Family Support & Involvement for Inclusion
Community Involvement for Inclusion
Resource Mobilisation for Inclusive Education

References:

- Bartlett, L. D., & Weisentein, G. R. (2003). Successful Inclusion for Educational Leaders. New Jersey: Prentice Hall.
- Chaote, J. S. (1991). Successful Mainstreaming. Allyn and Bacon.
- Choate, J. S. (1997). Successful Inclusive Teaching. Allyn and Bacon.
- Daniels, H. (1999). Inclusive Education.London: Kogan.
- Deiner, P. L. (1993). Resource for Teaching Children with Diverse Abilities, Florida: Harcourt Brace and Company.
- Dessent, T. (1987). Making Ordinary School Special. Jessica Kingsley Pub.
- Gargiulo, R.M. Special Education in Contemporary Society: An Introduction to Exceptionality. Belmont: Wadsworth.
- Gartner, A., & Lipsky, D.D. (1997). Inclusion and School Reform Transferring America's Classrooms, Baltimore: P. H. Brookes Publishers.
- Giuliani, G.A. & Pierangelo, R. (2007). Understanding, Developing and Writing IEPs. Corwin press: Sage Publishers.
- Gore, M.C. (2004) . Successful Inclusion Strategies for Secondary and Middle School Teachers, Crowin Press, Sage Publications.
- Hegarthy, S. & Alur, M. (2002). Education of Children with Special Needs: from Segregation to Inclusion, Corwin Press, Sage Publishers.
- Karant, P., & Rozario, J. ((2003). Learning Disabilities in India. Sage Publications.
- Karten, T. J. (2007). More Inclusion Strategies that Work. Corwin Press, Sage Publications.
- King-Sears, M. (1994). Curriculum-Based Assessment in Special Edcuation. California: Singular Publications.
- Lewis, R. B., & Doorlag, D. (1995). Teaching Special Students in the Mainstream. 4th Ed. New Jersey: Pearson.
- McCormick, S. (1999). Instructing Students who Have Literacy Problems. 3rd Ed. New Jersey, Pearson.
- Rayner, S. (2007). Managing Special and Inclusive Education, Sage Publications.

- Ryandak, D. L. & Alper, S. (1996). Curriculum Content for Students with Moderate and Severe Disabilities in Inclusive Setting. Boston, Allyn and Bacon.
- Sedlak, R. A., & Schloss, P. C. (1986). Instructional Methods for Students with Learning and Behaviour Problems. Allyn and Bacon.
- Stow L. & Selfe, L. (1989). Understanding Children with Special Needs. London: Unwin Hyman.
- Turnbull, A., Turnbull, R., Turnbull, M., & Shank, D.L. (1995). Exceptional Lives: Special Education in Today's Schools. 2nd Ed. New Jersey: Prentice-Hall.Inc.
- Vlachou D. A. (1997). Struggles for Inclusive Education: An Ethnographic Sstudy.
- Philadelphia: Open University Press.Westwood, P. (2006). Commonsense Methods for Children with Special Educational Needs- Strategies for the Regular Classroom. 4th Edition, London Routledge Falmer: Taylor & Francis Group.

Activities

1. Visit Special Schools of any two Disabilities & an Inclusive school & write observation report highlighting pedagogy
2. Prepare a Checklist for Accessibility in Mainstream Schools for Children with Disabilities
3. Design a Poster on Inclusive Education
4. Prepare a Lesson Plan on any one School subject of your choice using any one
5. Inclusive Academic Instructional Strategy

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	2	---	---	1	1	2	2	1	3	--	2
CO2	2	2	1	2	---	1	1	---	2	1	1	2	--	3
CO3	2	3	2	3	1	3	2	1	2	3	1	3	1	-
CO4	3	3	1	2	2	2	2	2	2	2	1	2	1	-

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

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 and implications Erickson's Theory of social and moral development- Concept, stages and implications with special reference to Indian context. Maria Montessori's Planes of development.

References:

- 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; Halt, Hodder and Stoughton Bernard, H. W., (1954). Psychology of Learning and Teaching, New York; MgGraw Hill

- 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 ofInstruction, New York; Halt, Rinehart and Winston
- Malek Parveenbanu M., (2014). Technology & Teacher, Ahmedabad; SSTCT Publication.
- Cole, M., Cole, S. R. and Lightfoot, C. (2004). *The Development of Children.* New York: Worth Publishers
- D. 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.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	2	2	3	3	----	3	----	----
CO2	3	2	1	1	1	1	2	2	3	3	3	----	3	2
CO3	---	1	1	1	1	1	2	1	2	3	3	3	---	2
CO4	2	1	1	1	1	1	1	1	2	3	3	---	2	2
CO5	1	1	1	1	1	1	2	1	2	3	3	---	2	2

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

Practicals:

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
10. Analysis of classroom teaching episode in the light of teaching skills / strategies

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	---	2	2	1	2	----	3	----	---
CO2	1	2	2	3	3	2	1	2	1	1	3	---	3	2
CO3	3	2	3	2	1	---	1	3	1	2	3	3	----	2

Course Title/Code	Professional Communication II (CDO109)	
Course Type/ Semester	Core	
Course Nature	Outcome	
L-T-P Structure	2-0-0	
Credits	2	
Course Objective	To familiarize students with the basic knowledge of Quantitative Aptitude & Logical Reasoning	
Course Outcomes (COs)		**Mapping**
CO1	Students will be able to exhibit effective reading and writing skills in a professionally stimulated environment.	**Skill Development**
CO2	Students will be able to enhance skills to effectively deliver formal and informal presentations to a variety of audiences in multiple contexts.	**Skill Development**
CO3	Students will be able to learn grammatically correct formal writing skills.	**Skill Development**
Prerequisites (if any)	**N.A**	

Section A

Unit I: Attitudinal Communication, Attitude and its Impact on Communication, Courtesy & Politeness in Communication, Diversity & Inclusion – Bullying, Cultural Sensitivity, Stereotypes, Sexual Harassment, LGBTQ, Respect, Chivalry, Racial & Gender Discrimination, Disability Harassment, Inclusion, Power Dressing

Section B

Unit II: Syntactical Communication – I, Common errors in communication, Identification of word class, Errors & rectifications, Article usage, Tenses usage - Present Perfect vs. Past Simple vs. Past Perfect, Subject Verb Agreement

Section C

Unit III: Phonetics, Impact of First Language Influence, Tone, Intonation, Rate of Speech, Pronunciation: Vowels & Consonant sounds

Section D

Unit IV: Developing Communication Skills –I (Listening & Speaking), Concept of LSRW: Importance of LSRW in communication, Listening Skills : Real Life challenges, Barriers to Listening, Speaking : Self Introduction, Interview, GD, Resume

CO PO Mapping

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	1	2	-	-	-	-	-	-	-	2	-	1	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	1	-	-	-

Course Title/Code	**Drama and Arts in Education (EDW125)**	
Course Type	Core	
Course Nature	Workshop	
L-T-P Structure	0-0-3	
Credits	1.5	
Course Objective	Student readiness for art-based education	
Course Outcomes (COs)		Mapping
CO1	To develop the skills to use visual art in teaching learning process effectively.	Skill Development
CO2	To develop the skills to use literary art in teaching learning process effectively.	Skill Development
CO3	To develop the skills to use performing art in teaching learning process effectively.	Entrepreneurship
CO4	To develop the skills to integrate technology and art in teaching learning process effectively.	Entrepreneurship
Prerequisite (if any)	NA	

SECTION A

INTRODUCTION TO ART EDUCATION

Art and art education: Meaning, scope, and difference, Artistic expression: Meaning and strategies to facilitate, Art therapy: Concept and application to students with and without disabilities, Linking Art Education with Multiple Intelligences, Understanding emerging expression of art by students

SECTION B

PERFORMING ARTS: DANCE AND MUSIC

Range of art activities related to dance and music, Experiencing, responding, and appreciating dance and music, Exposure to selective basic skills required for dance and music, Dance and Music: Facilitating interest among students: planning

and implementing activities, Enhancing learning through dance and music for children with and without special needs: Strategies and Adaptations

PERFORMING ARTS: DRAMA

Range of art activities in drama, Experiencing, responding, and appreciating drama, Exposure to selective basic skills required for drama, Drama: Facilitating interest among students: planning and implementing activities, Enhancing learning through drama for children with and without special needs: strategies and adaptations.

SECTION C

VISUAL ARTS

Range of art activities in visual arts, Experiencing, responding, and appreciating visual art, Exposure to selective basic skills in visual art, Art education: Facilitating interest among students: planning and implementing activities, Enhancing learning through visual art for children with and without special needs: strategies and adaptations.

SECTION D

MEDIA AND ELECTRONIC ARTS

Range of art activities in media and electronic art forms, Experiencing, responding, and appreciating media and electronic arts, Exposure to selective basic skills in media and electronic arts, Media and electronic arts: Facilitating interest among students: planning and implementing activities, Enhancing learning through media and electronic art for children with and without special needs: strategies and adaptations

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	3	2	1	1	2	1	1	2	---	---	1
CO2	1	2	1	3	2	1	1	2	1	1	2	1	---	2
CO3	1	2	1	3	2	1	1	2	1	1	2	1	---	1
CO4	1	2	1	3	3	1	1	2	1	1	2	-	---	1

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

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	3	---	---	---	---	---	---	---	---	---
CO2	1	3	---	---	---	---	---	---	---	---	---
CO3	1	3	---	---	---	---	---	---	---	---	---
CO4	1	3	---	---	---	---	---	---	---	---	---
CO5	1	3	---	---	---	---	---	---	---	---	---

MANAV RACHNA Vidyanatariksha

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

SEMESTER - 3

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH237B-T	Organic Chemistry I	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH237B-P	Organic Chemistry I Lab			0	0	2		
EDH204-T	Gymnosperms and Angiosperms	EDU		3	0	0	5	4
EDH204-P	Gymnosperms and Angiosperms Lab			0	0	2		
EDH205-T	Animal Diversity-III and Comparitive Anatomy of Vertebrates	EDU	CORE	3	0	0	5	4
EDH205-P	Animal Diversity-III and Comparitive Anatomy of Vertebrates Lab			0	0	2		
EDH224-T	Angiosperm Anatomy and Ecology	EDU	CORE	3	0	0	5	4
EDH224-P	Angiosperm Anatomy and Ecology Lab			0	0	2		
EDH216B	Knowledge and Curriculum	EDU	CORE	4	0	0	4	4
EDS222B	Gender, School and Society	EDU	CORE	2	0	0	2	2
EDW217	Understanding the Self	EDU	Elective CORE	0	0	3	3	1.5
EDW304	Yoga & Health Education							
TOTAL (LTP-O/CONTACT HOURS/CREDITS)				16	1	11	29	23.5

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

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

SEMESTER - 3								
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH237B-T	Organic Chemistry I	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH237B-P	Organic Chemistry I Lab			0	0	2		
PHH226-T	Electricity and Electromagnetism	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH226-P	Electricity and Electromagnetism Lab			0	0	2		
MAH220B	Multivariate Calculus & Vector Calculus	APPLIED SCIENCE	CORE	3	1	0	4	4
MAH221B-T	Probability & Statistics	APPLIED SCIENCE	CORE	3	0	0	5	4
MAH221B-P	Probability & Statistics Lab			0	0	2		
EDH216B	Knowledge and Curriculum	EDU	CORE	4	0	0	4	4
EDS222B	Gender, School and Society	EDU	CORE	2	0	0	2	2
EDW217	Understanding the Self	EDU	Elective CORE Workshop	0	0	2	2	1.5
EDW304	Yoga & Health Education							
TOTAL (LTP-O/CONTACT HOURS/CREDITS)				18	2	8	28	24.5

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

Course Title/Code	**Organic Chemistry I (CHH237B-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	To understand the stereo-chemistry of organic compounds and its applications.	Skill Development
CO2	To establish a basic concept for structure, properties and reactivity of aliphatic hydrocarbons.	Skill Development
CO3	To develop a firm foundation for scientific application of aromatic hydrocarbons	Skill Development
CO4	To apply knowledge to communicate reactions and mechanism in alkyl halides	Skill Development
Prerequisites	NA	

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) Mechanismof 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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	---	---	---	---	2	1	1	1	2	1	1
CO2	2	1	2	---	---	---	---	2	1	1	1	2	1	1
CO3	1	1	2	---	---	---	---	2	1	1	1	2	1	1
CO4	2	1	2	---	---	---	---	2	1	1	---	3	1	1

Course Title/Code	**Organic Chemistry I Lab (CHH237B-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	To Understand the stereo-chemistry of organic compounds and its applications.	Skill Development
CO2	To establish a basic concept for structure, properties and reactivity of aliphatic hydrocarbons.	Skill Development
CO3	To develop a firm foundation for scientific application of aromatic hydrocarbons	Skill Development
CO4	To apply knowledge to communicate reactions and mechanism in alkyl halides	Skill Development
Prerequisites		

Laboratory Techniques:

1. Calibration of Thermometer using naphthalene / acetanilide / urea
2. Determination of melting point of Benzoic acid / cinnamic acid / m – dinitro benzene / p- dichlorobenzene
3. Distillation of water – alcohol mixture using water condenser; Distillation of chlorobenzene – nitrobenzene mixture using air-condenser
4. Crystallization: Benzoic acid from hot water, naphthalene from ethanol
5. Sublimation of camphor / phthalic acid/succinic acid

Electrophilic Substitution Reactions

1. Preparation of Iodoform from ethanol / acetone
2. Preparation of *m*-dinitrobenzene from nitrobenzene by nitration
3. Preparation of *p*-bromoacetanilide from acetanilide by bromination

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	---	2	3	3	---	---	---	---	3	1	---	2	1	---
CO2	---	2	3	3	---	---	---	---	3	1	---	1	-	3
CO3	---	2	3	3	---	---	---	---	3	1	---	-	2	1
CO4	---	2	3	3	---	---	---	---	3	1	---	1	1	2

Course Title/Code	**Electricity and Electromagnetism (PHH226-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To enable students to acquire a broad conceptual of electromagnetic phenomena.	
Course Outcomes (COs)		Mapping
CO1	Students would be able to understand, explain and demonstrate about vector calculus, Gauss law and its application to determin D with problems and diagrams.	Skill Development
CO2	Students would be able to understand, construction and working of different types of capacitors. Also, they will able to understand polarization phenomenon.	Skill Development
CO3	Students would be able to understand about Biot Savarts law, Amperes law and different types of forces in magnetostatics.	Employability
CO4	Students would be able to understand about propagation of electromagnetic waves and electromagnetic induction.	Skill Development
Prerequisites (if any)	NA	

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 ofa spherical and cylindrical capacitor, energy stored in a capacitor, capacitor with dielectric, atomic view of dielectrics, polarization, electric field due to a polarised material, Gauss's law in dielectrics, Dielectric constant, Energy density of an electrostatic field (with and without dielectric).
Polarisability and susceptibility – Frequency dependence of polarisability, 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, magneticenergy 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:

- 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.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO2	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO3	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
CO4	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1

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

Electricity and Electromagnetism Practical

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	--	2	3	--	--	2	1	--	--	--	--	1	--	--
CO2	1	1	2	--	--	-	2	--	--	--	--	1	--	--
CO3	1	-	2	--	--	2	1	--	--	--	--	1	--	--
CO4	--	2	3	--	--	1	2	--	--	--	--	1	--	--

Course Title/Code	**Multivariate Calculus & Vector Calculus (MAH220B)**
Course Type	Core
Course Nature	Hard
L-T-P Structure	3-1-0
Credits	4
Course Objective	To familiarize the fundamental concepts of multivariable calculus and to develop student understanding and skills in the topic necessary for its applications to science and engineering.

Course Outcomes (COs)		**Mapping**
CO1	Understand and apply the concept of calculus of function of several variable	**Skill Development**
CO2	Apply change of variables, change of order of integration involving double and triple integrals.	**Skill Development**
CO3	Apply the concepts of vector calculus in problems related to mechanics, electrical engineering, fluid mechanics etc.	**Skill Development**
Prerequisites (if any)	NA	

Section A

Partial Derivatives: Functions of two or more variables, Limits, Continuity, Partial derivatives, Differentiable functions, Homogeneous functions, Euler's Theorem, Chain Rule, Change of Variable, Partial Derivatives of higher order, Taylor's Theorem, Derivate of Implicit functions, Jacobians.

Section B

Multiple Integrals: Definition of a line integral and basic properties, Evaluation of line integrals, Definition of double integral, Conversion to iterated

integrals, Evaluation of Double integral, change of variables, Surface areas. Definition of a triple integral, Evaluation, Volume as a Triple integral.

Section C

Vector Differentiation: Limit & Continuity of vector functions, differentiation of vector functions, tangent and normal components of vector functions, vector fields and scalar fields, gradient of a scalar field and directional derivative. Divergence and Curl of a vector field and their physical interpretations, Irrotational and Solenoidal fields. Laplacian operator.

Section D

Vector Integration: Integration of vector functions Line integral, Integrals independent of path, Surfaces in space, Surface integral, Volume integral, Gauss Divergence theorem, Stoke's theorem and Green's theorem.

Recommended Books:

1. Calculus by Lipman Bers, Vols 1 and 2, Holt Rinehart and Winston publishers.
2. First Course in Calculus by Serge Lang, Springer.
3. Calculus – Single and Multivariable by Hughes Hallet, Wiley.
4. Calculus by Thomas and Finny, Pearson

Course Outcomes	Program Outcomes													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1:		2	3	----	3	2	3	2	----	----	----	----	----	1
CO2:		2	3	----	2	2	2	1	----	----	----	----	----	2
CO3:		1	2	----	2	2	1	3	----	----	----	----	----	1

Course Title/Code	**Probability & Statistics (MAH221B - T)**
Course Type	Core
Course Nature	Hard
L-T-P Structure	3-0-0
Credits	3
Course Objective	To equip the students with the concepts of Statistics & Probability Distributions and their applications in the real world.

Course Outcomes (COs)		**Mapping**
CO1	Compute measures of central tendency & measures of dispersion and solve related problems in the real world.	**Skill Development**
CO2	Assess the shape and peakness of data and calculate the various methods of measurements	**Skill Development**
CO3	Apply correlation and regression techniques to check the dependency in data.	**Skill Development**
CO4	Apply the concept of probability theory and probability distributions to solve related problems	**Skill Development**
CO5	Apply the knowledge of sampling theory to analyse and interpret given data.	**Skill Development**
Prerequisites (if any)	NA	

SECTION A

Measures of Central Tendency: Introduction, types of averages- Mean, Median, Mode, Quartile, Percentile

Measures of Dispersion: Introduction, Significance of measuring variations, Range, Quartile deviation, Mean deviation, Standard deviation, Relation between them, Coefficient of variation

SECTION B

Skewness, Moments & Kurtosis: Introduction, Difference between dispersion and skewness, Measures of skewness, Karl Pearson's coefficient of skewness, Moments, Moments about arbitrary point, about mean, Measures of Kurtosis.

Correlation & Regression Analysis: Introduction, Types of correlation, Karl Pearson's coefficient of correlation, Introduction to regression analysis, Difference between correlation and regression analysis, Regression lines and Regression equations.

SECTION C

Probability Distributions: Random variable, probability distribution of a discrete & continuous random variable, cumulative probability function, moments, Mathematical expectation. Theoretical Distributions: Binomial, Poisson and normal.

SECTION D

Test of significance: large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Small samples: t – test, Test for single mean, difference of means and correlation coefficients, test for ratio of variances F Test, Chi-square test for goodness of fit and independence of attributes.

Recommended books:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. S. P. Gupta, Statistical Methods, Sultan Chand & Sons, Educational publishers, New Delhi
5. **S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.**

Course Title/Code	**Probability & Statistics (MAH221B** - P)
Course Type	Core
Course Nature	Hard
L-T-P Structure	0-0-2
Credits	1
Course Objective	To equip the students with the concepts of Statistics & Probability Distributions and their applications in the real world.

Course Outcomes (COs)		**Mapping**
CO1	Compute measures of central tendency & measures of dispersion and solve related problems in the real world.	**Skill Development**
CO2	Assess the shape and peakness of data and calculate the various methods of measurements	**Skill Development**
CO3	Apply correlation and regression techniques to check the dependency in data.	**Skill Development**
CO4	Apply the concept of probability theory and probability distributions to solve related problems	**Skill Development**
CO5	Apply the knowledge of sampling theory to analyse and interpret given data.	**Skill Development**
Prerequisites (if any)	NA	

STATISTICS & PROBABILITY LAB MAH221B-P

List of Experiments

1. Graphical representations of data: Pie Charts, Line Graphs, Bar Graphs, Histographs, frequency polygon.
2. Calculating mean using excel
3. Calculating median and mode using excel
4. Calculate Quartile deviation, Mean Deviation
5. Calculate Standard Deviation & coefficient of variation
6. Rank & Karl Pearson's Coefficient of Correlation
7. Plotting of Regression lines
8. Compute probability of each element of the matrix row wise and column wise.
9. Discrete & continuous probability distributions.
10. Testing of hypothesis

Mini Projects:

a) Collect data live – class test scores/ survey data and generate frequency distribution table and represent it graphically.
b) Collect test scores of any school subject of any class and compute Mean, Quartile Deviation and Standard Deviation.
c) Compute coefficient of correlation among language subject papers and core subject papers like – English and History, Mathematics and Science, etc.
d) Study the sampling procedures adopted by taking various school contexts like selecting a team for school reports, team for debate competition

Course Outcomes	Program Outcomes													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1:		2	3	----	3	2	3	2	----	----	----	----	----	1
CO2:		2	3	----	2	2	2	1	----	----	----	----	----	2
CO3:		1	2	----	2	2	1	3	----	----	----	----	----	1
CO4:		1	1	----	2	2	2	2	----	----	----	----	----	1

Course Title/Code	**Gymnosperms and Angiosperms (EDH204-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	(3-0-0)	
Credits	3	
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)		Mapping
CO1	Understand the General characteristics, classification and economic importance of Gymnosperms	Employability
CO2	Understand the diverse structural and morphological characteristic features of Angiosperm Flower	Skill Development/ Employability
CO3	Understand the development of male and female gametophyte	Skill Development
CO4	Describe Pollination and Fertilization. Different types of Endosperms, Fruit and Seed	Skill development
Prerequisites (if any)	NA	

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:

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

- Singh, V., Pande, P.C. &Jain, D.K. (2007). *Diversity and systematics of seed plants.* Meerut: Rastogi Publications.
- Pandey, S.N., Mishra, S.P. & Trivedi, P.S. (2004). *A Textbook of Botany Vol.II,* Delhi: Vikas Publishing House.
- Chopra G.L. (1972). *Gymnosperms.Jullandar*: S. Nagin & Co.
- Bhojwani, S. S. and Bhatnagar, S.P. 000. *The Embryology of Angiosperms*. Delhi: Vikas Publishing House.
- 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.
- Johri, B.M.(Ed.). (1984). *Embryology of Angiosperms*. Germany: Springer- Verlag.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	----	-----	----	-----	2	2	1	1	3	1	2
CO2	2	1	1	----	-----	----	-----	2	3	1	1	3	1	1
CO3	2	1	1	----	-----	----	-----	2	1	1	1	3	1	1
CO4	2	1	1	----	-----	----	-----	2	2	1	1	3	1	1
CO5	2	1	1	----	-----	----	-----	2	2	1	1	3	1	1

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

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 micropreparations and using permanent slides.
- Study of crustose, foliose and fruticose lichens.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	--	--	--	--	3	2	2	--	3	--	3
CO2	1	1	2	--	--	--	--	3	3	--	1	3	--	3
CO3	1	1	2	--	--	--	--	3	3	1	1	3	--	3
CO4	1	2	3	--	--	--	--	2	2	2	2	1	--	1

Course Title/Code	**Animal Diversity III and Comparative Anatomy of Vertebrates (EDH205-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	To understand and analyse characteristics of Pisces	Skill Development
CO2	To Understand basic characteristics of amphibians and parental care	Skill Development
CO3	To understand and analyse hierarchy in reptiles and aves	Skill Development
CO4	. To develop the understanding of evolutionary trends in Mammalia	Skill Development
CO5	To develop the understanding of heart and aortic arches	Entrepreneurship & Skill Development
CO6	To understand the structure and evolution of kidneys and gonads in vertebrates	Skill Development
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 ofAmphibia, 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 withexamples (5 important orders only), salient features of Archaeornithes andNeornithes, flight adaptation and migration in birds
c) Mammalia: General characters and classification of class Mammalia up to orderswith examples; General characters of Prototheria; Adaptive radiation inMarsupialia and Primates ; Adaptive features of Chiropetera and Cetacea ;Dentition in mammals.

SECTION C

TYPE STUDY – RABBIT AND COMPARATIVE ANATOMY–I

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

SECTION D

COMPARATIVE ANATOMY–II

a) Comparative studies in amphibians, reptiles, birds and mammals:
   - i) Brain
   - ii) Eye and ear of birds and mammals
   - iii) Cranial and spinal nerves, Autonomous nervous system
   - iv) Different types of vertebrae in vertebrates

b) Structure and evolution of kidneys in vertebrates

c) Structure of gonads and gonoducts formation

References:

- Modern Textbook of Zoology: Vertebrates by R.L. Kotpal – RastogiPublications, 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).
- Life of Vertebrates by J.Z. Young – (Oxford University Press).
- The Vertebrate Body by A.S. Romer – (Vakils, Ferrer& Simons, Bombay).
- Elements of Chordate Anatomy by Weichert – (McGraw Hill).
- The Birds by R.L Kotpal (4th edition) – (Rastogi Publications, 2008).
- 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) (RastogiPublications, 2008).
- 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, 1973.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	-----	3	----	-----	2	1	1	1	3	3	3
CO2	2	1	2	-----	3	----	-----	2	1	1	1	3	3	3
CO3	2	1	2	-----	3	----	-----	2	1	1	1	3	3	3
CO4	2	1	2	-----	3	----	-----	2	1	1	1	3	3	3
CO5	2	1	2	-----	3	--	-----	2	1	1	1	3	3	3
CO6	2	1	2	-----	3	-----	-----	2	1	1	1	3	3	3

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

1. Study of specimens of Chondrichthyes:
    - Zygaena
    - Pristis
    - Trygon
    - Skate
2. Study of specimens of Osteichthyes:
    - Echeneis
    - Clarias
    - Hippocampus
    - Anguilla
    - Belone
    - Synaptura
    - Tetradon
    - Diodon
3. Mounting of fish scales:
    - Placoid scales
    - Cycloid scales
4. Dissection of Scoliodon(Study of dissected specimens):
    - Afferent and efferent branchial system.
    - Cranial nerves (5th, 7th, 9th and 10th).
5. Study of specimens of Amphibians:
    - Rana
    - Bufo
    - Hyla
    - Rhachophorus
    - Salamander
    - Ichthyophis
    - Axolotal larva.

6. Study of specimens of Reptilia:
    - Chameleon
    - Varanusc
    - Draco
    - Tortoise
    - Crocodile
7. Identification of poisonous and non-poisonous snakes:
    - Cobra
    - Krait
    - Rat snake
    - Viper
    - Dryophis
    - Hydrophis
8. Study of specimens of Aves:
    - Barn owl
    - Water hen
    - Wood pecker
    - Cattle egret
    - Koel
    - King fisher
9. Local field visit to identify and classify 10 fauna (common birds and mammals); submission of report.
10. Dissection of rat (demonstration):
    - Digestive system
    - Urinogenital system
    - Arterial system
11. 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
12. Study of different types of vertebrae
13. Study of pectoral and pelvic girdles of Frog, Varanus/Calotes, Bird

References:

- Modern Textbook of Zoology: Vertebrates by R.L. Kotpal – RastogiPublications, 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).
- Life of Vertebrates by J.Z. Young – (Oxford University Press).
- The Vertebrate Body by A.S. Romer – (Vakils, Ferrer& Simons, Bombay).

CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	-	2	3	-	-	2	1	-	-	-	-	1	--	--
CO2	1	1	2	-	-	-	2	-	-	--	-	1	-	-
CO3	1	-	2	--	-	2	1	-	-	-	-	1	-	-
CO4	-	2	3			1	2	--	-	-	-	1	-	-

Course Title/Code	**Angiosperm Anatomy and Ecology (EDH224-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	Understand the development, organization, and functions of various plant tissues in angiosperms.	Skill Development
CO2	Understand the diversity of histological complexity in Angiosperms.	Skill Development
CO3	Understand various ecological factors and energy flow in ecosystem	Employability & Entrepreneurship
CO4	Understand phytogeography, populayion and community diversity.	Skill Development
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

Introduction

Ecological factors

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Otimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes

Ecosystem

Structure; energy flow trophic organization; food chain and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and phosphorus.

SECTION D

Phytogeography

Principle biogeographical zones; Endemism

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

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.

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	----	2	----	----	----	----	1	2	1	1	3	1	1
CO2	1	----	2	----	----	----	----	1	2	1	1	3	1	1
CO3	1	----	2	----	----	----	----	1	2	1	1	3	1	1
CO4	1	----	2	----	----	----	----	1	2	1	----	2	3	1

Course Title/Code	**Angiosperm Anatomy and Ecology Lab (EDH224-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	The course gives an understanding about the systematic position of Generas, Species and Families, and knowledge about plant nomenclature.	
Course Outcomes (COs)		Mapping
CO1	To develop the skill of free hand sectioning, staining and mounting of plant parts for anatomical study.	Skill Development
CO2	To observe and identify different types of tissues using temporary and permanent slides.	Employability
CO3	To develop the skill of studying population density	Skill Development
CO4	To develop skills to determine soil texture, pH and water holding capacity	Entrepreneurship
Prerequisites (if any)	**Basic understanding of Plant Anatomy and Evolution**	

Angiosperm Anatomy, Evolution and Economic Botany Practical (EDH224-P) Activities:

- 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.
- To study the plant population density by quadrant method.
- To measure the aboveground plant biomass in a grassland.
- To determine the percent leaf area injury of different leaf samples collected around poluuted sites.
- To study soil texture.
- To determine soil pH.
- To determine water holding capacity.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	3	3	2	3	3	3	1	1
CO2	3	3	3	2	3	3	3	3	2	3	3	3	1	1
CO3	3	2	2	2	3	3	3	3	2	2	2	3	1	1
CO4	2	2	3	2	2	2	2	3	2	3	2	2	3	1

Course Title/Code	**Knowledge and Curriculum (EDH216B)**
Course Type	Core
Course Nature	Hard
L-T-P Structure	(4-0-0)
Credits	4
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)		Mapping
CO1	Explain the concept of knowledge and its relationship with various aspects of curriculum Development	Skill Development
CO2	Analyse epistemological thoughts of various Indian and western educationists with regard to significant aspects of curriculum	Employability
CO3	Infer the interrelationship among Education, social forces and curriculum development	Skill Development
CO4	Assimilate the process of curriculum development with all its significant components	Entrepreneurship
CO5	Reflect on the role of National Level institutions in curriculum Planning	Entrepreneurship
Prerequisites (if any)	NA	

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

SECTION A

KNOWLEDGE AND EDUCATION

Concept of knowledge, Methods of acquiring knowledge, Different kinds of knowledge, Nature of knowledge, belief, information, skill, and perception. Role of teacher in knowledge construction, Epistemological thoughts of M.K. Gandhi, Rabindranath Tagore, Rousseau and John Dewey, 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. economy, politics, and History.

SECTION B

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,

Addressing critical issue through Curriculum: Environmental concern, Gender Difference, inclusiveness and value inculcation

SECTION D

CURRICULUM FRAMEWORK AND TRANSACTION

Meaning of Curriculum Framework and Curriculum Transaction, Critical analysis of NPE 2020 and its recommendations with special reference to curriculum framework and curriculum Transaction, Role of National and State level agencies in framing of the Curriculum- NCERT, SCERT, Boards of Education, Role of textbooks in Curriculum transaction.

Reference Books and Readings:

- Bawa, M. S. & Nagpal, B. M. eds (2016). *Developing Teaching Competencies*. New Delhi: Viva Books pvt. ltd.
- Butchvarov, P. (1970). *The Concept of Knowledge*. Evanston, Illinois: North Western University Press.
- Dewey, J. (1997). *Experience and Education*. Touchstone, New York.
- Kelly, A. V. (2006). *The Curriculum: Theory and Practice* (Fifth Edition). Sage Publications
- Krishna, D. (1997). *Gyan Mimansa*. Jaipur: Rajasthan Hindi Granth Academy.
- NCERT (2005). *National Curriculum Framework*. New Delhi: NCERT.
- NCERT (2006). *Position Paper, National Focus Group on Curriculum, SylLabus and textbooks*. New Delhi: NCERT.
- NCERT (2006). *Position Paper, National Focus Group on Systematic Reforms for Curriculum Change.* New Delhi: NCERT.
- Sarangapani, P. (2003). *Construction of leadershio Knowledge*. New Delhi: Sage Publication.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	3	-----	1	-----	2	1	2	2	3	3	3
CO2	3	2	2	3	1	2	-----	2	1	2	2	3	3	3
CO3	2	3	3	2	-----	1	-----	2	3	3	3	3	2	1
CO4	1	2	2	3	-----	1	2	1	2	2	2	----	-----	----
CO5	1	2	1	1	-----	----	1	1	2	1	2	----	3	3

Course Title/Code	**Gender, School and Society (EDS222B)**	
Course Type	Core	
Course Nature	Soft	
L-T-P Structure	2-0-0	
Credits	2	
Course Objective	To examine the role of school and society in shaping gender identities.	
Course Outcomes (COs)		Mapping
CO1	To develop a positive notion on sexuality amongst young people.	Skill Development
CO2	To identify social construction of gender under the lens of class and caste intersectionality.	Skill Development
CO3	To analyse the role of schools in promoting gender equality through value education.	Employability
CO4	To develop a strategic approach towards women empowerment with the support of government agencies.	Entrepreneurship
Prerequisites (if any)	**NA**	

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:reservationsand legal provisions Millenium DevelopmentGoal: 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.
3. Bordia, A. (2007). *Education for gender equity.* The Lok Jumbish experience, p. 313-329.
4. Chatterji, S.A. (1993). *The Indian Women in Perspective.* New Delhi: Vikas Publishing.

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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	3	3	3	3	3	1	---	2
CO2	3	2	3	1	2	2	1	2	3	1	2	2	2	---
CO3	1	3	2	2	1	3	2	1	3	2	3	2	1	1
CO4	1	1	3	2	1	2	2	1	3	2	3	3	---	---

Course Title/Code	**Understanding the Self (EDW217)**	
Course Type	Core	
Course Nature	Workshop	
L-T-P Structure	0-0-3	
Credits	1.5	
Course Objective	To enable the trainee teachers to understand and apply awareness of oneselfin becoming a professional and humane teacher	
Course Outcomes (COs)	Mapping	
CO1	Assimilate the concept of Self Identity	Employability
CO2	Reflect on the factors which influence one's selfIdentity	Employability
CO3	Analyse the factors which positively enhance one's professional Identity	Skill Development
CO4	Appreciate the teacher's role as a facilitator to buildstudents self identity and professional identity	Skill Development
CO5	showcase qualities of teacher as a reflective practitioner	Employability
Prerequisites (ifany)	NA	

SECTION A
UNDERSTANDING AND DEVELOPING SELF

Exploring oneself: Self-identity, potential, fears, aspirations, reflecting on one's own self and identity with critical analysis. Identifying factors in the development of self and in shaping identity. Building an understanding about philosophical and cultural perspectives of self-Understanding socio-cultural, historical, and political influences in shaping one's professional identity

SECTION B

REFLECTIVE PRACTICE AND YOGA

Building an understanding about values and professional ethics as a teacher to live in harmony with one's self and surroundings, Teacher as a reflective practitioner, Understanding the role of teacher as facilitator and partner in well being among learners.Developing skills of awareness about identity, effective listening, accepting, positive regard etc. among learners as a facilitator.

Introduction of yoga, and meditation as important components to enhance understanding of bodyand mind

Practical Activities

1. Developing self awareness as a teacher
2. Exploring the 'known' and 'unknown' self' in relation to what one and others knowabout one self and what others do not know
3. Reflecting, recording, and sharing of critical moments in one's life
4. Reflections on critical moments in the lives of peers
5. Critically evaluate yourself as a 'prospective teacher'.
6. Briefing a self- reflecting account on significant experiences concerning gender,stereotypes, and prejudices
7. Role play and paired activity for empathetic listening
8. Give a reflective feedback on your contribution during any community service
9. Conducting yoga/ meditation sessions (Group activity)
10. Any other suitable activity

Reference Books and Readings

1. Bhatt, H. (n.d.). *The Diary of a School Teacher* . An Aziz Premji University Publication.Retrieved from www.arvindguptatoys.com/arvindgupta/diary-school-teacher-eng.pdf
2. Bhattacharjee, D. K. (ed.) (2001). *Psychology and Education- Indian Perspectives,*Section III 'Self and Growth Process' pp. 255-402, NCERT publication.
3. Brooksfield, S. D. (1995). *Becoming a Critically Reflective Teacher* . San Francisco. CA:John Wiley & Sons.
4. Dalal, A. S. (ed.) (2001). *A Greater Psychology- An Introduction to the Psychologicalthoughts of Sri Aurobindo* . Puducherry: Sri Aurobindo Ashram publication.
5. Delors, J. (1996). *Learning the Treasure within- 21st century Education*. UNESCOEducation Commission Report.
6. Duval, T. S., & Silvia, P. J. (2001). *Self awareness and Causal attribution: A Dualsystems Theory*. Boston: Kluwer Academics.
7. Krishnamurti, J. (1998). *On Self- knowledge*. Chennai: Krishnamurti Foundations India.
8. Krishnamurti, J. (2000). *Education and Significance of Life.* Chennai: KrishnamurtiFoundations India.
9. Pant, D., & Gulati, S. (2010). *Ways to Peace- A Resource Book for Teachers* . NCERTpublications.

10. Venkateshamurthy, C. G., & Rao, A. V. G. (2005). *Life Skill Education TrainingPackage*. R.I.E. Mysore.

CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	-	2	2	2	-	1	2	2	2
CO2	-	3	-	2	3	2	-	1	2	2	2
CO3	1	2	1	1	1	2	2	1	2	2	2
CO4	2	2	3	2	3	2	1	1	2	2	2
CO5	2	2	2	1	1	2	1	1	2		2

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

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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	.....	.....	2	.....	2	2	2	3	1	2	2
CO2	2	2	3	.....	.....	2	.....	3	2	3	3	1	2	2
CO3	3	3	3	.....	.....	2	.....	3	2	3	3	1	2	2
CO4	3	3	3	.....	.....	2	.....	2	2	2	3	1	2	2

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

SEMESTER - 4

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH313B-T	Organic Chemistry II	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH313B-P	Organic Chemistry II Lab			0	0	2		
PHH227-T	Optics	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH227-P	Optics Lab			0	0	2		
MAH320B	GROUPS AND RINGS	APPLIED SCIENCE	CORE	3	1	0	4	4
EDH122-T	Assessment For Learning	EDU	CORE	3	0	0	5	4
EDH122-P	Assessment For Learning Lab			0	0	2		
EDS227B	School Organization & Management	EDU	CORE	2	0	0	2	2
MOOC-19E-EDS-202	Principles of Human Resource Management	MGT	Elective	2	0	0	2	2
MOOC-19E-EDS-202	Design Thinking- A Primer							
MOOC-22E-EDS-201	Principles of Management							
MCS231	Basics of Economics							
MCS232	Introduction to Finance							
	Basics of Entrepreneurship							
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			16	2	6	24	21

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

SEMESTER - 4

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH313B-T	Organic Chemistry II		CORE	3	0	0	5	4

CHH313B-P	Organic Chemistry II Lab	APPLIED SCIENCE		0	0	2		
EDH301T	Plant Systematics and Angiosperm Phylogeny	EDU	CORE	3	0	0	5	4
EDH301P	Plant Systematics and Angiosperm Phylogeny Lab			0	0	2		
EDH303-T	Cell Biology and Genetics	EDU	CORE	3	0	0	5	4
EDH303-P	Cell Biology and Genetics Lab			0	0	2		
EDH225-T	Animal Physiology and Endocrinology	EDU	CORE	3	0	0	5	4
EDH225-P	Animal Physiology and Endocrinology Lab			0	0	2		
EDH122-T	Assessment For Learning	EDU	CORE	3	0	0	5	4
EDH122-P	Assessment For Learning Lab			0	0	2		
EDS227B	School Organization & Management	EDU	CORE	2	0	0	2	2
MOOC-19E-EDS-202	Principles of Human Resource Management	MGT	Elective	2	0	0	2	2
MOOC-19E-EDS-202	Design Thinking- A Primer							
MOOC-22E-EDS-201	Principles of Management							
MCS231	Basics of Economics							
MCS232	Introduction to Finance							
	Basics of Entrepreneurship							
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			19	0	10	29	24

	Two weeks Community Connect internship (1.5 credits) ED0 239

Course Title/Code	**Organic Chemistry-II (CHH313B-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	To develop an understanding of the chemistry of Functional groups and mechanisms of Organic Reactions.	Skill Development
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	Skill Development
CO3	Learn the properties, synthesis and chemical reactions of halogen and/or oxygen containing functional groups in organic chemistry	Skill Development
CO4	Perform inter-conversions of various functional groups in organic chemistry.	Skill Development
Prerequisites	NA	

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 [$Pb(OAc)_4$ 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.

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.

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.

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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	2	2	1	1	---	1	---	---	---	3	2	1
CO2	1	2	2	2	2	1	---	1	---	---	---	2	2	1
CO3	1	2	2	1	2	1	---	1	---	---	---	1	2	1
CO4	1	2	2	2	2	1	---	1	---	---	---	1	1	1

Course Title/Code	**Organic Chemistry-II Lab (CHH313B-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	To develop an understanding of the chemistry of Functional groups and mechanisms of Organic Reactions.	Skill Development
CO2	To develop basic skills for the analysis of organic compounds based on properties of functional groups for identification	Skill Development
CO3	Learn the properties, synthesis and chemical reactions of halogen and/or oxygen containing functional groups in organic chemistry Laboratory	Skill Development
CO4	Perform inter-conversions of various functional groups experimentally	Skill Development
Prerequisites	**NIL**	

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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	3	---	---	---	---	3	1	---	---	2	3
CO2	2	2	3	3	---	---	---	---	3	1	---	---	2	3
CO3	2	2	3	3	---	---	---	---	3	1	---	---	2	3
CO4	2	2	3	3	---	---	---	---	3	1	---	---	2	3

Course Title/Code	**Optics (PHH227-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
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)		Mapping
CO1	Students would be able to understand about interference of light.	Skill Development
CO2	Students would be able to understand about diffraction of light.	Skill Development
CO3	Students would be able to understand about the polarisation oflight.	Employability
CO4	Students would be able to understand about LASER and Optical fiber.	Skill Development
Prerequisites (if any)	**NA**	

SECTION A

Course Content: INTERFERENCE

Huygen's principle, explanation of reflection and refraction, Conditions for Sustained Interference, Coherent Sources, Young's Double Slit Experiment, Interference based on the Division of Wave Front, Interference based upon Division of Amplitude, Fresnel Bi-Prism and its Applications, Interference in Thin Films, Newton's Ring and its Applications, Michelson Interferometer and its Applications.

SECTION B

DIFFRACTION

Difference between interference and diffraction; Fraunhoffer and Fresnel diffraction; Fraunhoffer diffraction through a single slit; plane transmission diffraction grating (N-slits); absent spectra; Resolving power-Rayleigh's criterion of resolution; Dispersive power; Resolving power of a grating. (10L)

SECTION C

POLARISATION

Polarized and Un-Polarized Light; Brewster's law, Malus Law; Uniaxial crystals, Double Refraction; Nicol Prism; Quarter and Half Wave Plates; Detection and Production of Different Types of Polarized Light; Polarimetry; Bi-Quartz and Laurent's Half Shade Polarimeter (10L)

SECTION D

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

Fiber 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/ Text Books:

1. Textbook of Optics, Brijlal and Subramaniam
2. Optics- A K Ghatak
3. Fundamentals of Optics- Jenkins and White
4. Optics- Eugene Hecht
5. Fundamentals of Optics- Khanna and Gulati
6. Engineering Physics- Satya Parkash
7. Modern Physics- S P Taneja
8. Fundamentals of Engineering Physics-M S Khurana
9. Principals of Lasers-O. Svelto

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	----	1	----	----	2	----	----	----	----	1	----
CO2	2	1	2	----	1	----	----	2	1	1	1	3	1	1
CO3	2	1	2	1	----	1	----	2	1		1	3		1
CO4	2	1	2	----	----	----	----	2	1	1	1	3	1	1

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

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 fiber using laser light.

References:

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

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	---	---	2	1	---	---	---	---	1	---	---
CO2	1	1	2	---	---	-	2	---	---	---	---	1	---	---
CO3	1	---	2	---	---	2	1	---	---	---	---	1	---	---
CO4	2	2	3	---	---	1	2	---	---	---	---	1	---	---

SECTION A

Course Title/Code	GROUPS AND RINGS (MAH320B)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To develop understanding of the abstract concepts of groups, rings, and special classes of rings and to appreciate modern mathematical concepts.	
Course Outcomes (COs)		**Mapping**
CO1	Recognize the mathematical objects called groups & rings and apply the fundamental concepts of these algebraic structures	**Skill Development**
CO2	Explain the significance of the notions of cosets, normal subgroups, and factor groups and analyze consequences of Lagrange's theorem.	**Skill Development**
CO3	Illustrate structure preserving maps between different algebraic structures & its consequences.	**Skill Development**
CO4	Apply the basic concepts of ring of polynomials and irreducibility tests for polynomials over ring of integers.	**Skill Development**
CO5	Appreciate the significance of unique factorization in rings and integral domains.	**Skill Development**
Prerequisites (if any)	NA	

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 Outcomes	Program Outcomes													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1:		2	3	----	3	2	3	2	----	----	----	----	----	1

CO2:		2	3	----	2	2	2	1	----	----	----	----	----	2
CO3:		1	2	----	2	2	1	3	----	----	----	----	----	1
CO4:		1	1	----	2	2	2	2	----	----	----	----	----	1
CO5:		2	3	----	3	2	3	2	----	----	----	----	----	1

Plant Systematics and Angiosperm Phylogeny (EDH301-T)

Course Title/Code		
Course Type	Core	
Course Nature	Hard	
L-T-P-O Structure	(3-0-0)	
Credits	3	
Objectives	After going through this course, the learner will be able to appreciate the evolution oftaxonomic thought and the various systems of classification	
Course Outcomes (COs)		Mapping
CO1	Understand the basis, aim and principles of classification ofAngiosperms	Skill Development
CO2	Understand the salient features of Bentham and HookerClassification	Skill Development
CO3	Understand the diagonistic features, salient vegetative and floral characteristics and economically important plant of various Angiosperm (dicot) families.	Skill Development/Employability
CO4	Understand the diagonistic features, salient vegetative and floral characteristics and economically important plant of various Angiosperm (monocot) families.	Skill development
Prerequisites(if any)	NA	

SECTION A

PLANT SYSTEMATICS

ICN (formerly known as ICBN), principles and aims; type Concept, Concept of genus and specific epithet, Principle of priority, Units of classification.
Brief history, Development of taxonomic thought, Outlines of artificial, natural and phylogenetic systems of classification.
Salient features and outline classification of Bentham & Hooker and Cronquist. Brief 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 EuphorbiaceaeCapparidaceaeFabaceae

SECTION C

ANGIOSPERM PHYLOGENY-II

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

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:

Jones, A.B. and Luchsinger, A.(1979). *Plant Systematics*. New York: McGraw-Hill Book Co.

1. Shukla Pritiand Misra.(1988).*Taxonomy of Angiosperms*, New Delhi: Vikas Publishing House.
2. Hutchinson, J.(1959).*The families of Flowering Plants*.Oxford: Clarendon Press.
3. Davis, P.H. and Heywood,V.H.(1963).*Principles of Angiosperm Taxonomy*.London:
4. Oliver and Boyd.
5. Heywood, V.H. and MooreD.M.(1984).*Current concepts in Plant Taxonomy*. London: Academic Press.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	3	----	----	----	----	2	2	2	2	3	1	1
CO2	2	1	3	----	----	----	----	2	2	2	2	3	1	1
CO3	2	1	3	----	----	----	----	2	2	2	2	3	1	1
CO4	2	1	3	----	----	----	----	2	2	2	3	3	1	1

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

Plant Systematics, and Angiosperm Phylogeny Practical (EDH301-P)

To identify common taxa using taxonomic keys.

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

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

References Books and Readings:

- Singh, G. (1999). *Plant Systematics: Theory and Practice*.New Delhi: Oxford and IBH Pvt. Ltd., New Delhi.
- Stace, C.A. (1989).*Plant Taxonomy and Biosystematics (2nd Ed.*). London: Edward Arnold.
- Singh V. andJain,D.K.(2005).*Taxonomy of Angiosperms*. Meerut.Rastogi Publications.
- Kochhar S.L.(1981).*Economic Botany in the Tropics*. Delhi: MacMillan India Ltd.
- Vashista P.C. (1980).*Taxonomy of Angiosperms*.New Delhi: Sultan Chand & Co.
- Lawrence, G.H.M. (1950).*Taxonomy of Vascular Plants*. London: MacMillan.

MANAV RACHNA
vidyanatariksha

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	-	-	1	-	2	2	1	-	3	--	3
CO2	1	1	2	-	-	-	1	2	2	1	1	3	-	3
CO3	1	1	2	--	-	-	-	2	2	-	1	3	-	3
CO4	1	2	2	-	-	-	-	1	2	1	1	1	-	2

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

SECTION A

Cell and Cell organelles

a) Ultrastructure of Prokaryotic and Eukaryotic cells.
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

Solving problems related to Mendel's laws. Incomplete dominance, complementary gene action (flower colour in sweet pea). Supplementary gene action (coat colour in mice), SAPLING

SECTION D

Epistasis (fruit colour in summer squash)

a) Multiple factor inheritance (ear size in maize).
Sex determination in plants – Melandrium.

Cytoplasmic inheritance –plastid inheritance in Mirabilis

b) *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 CollegePublishing.
- 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 & BartlettPublishers.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	----	3	----	----	2	1	1	1	**3**	**3**	**3**
CO2	2	1	2	----	3	----	----	2	1	1	1	**3**	**3**	**3**
CO3	2	1	2	----	3	----	----	2	1	1	1	**3**	**3**	**3**
CO4	2	1	2	----	3	----	----	2	1	1	1	**3**	**3**	**2**

Course Title/Code	Cell Biology and Genetics Lab (EDH303-P)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To develop skills of staining cells and observing cell organelles. To prepare temporary and permanent cytological preparations of suitable plant materials tostudy mitosis and meiosis. • To verify Mendelian laws of inheritance • To understand the cell structure in details	
Course Outcomes (COs)		Mapping
CO1	To develop skills of staining cells and observing cellorganelles	Skill Development
CO2	To prepare temporary and permanent cytological preparationsof suitable plant materials to study mitosis and meiosis	Skill Development
CO3	To verify Mendelian laws of inheritance	Employability
CO4	. To understand the cell structure in details	Skill Development
Prerequisites(if any)	Basic knowledge of Biological Science	

Activities

1.	Comparative study of cell structure in onion cells *Hydrilla* and
2.	*Chara*/*Spirogyra*.Study of plastids to examine pigment distribution in plants (e.g. *Cassia*, *Lycopersicon* and *Capsicum*)
3.	Examination of electron micrographs of virus, bacteria, Cyanobacteria. and eukaryotic cells with special reference to organelles
4.	Study of various stages of mitosis and meiosis by preparing slides of suitable plant materials (onion root tips and onion flower buds).
5.	Working out genetic problems related to Mendelian laws of inheritance and interaction of genes.

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.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	3	3	2	3	3	**1**	**-**	**2**
CO2	3	3	3	2	3	3	3	3	2	3	3	**2**	**2**	
CO3	3	2	2	2	3	3	3	3	2	2	2		**1**	**1**
CO4	2	2	3	2	2	2	2	3	2	3	2		**3**	

Course Title/Code	**Animal Physiology and Endocrinology (EDH225-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	Comprehend the enzyme action and physiology of digestion	Skill Development
CO2	Critically analyse the complexity of respiration and understand the mechanism of transport of gases	Skill Development
CO3	Reflect upon the mechanism of blood circulation, blood clotting and functioning of human heart	Skill Development/Employability
CO4	Explain the process of excretion and homeostasis	Skill development
CO5	Explain the process of excretion and homeostasis	Skill Development
CO6	To conceptualize the mechanism of endocrine and exocrine glands	Employability
Prerequisites(if any)	NA	

SECTION A

ENZYME, DIGESTION AND RESPIRATION

a) Enzymes –Introduction, nomenclature and classification, mechanism of enzyme action, Enzyme Kinetics, Inhibition and Regulation

b) Digestion – Physiology of digestion in alimentary cannal, absorption of carbohydrates, proteins and lipids;

c) Respiration –Respiratory organs, Mechanism of breathing, Respiratory volumes and capacities, Exchange of oxygen and carbon dioxide, Transport of gases oxygen and carbon dioxide in blood, Control of respiration; Disorder of respiratory system.

SECTION B CIRCULATION,

EXCRETION

a) Circulation: Blood – Composition of blood, Hemostasis, physiology of blood clotting ;Lymphatic system , myogenic and neurogenic hearts, structure and functioning of human heart, origin and conduction of the cardiac impulse, cardiac cycle, blood vessels, blood pressure.

b) Excretion: structure of human kidney and nephron, mechanism ofurine formation, counter-current mechanism

SECTION C

NERVE AND MUSCLE

a) Structure of a neuron and neuroglia, classification of neuron, Resting membrane potential, Graded potential, 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 skeletal muscle, Contractile and regulatory proteins, Mechanism of muscle contraction, Neuro-muscular junction and relaxation, sliding filament theory, chemical changes during muscle contraction and relaxation.

SECTION D

ENDOCRINE GLANDS AND REPRODUCTION

a) Endocrinology –Structure and Function of Pituitary, Thyroid, Adrenal and Pancreas, their structures, secretion and mode of hormone action (steroid and peptides); hormone feedback mechanism.

b) Physiology of male reproduction: hormones produced and their role. Physiology of female reproduction: hormonal control of menstrual cycle; Hormonal regulation of a) Estrous cycle, b) Menstrual cycle, c) Implantation ; Family planning - Need andmethods of contraceptives .

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).
4. Endocrinology and Reproductive Biology by K.V. Sastry – (RastogiPublications, 2008).
5. Animal Physiology by Arora M.P. (1989) – Himalaya Publishing House.
6. Textbook of Medical Physiology by Guyton A.C. & Hall J.E. (1996) – (W.B.Saunders &Co.).
7. General and Comparative Physiology by Hoar W.S. (1983) – (Prentice HallPublication).

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	-----	3	----	-----	2	3	1	1	3	3	3
CO2	1	1	2	-----	3	----	-----	2	1	1	1	3	3	3
CO3	1	1	2	-----	--	2	-----	2	1	1	1	3	2	3
CO4	1	1	2	-----	1	----	-----	2	1	1	1	3	3	3
CO5	1	1	2	-	1	-	-----	2	1	1	1	3	3	3
CO6	2	1	2	-	1	-	-----	2	1	1	1	3	3	3

Course Title/Code	**Animal Physiology and Endocrinology Lab (EDH225-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	To enable students to analyse biochemically the foodstuffs and urine	Skill Development
CO2	To enable students to analyse the biochemical action of enzymes	Skill Development
CO3	To develop in the students the skills of separation of macro molecules using chromatography and electrophoresis	Employability
CO4	To demonstrate physiological experiments and the skills of haematology and endocrinology	Employability /Skill Development
Prerequisites (if any)	**NA**	

Practical (EDH225-P)

1. Demonstration of endocrine glands in rat and man (Chart).
2. Effect of temperature and pH on the salivary amylase enzyme activity.
3. Detection of various enzymes in the digestive tract of cockroach.
4. Preparation of blood smears of Frog and man
   (a) Total count of RBC
   (b) Total count of WBC
   (c) Differential count of Leucocytes
   (d) Estimation of haemoglobin by Sahlis method
5. Human urine analysis for a) Nitrogenous substances, b) Normal inorganicconstituents, c) Abnormal constituents – (i) glucose, (ii) protein, (iii) ketonebodies.
6. Analysis of nitrogenous wastes in bird and fish.
7. Separation and analysis of amino acids in body fluids and food using paperchromatography.
   (a) Demonstration of heart beat in Frog – a) Preparation of simple cardiogram, b)Effect of various chemicals on heartbeat.
   (b) To set up simple experiments to find out the rate of respiration in terrestrialanimals like cockroach and rat.
   (c) Qualitative and quantitative estimation of carbohydrates, proteins and lipids infood
   (d) Demonstration of separation of proteins/enzymes with electrophoresis.
8. Study of permanent slides of mammals: a) Pituitary, b) Adrenal gland,c) Thyroid, dTestis, e) Ovary, f) Placenta, g) Pancreas.

Field Visit- Museum

References Books and Readings:

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

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	---	---	2	1	---	---	---	---	3	---	3
CO2	1	1	2	---	---	-	2	---	---	---	---	3	---	3
CO3	1	---	2	---	---	2	1	---	---	---	---	3	---	3
CO4	1	2	3	---	---	1	2	---	---	3	---	1	---	---

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

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 leaningsituations)

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 ofachievement 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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	2	2	3	3	----	3	----	----
CO2	3	2	1	1	1	1	2	2	3	3	3	----	3	2
CO3	----	1	1	1	1	1	2	1	2	3	3	3	----	2
CO4	2	1	1	1	1	1	1	1	2	3	3	----	2	2
CO5	1	1	1	1	1	1	2	1	2	3	3	----	2	2

Course Title/Code	**Assessment for Learning Lab (EDH122-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To enable a learner to apply the concepts of assessment and evaluation systems in education	
Course Outcomes (COs)		Mapping
CO1	Develop critical thinking and scientific temper	Employability
CO2	To justify the role of continuous and comprehensive assessment in holistic development	Skill Development
CO3	Acquire skills to develop digital assessment tools for various learner groups	Entrepreneurship
Prerequisites (if any)	**NA**	

Practicals

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.

*Field activity

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	P05	P06	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	1	1		1	2	1	3
CO2	1	3	3	2	1	---	1	3	1	2	----
CO3	2	3	2	1	3	2	3	--	2	----	3

Course Title/Code	**School Organization and Management (EDS227B)**	
Course Type	**Core**	
Course Nature	**Soft**	
L-T-P Structure	**2-0-0**	
Credits	**2**	
Course Objective	**To Facilitate the Basics of School Organization and management in the Learners.**	
Course Outcomes (COs)		**Mapping**
CO1	Use various strategies to create positive school climate	Entrepreneurship Employability
CO2	Analyse various features of school as an organization.	Entrepreneurship
CO3	Discuss different components of school management	Entrepreneurship Employability
CO4	Assimilate the concept and process of educational administration	Entrepreneurship Employability
Prerequisites (if any)	**NA**	

SECTION A

SCHOOL AS AN ORGANISATION

The school – its functions and relationship with the society, School plant – location, classroom, furniture, design of the building, sanitary requirements, the environment, laboratory apparatus, library, museum and the hostel. The school staff – Principal: his qualifications and duties, role and responsibilities, leadership qualities, relations with subordinates, the guardians and the public. Teacher: role and responsibilities, Qualities and competencies of teacher, and professional ethics and Code of Conduct.

SECTION B

SCHOOL ADMINISTRATION AND MANAGEMENT

Concept of School Management, its aims, objectives, functions, principles and scope. , Concept of School Administration, its aims and objectives, functions, principles and scope. School as an Organization Concept of Organizational Culture and School Climate. Difference between organizational culture and School Climate. Factors influencing the organizational culture of any institution.

SECTION C

ELEMENTS OF SCHOOL MANAGEMENT

School time tables – principles and techniques of time table preparation, school records and registers (Academic and Administrative). Organisation of co-curricular activities and role of students. Problems faced in School Management: Issues of Disaster Management, Student Unrest and how to deal with it. Role of Parent Teacher Associations in School Development

SECTION D

INSTITUTIONAL PLANNING AND TQM

Institutional Planning- Meaning and functions and its importance in school organization, TQM – Meaning and Characteristics and its importance in School organization, Regulatory Bodies in Quality Assurance in Education - NAAC, NCTE, NCERT, SCERT, RCI and AICTE. School finance – sources of income and items of expenditure.

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 Pvt. Ltd.
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
6. NAAC (2003). *Total Quality Management for Tertiary Education* Bangalore: NAAC. Retrievedfrom: *www.naac.gov.in/.../Total%20Quality%20Management%20for%20Tertia.*

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	---	2	----	3	---	2	2	----	2	3
CO2	----	----	3	3	---	3	---	3	----	2	2	-----	2	3
CO3	----	----	3	3	----	3	----	3	----	2	2	---	2	3
CO4	1	1	3	2	---	2	----	3	---	2	2	----	2	3

Course Title/Code	Principles of Human Resource and Management (MOOC-19E-EDS-201)	
Course Type	Elective	
Course Nature	Soft	
L-T-P	2-0-0	
Credits	2	
Course Objective	The course aims managerial competence among the learners	
Course Outcomes (COs)		Mapping
CO1	To know about staffing/recruitment	Employability /Skill
CO2	To explore performance management and appraisal process	Skill Development
CO3	To explore training and development	Entrepreneurship/Skill
CO4	To evaluate processes of career management	Skill development
Prerequisites (if any)	NA	

Syllabus

Introduction to HRM

Staffing / Recruitment : Job Analysis and Design, Human resource Planning / Recruitment, Employee Testing and Selection, Interviewing Candidates

Performance Management and Appraisal Process : Performance Appraisal Process / Types of Performance Appraisal / Performance Evaluation / Performance Feedback

Training and development : Training Process / Need for Training / Training Methods / General and Specific Training/ Training evaluation

Managing Careers : Basics of Career Management / Career Planning / Succession Planning/ Career Development / Promotions and Transfers / Employee Commitment

Implications : Implications of the above in real life

Compensation Management : Components of Wage Structure / Wage and Salary Administration / Compensation Structure /

Compensation Benchmarking / Internal and External Parity / Competency based pay

Pay for Performance and Incentives : Competency / Performance based pay / Variable pay / Team or Group base pay / Incentives / Managerial Incentives / Fringe Benefits

Benefits and Services : Retirement / Insurance / Flexible benefits

Employee Relations : Ethics, Justice and Fair treatment in HR / Collective Bargaining /Employee Safety and Health / Managing Global Human Resources / International HRM

Strategic Human Resource Management and HR Scorecard :Linking people, strategy and performance

a. HR – Strategic Partner
b. Creating an HR scorecard
c. Measuring HR alignment

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	----	----	----	----	----	----	----	1	1	1	1	1
CO2	1	1	----	----	----	----	----	----	----	2	1	1	1	1
CO3	1	1	----	----	----	----	----	----	----	2	1	1	1	1
CO4	1	1	----	----	----	----	----	----	----	2	1	1	1	1

Course Title/Code	**Design Thinking: A Primer** MOOC-19E-EDS-202	
Course Type	Elective	
Course Nature	NTCC	
L-T-P Structure	2-0-0	
Credits	2	
Course Objective	The Course aims at developing skills related with design thinking	
Course Outcomes (COs)		Mapping
CO1	To know about design thinking	Employability /Skill
CO2	To learn about customer journey mapping	Skill Development
CO3	To know about the analysis phase of design thinking	Entrepreneurship/Skill
CO4	To know about the ideation phase of design thinking	Skill development
Prerequisites (if any)	NA	

Syllabus

- Introduction to Design Thinking Week

- Empathize Phase: Customer Journey Mapping Week
- Analyze Phase: 5-Whys and How might we... Week
- Solve Phase: Ideation: Free Brainstorming & Make/Test Phase: Prototype

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	---	---	1	---	---	---	---	---	---	1	1
CO2	1	1	1	---	---	---	---	---	---	---	---	---	2	2
CO3	1	1	2	---	---	1	---	1	---	---	---	---	2	1
CO4	1	1	2	---	---	1	---	------	---	---	---	---	2	2

Course Title/Code	**Principles of Management (MOOC-22E-EDS- 201)**	
Course Type	Elective	
Course Nature	NTCC	
L-T-P Structure	2-0-0	
Credits	2	
Course Objective	The Course aims at developing communication skills among learners	
Course Outcomes (COs)		Mapping
CO1	To know about staffing/recruitment	Employability /Skill
CO2	To explore performance management and appraisal process	Skill Development
CO3	To explore training and development	Entrepreneurship/Skill
CO4	To evaluate processes of career management	Skill development
Prerequisites (if any)	NA	

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 Organisational Change.
Organizational Change: Introduction, Resistance to Change, Behavioural Reactions to Change, Approaches Or Models to Managing Organisational 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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	----	----	----	----	----	----	----	1	1	1	1	1
CO2	1	1	----	----	----	----	----	----	----	2	1	1	1	1
CO3	1	1	----	----	----	----	----	----	----	2	1	1	1	1
CO4	1	1	----	----	----	----	----	----	----	2	1	1	1	1

Course Title/Code	**Basics of Economics / MCS231**	
Course Type	Elective	
Course Nature	Soft	
L-T-P Structure	2-0-0	
Credits	2	
Objective	Students (A) will be able to explain the basic economic concepts and laws, (B) their relation with real life situations, (C) discuss the nature and characteristics of Indian Economy.	
Course Outcomes		
CO1	To comprehend the economic problems of the society.	Employability
CO2	To Enlighten the laws of utility, demand and supply and their measurement.	Entrepreneurship
CO3	To Explain the laws of production and various concepts of costs.	Entrepreneurship
CO4	To eLaborate the various market forms	Skill Development
Prerequisites (if any)	NA	

SECTION A

Definition of Economics - various definitions, Nature of Economic problem, Production possibility curve, Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility - its practical application and importance.

SECTION B

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, degrees of Price elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand.

SECTION C

Meaning of production and factors of production, laws of production, various concepts of cost - Fixed cost, variable cost, average cost, marginal cost, money cost, real cost and opportunity cost. Shape of short run cost curves.

SECTION D

Meaning of Market, Types of Market -Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets). Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices.

REFERENCES

- Principles of Economics: P.N. Chopra (Kalyani Publishers).
- Economics for Engineers- T R Jain & O P Khanna
- Micro Economic Theory – M.L. Jhingan (S.Chand).
- Micro Economic Theory - H.L. Ahuja (S.Chand).
- Modern Micro Economics: S.K. Mishra (Pragati Publications).
- Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co.).

- Indian Economy: Rudar Dutt & K.P.M. Sundhram

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	---	---	---	---	3	2	2	---	2	2
CO2	1	1	1	1	---	---	---	---	1	1	1	---	1	1
CO3	2	1	2	1	---	---	---	---	1	2	3	---	2	3
CO4	2	1	---	---	---	---	---	---	3	1	1	---	1	1

Course Title/Code	**Introduction to Finance (MCS232)**	
Course Type	Elective	
Course Nature	Soft	
L-T-P Structure	2-0-0	
Credits	2	
Objective	This course's goal is to teach students to fundamental financial concepts. A job in corporate finance or additional study in the fields of investments, real estate, banking, and insurance require this foundational understanding.	
Course Outcomes		
CO1	To take an overview of Financial management and its need to take financial decisions.	Employability
CO2	To understand financial statements and distinguishes between profit & loss and Balance sheet of different business organizations.	Entrepreneurship
CO3	To identify the different sources of long term finance and differentiate amongst equity, preference and Debt	Skill Development
CO4	To eLaborate and apply various techniques of capital budgeting and analyse cost of capital and capital structure	Skill Development
Prerequisites (if any)	NA	

SECTION A

Financial Management: An Overview—forms of business organization, financial decision in a firm, Financial System, Financial Markets and Intermediaries.

SECTION B

Financial Analysis and Planning : Financial Statements-Balance sheet, Statement of Profit and Loss, Taxes and Cash Flow , Financial Ratios, Break Even Analysis.

SECTION C

Sources of Long term Finance – Equity Capital, Preference Capital, Terms Loans, Debentures; Raising Long term Finance

SECTION D

Time Value of Money, Capital Budgeting- Techniques of Capital Budgeting, Net Present Value and Payback Period, Capital Structure and Cost of Capital

REFERENCES

- Pandy, I.M., Financial Management, Vikas Publishing House, New Delhi
- Khan M.Y, and Jain P.K., Financial Management, Tata McGraw Hill, New Delhi
- Keown, Arthur J., Martin, John D., Petty, J. William and Scott, David F, Financial Management, Pearson Education
- Chandra, Prasanna, Financial Management, TMH, New Delhi
- Van Horne, James C., Financial Management and Policy, Prentice Hall of India
- Brigham & Houston, Fundamentals of Financial Management, Thomson Learning, Bombay

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	---	3	2	1	---	---	---	---	---	2	2
CO2	3	2	1	---	3	2	1	---	---	---	---	---	1	1
CO3	3	2	1	---	3	2	1	---	---	---	---	---	2	3
CO4	3	2	1	---	3	2	1	---	---	---	---	---	1	1

Course Title/Code	**Basics of Entrepreneurship MCS368**
Course Type:	Elective
Course Nature:	Soft
L-T-P Structure	2-0-0
Credit	2
Course Objectives	The course aims to equip the students towards understanding the various steps involved in the journey from an idea or problem worth solving to the stage of creating a Minimum Viable product(MVP)

Course Outcomes (COs)		**Mapping**
CO1	Students will be able to identify a problem worth solving using Jobs-to-be-Done (JTBD) methodology and empathize with the customer to further define the problem using Design Thinking.	**Entrepreneurship**
CO2	Students will be able to craft their solutions using the Value Proposition Canvas by defining the gain creators and pain relievers	**Entrepreneurship**
CO3	Students will be able to create your own business model using the Lean Canvas template	**Entrepreneurship**
CO4	Students will be able to build solution demo, validate solution demo, build and validate MVP or pivot through MVP interviews	**Entrepreneurship**

Decision to become an entrepreneur
Introduction to entrepreneurship- Defining entrepreneurship, characteristics of successful entrepreneurs, importance of entrepreneurship, Myths about entrepreneurs, Corporate entrepreneurship, Self-Discovery & SWOT analysis, Effectuation –Meaning , Five principles of effectuation, , Defining a Start-up, 4 Ps of a Startup, Reasons of Start-up failure, Basic Model of entrepreneurial process.
Unit 2
Opportunity discovery
Recognizing opportunities and generating Ideas, Validating the market need, Identify problem worth solving using Jobs to be done(JTBD) methodology, design Thinking- Meaning, Design Thinking Values, Design Thinking Process, Double diamond approach in design thinking
Unit 3
Customer and Solution-
Customer Vs. Consumer, different market types and their specific requirements, estimate the market size, identify your customer Segment (through STP), Switching costs and psychological biases, understanding Market research for start ups, Customer profile ,Value proposition Canvas- understanding the jobs, pains and gains.

Unit 4
Business Model & Validation and Business Plan
Business Model- Concept, Elements of Business Model and Lean Approach, Lean canvas template, , Blue Ocean Strategy, difference between Solution Demo and MVP, Business plan- definition and importance, components of Business plan- market, technical and financial, legal and ethical aspects in a Start-Up.

Unit 5- Finance, Marketing & Sales
Cost Structure, Estimate Your Costs, Revenue Streams, Types of Revenue, Identify Your Secondary Revenue Streams, Pricing, Estimate Your Revenue and Price, Check the Profitability of Your Business Idea, Bootstrapping; Sources and Uses of Funds, Identify Sources and Uses of Funds, Create Your Positioning Statement, What Is Branding?, Create Your Brand Strategy, Introduction to Channels, Selecting Your Channels, Create Your Company Profile.
Legal and ethical steps in startups, frugal innovation and social entrepreneurship
Relation between Creativity and Innovation, types of innovation, frugal innovation- features and importance, concept of social entrepreneurship.

References:

- Higgins, M., & Nohria, N. (1999). The sidekick effect: Mentoring relationships and the development of social capital. In Corporate social capital and liability (pp. 161-179). Springer US.
- Sullivan, R. (2000). Entrepreneurial learning and mentoring. International Journal of Entrepreneurial Behavior & Research, 6(3), 160-175

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	---	3	2	1	---	---	---	---	---	2	2
CO2	3	2	1	---	3	2	1	---	---	---	---	---	1	1
CO3	3	2	1	---	3	2	1	---	---	---	---	---	2	3
CO4	3	2	1	---	3	2	1	---	---	---	---	---	1	1

Course Title/Code	**Community Connect Program (EDO239)**
Course Type	Core
L-T-P Structure	0-0-0
Credits	1.5
Course Objective	
Course Outcomes	To equip the learners to do intensive research on a specific case, and to make it possible to identify essential factors, processes and relationships in teaching learning process

CO- PO Mapping

CO	Course Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Become sensitive towards the prevailing socio-economic conditions	3	-	-	-	-	-	-	-	-	3	2
CO2	Imbibe the universal values of humanity, love and compassion	3	-	-	-	-	-	-	-	-	3	2
CO3	Appreciate interdependence of various components of society	3	-	-	-	-	-	-	1	-	3	2
CO4	Contribute to the social welfare by participating in community-based activities	3	-	-	-	-	-	-	1	-	3	2

MANAV RACHNA Vidyanatariksha

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

SEMESTER - 5

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH312B-T	Transition Elements and Coordination Compounds	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH312B-P	Transition Elements and Coordination Compounds Lab			0	0	2		
PHH330-T	Basic Electronics	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH330-P	Basic Electronics Lab			0	0	2		
MAH319B	DIFFERENTIAL EQUATIONS	APPLIED SCIENCE	CORE	3	1	0	4	4
EDH214B	Education in Contemporary India	EDU	CORE	4	0	0	4	4
EDH110-T	Pedagogy of Mathematics	EDU	CORE	3	0	0	5	4
EDH110-P	Pedagogy of Mathematics Lab			0	0	2		
EDW228	e-learning	EDU	CORE	0	0	3	3	1.5
EDO209	Phase I (Field Engagement)	EDU	CORE					2
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			16	2	9	28	25.5

SEMESTER - 5

SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH312B-T	Transition Elements and Coordination Compounds	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH312B-P	Transition Elements and Coordination Compounds Lab			0	0	2		
EDH310-T	Plant Physiology and Metabolism	EDU	CORE	3	0	0	5	4
EDH310-P	Plant Physiology and Metabolism Lab			0	0	2		
EDH302-T	Ecology and Animal Behaviour	EDU	CORE	3	0	0	5	4
EDH302-P	Ecology and Animal Behaviour Lab			0	0	2		

EDH214B	Education in Contemporary India	EDU	CORE	4	0	0	4	4
EDH109-T	Pedagogy of Biological Sciences	EDU	CORE ELECTIVE	3	0	0	5	4
EDH109-P	Pedagogy of Biological Sciences Lab			0	0	2		
EDW228	e-learning	EDU	CORE	0	0	3	3	1.5
EDO209	Phase I (Field Engagement)	EDU	CORE					2
TOTAL (LTP-O/CONTACT HOURS/CREDITS)				16	1	11	28	24.5
Under Choice based Credit system, a basket of electives will be offered from which two electives will taken by the student								

Course Title/Code	**Transition Elements, Coordination Compounds and Chemical Kinetics (CHH312B-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
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)		Mapping
CO1	Interpret the properties of d and f block elements and their compounds in terms of their electronic configuration and bonding.	Skill Development
CO2	Identify the properties of coordination compounds in terms of bonding theories	Skill Development
CO3	Develop knowledge on Principles of Chemical Kinetics	Skill Development
CO4	Develop knowledge on Principles of Surface Chemistry	Skill Development
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 d-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 behaviour, spectral properties and stereochemistry.Powder metallurgy
– extraction of tungsten.Position of lanthanaides 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 andHelmholtz functions: Gibbs function (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, mathematical
characteristics 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.

SECTION D

SURFACE PHENOMENA

Study of Characteristics of Solid surface, surface phenomenon to explain various applications in daily life situations.Catalysis, characteristics of catalysed 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

Reference Books and Readings:

- 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
- Inorganic Chemistry: James Huhey

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	--	--	--	--	--	--	2	--	--	3	2	--
CO2	2	2	--	--	--	--	--	--	2	--	--	3	2	1
CO3	--	3	--	--	--	--	--	--	2	--	--	3	2	1
CO4	1	--	--	--	--	--	--	--	2	--	1	3	2	1

Course Title/Code	**Transition Elements, Coordination Compounds and Chemical Kinetics Lab (CHH312-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	To familiarize the transition metals and estimating them by gravimetric analysis	Employability
CO2	To familiarize the properties of coordination compounds and determine the crystal field stabilization energy of metal complexes	Skill Development
CO3	To explore the kinetics of a reaction by titrimetric and spectrophotometric methods	Employability
CO4	To understand surface chemistry by adsorption, viscosity and partition coefficient experiments	Skill Development
Prerequisites	XII, TESLab	

Chemical Kinetics

1. Iodination of Acetone by titration and Colorimetry.
2. Acid Hydrolysis of Ester
3. Reaction between Potassium Peroxydisulphate 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 Text Book of Quantitative Inorganic Analysis, A I Vogel
- Practical Physical Chemistry, A Findlay

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	1	-	-	1	-	1
CO2	3	2	-	-	-	-	-	-	1	-	-	1	-	1
CO3	3	2	-	-	-	-	-	-	1	-	-	1	-	1
CO4	3	2	-	-	-	-	-	-	1	-	-	1	-	1

Course Title/Code	**Plant Physiology and Metabolism (EDH310-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P- Structure	3-0-0	
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)		Mapping
CO1	Recognise the water relationships of plants and transpiration	Skill Development
CO2	Understand the ascent of sap and transpiration.	Employability
CO3	Comprehend the process of absorption and mineral nutrition	Skill Development
CO4	Explain the process of photosynthesis and its significance.	Entrepreneurship
Prerequisites (if any)	Basic understanding of plant physiological processes	

Course Title/Code	**Basic Electronics (PHH330-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
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)		Mapping

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 ableto analyze and evaluate the related problems.	Skill Development
CO2	Understand, explain and demonstrate various laws and concepts of basic semiconductorphysics and simulate applications for Transistor, FETs and MOSFETS. The students would be able to analyze and evaluate the related problems.	Skill Development
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.	Skill Development
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.	Skill Development
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.	Employment
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

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	3	1	1	1	3	1	2	2	3	1	3
CO2	1	2	3	3	1	1	1	3	1	2	2	3	1	2
CO3	1	2	3	3	1	1	1	3	1	2	2	3	1	2
CO4	1	2	3	3	1	1	1	3	3	3	2	3	3	3

Course Title/Code	**Basic Electronics Lab (PHH330-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
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.	Employability
Prerequisites (if any)	Mathematical knowledge and experimental understanding of electronics components and their behavior is required	

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	3	3	-	2	-	3	3	2	1	3	1	2

Course Title/Code	**Differential Equations (MAH319B)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To equip the students with the concepts of Ordinary differential equations.	
Course Outcomes (COs)		Mapping
CO1	explain and solve some standard types of linear differential equations and its applications.	Skill Development
CO2	explain and solve the differential equations of 1 st order and 1 st degree and its applications.	Skill Development
CO3	explain and solve higher order linear differential equations and simultaneous linear differential equations.	Skill Development
CO4	explain and solve some special types of ordinary differential equations.	Skill Development
CO5	formulate and solve the linear and non-linear PDE.	Skill Development
CO6	solve & analyze the differential equations using OCTAVE.	Skill Development
Prerequisites (if any)	Basic knowledge of sets and real number system.	

SECTION A

Definition, Formation of a differential equation, Solution of a differential equation, Equations of the first order and first degree, Variables separable, Integrating factors, Homogeneous form – Reducible to homogeneous form, Linear equations, Bernoulli's equation, Exact equations, Equations reducible to exact equations.

SECTION B

Equations of the first order and higher degree, Clairaut's equation solvable for x and y and p, Orthogonal trajectories in polar and Cartesian form, Operator D, Rules for finding the particular integral, Cauchy-Euler differential equation, Legendre's differential equations, Simultaneous differential equations.

SECTION C

Equations which do not contain x, Equation whose one solution is known, Equations which can be solved by changing the independent variable and dependent variable, Variation of parameters, Total differential equation :$Pdx + Qdy + Rdz = 0$, Simultaneous equations of the form $dx/P = dy / Q = dz / R$.

SECTION D

Formation by elimination of arbitrary constants, Formation by elimination of arbitrary functions, Solution by direct integration, Lagrange's linear equations $Pp + Qq = R$, Standard types of first order non-linear partial differential equations, Charpit's method, Homogeneous linear equations with constant coefficients, Rules for finding the complementary functions, Rules for finding the particular integral, Separation of variables.

References:

- Higher Engineering Mathematics by Grewal, Wiley Eastern Ltd.
- An Introduction to Partial Differential Equations by Stephenson, ELBS. A Short Course in Differential Equations by Rainville and Bedient, IBH. Advanced Engineering Mathematics by Kreyszig, Wiley Eastern Ltd.
- Introductory Course in Differential Equations by Murray, Orient Longman. Differential Equations by Simmons, TMH.
- Differential Equations by Ayres, Schaum Publishing Company.
- Ordinary and Partial Differential Equations by Raisinghania, S. Chand and Co. Differential Equations by Vasishta and Sharma, Krishna PrakashanMandir.
- A Textbook of Differential Equations by Mittal, Har Anand Publications.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	----	----	----	1	2	----	2	2	----	----
CO2	2	3	1	2	----	----	----	1	2	----	2	2	----	----
CO3	2	3	1	2	----	----	----	1	2	----	2	2	----	----
CO4	2	3	1	2	----	----	----	1	2	----	2	2	----	----
CO5	2	3	1	2	----	----	----	1	2	----	2	2	----	----
CO6	----	----	----	----	----	----	2	----	----	----	----	----	----	----

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:

- John, J.L. (1994). *Fundamentals of Biochemistry*. New Delhi: Sultan Chand & Co.
- Srivastava, H.S. (2005). *Plant Physiology, Biochemistry and Biotechnology*. Meerut: Rastogi Publications.
- Srivastava H.S. and N Shankar, N. (2006). *Plant Physiology and Biochemistry*. Meerut: Rastogi Publications.
- Taiz, L. and Zeiger, E. (1998). *Plant Physiology (2nd Ed.)*. USA: Sinauer Associates Inc.
- Salisbury, F.B. and Ross, C.W. (1992). *Plant Physiology (4th Ed.).* USA: Wadsworth Publishing Co.
- Leo, P.J. and R.C. Leegood, R.C. (1999). *Plant Biochemistry and Molecular Biology*. England: John Wiley & Sons.
- Hopkins, W.J. (1995). *Introduction to Plant Physiology*. New York: John Wiley and Sons, Inc.
- Lehninger, A.B. (1982). *Principles of Biochemistry*. New Delhi: CBS Publishers and Distributors.

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO PO Mapping

CO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	2	----	----	----	----	3	2	1	1	3	1	1
CO2	1	2	2	----	----	----	----	3	2	2	1	3	1	1
CO3	1	2	2	----	----	----	----	3	2	2	1	3	1	1
CO4	1	2	2	----	----	----	----	3	2	2	2	3	1	1

Course Title/Code	**Plant Physiology and Metabolism Lab (EDH310-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	To understand the functioning of a plant from the physiological point of view.	Skill Development
CO2	To enable students to handle glassware and equipment for setting up physiology experiments.	Employability
CO3	To study responses of plants by manipulating the variables.	Skill Development
CO4	To study the role of N, P, K, Ca, Mg, Fe, N & Zn in plant metabolism.	Entrepreneurship
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.

CO PO Mapping

CO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	3	3	2	3	3		1	1
CO2	3	3	3	2	3	3	3	3	2	3	3		2	1
CO3	3	2	2	2	3	3	3	3	2	2	2		2	1
CO4	2	2	3	2	2	2	2	3	2	3	2		2	2

Course Title/Code	**Ecology and Animal Behavior (EDH302-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	To understand the concept of population dispersal and distribution pattern	Skill Development
CO2	To understand the dynamics of community Diversity	Skill Development
CO3	To understand the dynamics of Ecosystem	Employability
CO4	. To develop understanding of the animal behaviour	Skill Development
CO5	To understand the evolution of society	Entrepreneurship & Skill Development
CO6	To develop the understanding of biological rhythm	Skill Development
Prerequisites (if any)	NA	

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 behavior; Control of behavior.

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

References Books and Readings:

1. Fundamentals of Ecology by E.P. Odum – W.B. Saunders, Philadelphia).
2. Environmental Studies by S.V.S. Rana – (Rastogi Publications, 2008).
3. Animal Ecology by S.P. Singh, 6th Revised Edition – (Rastogi Publications,2008).
4. Basic Ecology by E.P Odum (Holt, Rinehart & Winston, New York).
5. Ecology by S.K.Charles – (Prentice Hall Of India, New Delhi)
6. Animal Behaviour by V.G.Dethier and E Stellar -(Prentice hall of India, NewDelhi)
7. Current Problems in Animal Behaviour by W.H. Thorpe and L.Zangwill
8. Experimental Animal Behaviour-A selection of Lab. Exercises by H Hansell and JJ Aitken – (Blakie& Sons, Glasgow)
9. The study of Instinct by N Tinbergen.
10. The Dancing Bees by K V Frisch
11. Learning and Instincts in Animals by W H Thorpe and W Homan.
12. Animal behaviour: An evolutionary approach by AICOK J (1984) – Sinauer Associates.
13. Ecology: Principles and Applications by Chapman E (1988) – Cambridge University Press.
14. Modern Concept of Ecology by Kumar HD (1986) – Vikas Publishing House.
15. Ecology and Environment by Sharma PD (1991) – Rastogi Publications.

16. Environmental Biology by Trivedi PR &Gurudeep Raj (1992).

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO2	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO3	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO4	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO5	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO6	2	1	2	----	3	----	----	2	1	1	1	3	3	3

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

Practical (EDH302-P)

1. Estimation of dissolved alkalinity in the pond water.
2. Estimation of dissolved salinity in the pond water.
3. Gut content analysis in fish.
4. Qualitative analysis of marine plankton to identify the most common mero- andholo- plankton.
5. Identification of the most common benthos, and Nekton in aquatic environment (marine and fresh water).
6. Population study of Local insects and ciliates in the culture medium for growthpattern (logistic and exponential curves).
7. Collection and qualitative and quantitative analysis of soil organisms – Depictionof histogram and pie diagram.
8. Animal adaptation in different habitats- Study of specimens: a) Morphologicalb) physiological adaptation with respect to excretion
9. Study of Preferences, a) Preening behaviour in birds, b) Photo–, chemo–, andGeotaxes in Drosophila (Project work).
10. a) Stimuli eliciting aggressive displays in male Siamese fighter fish; b) colour change in female Siamese fighter fish (demonstration).
11. Experiments with maze for studying behavioural motivation in rat. Field Visit- Lake or pond

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	2	3	-	-	2	1	-	-	-	-	1	--	--
CO2	1	1	2	-	-	-	2	-	-	--	-	1	-	-
CO3	1	-	2	--	-	2	1	-	-	-	-	1	-	-
CO4	-	2	3			1	2	--	-	-	-	1	-	-

Course Title/Code	**Education in Contemporary India (EDH214B)**
Course Type	Core
Course Nature	Hard
L-T-P Structure	4-0-0
Credits	4
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)		Mapping
CO1	Explain diverse social realities and challenges faced by Indian Education System	Skill Development
CO2	Examine constitutional provisions and safeguards avaiLable for Indian citizen particularly in context of contemporary Educational set up for bringing social equality	Employability
CO3	Analyze current educational scenario in light of the recommendations of various Committees, Commissions and National Policies	Skill Development
CO4	Appreciate the role of nodal educational agencies and policy making institutions in national development.	Entrepreneurship
CO5	Reflect upon the structural organization of Indian education system and role of teacher in inclusive education	Entrepreneurship
Prerequisites	NA	

(if any)	

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 childrento 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 Balika Vidyalaya, RashtriyaMadhyamikShikshaAbhiyan(RMSA)

Reference Books and Readings

1. GOI. (1966). *Report of the Education Commission-1964-66*. New Delhi: Ministry of Education.
2. 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
3. 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
4. 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
5. Kashyap, S.C. (2009). *The constitution of India,* New Delhi: National Book Trust.
6. Mishra, B.K. &Mohanty, R.K. (2003). *Trends and issues in India Education,* Meerut: Surya publications.
7. Nambissan, G. B. (2009). *Exclusion and discrimination in schools: Experiences of dalit children*. Indian Institute of Dalit Studies and UNICEF.
8. NCERT. (2006). *Position paper-National focus group on problems of scheduled caste and scheduled tribe children (NCF2005).* New Delhi: NCERT
9. Rajput, J.S. (1994). *Universalisation of Elementary Education*, New Delhi: Vikas Publishing House.
10. Sachdeva,M.S. et.al (2011). *Philosophical, Sociological and Economic bases of Education*, Patiala: Twenty First Century Publications.
11. Shankar, M. (2007*). Contemporly issues in modern Indian education*, New Delhi: Authors Press.
12. Stormquist, N. P.(2002). *Education in a Globalised world.* New York: Rowman & Littlefield publishers.
13. Walia,J.S.(1979). *Modern Indian Education and its Problems,* Jalandhar City: Paul Publishers, Gopal Nagar.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	3	-	1	-	-	-	-	2	2	1	1	1
CO2	3	-	3	-	1	-	-	-	-	2	2	1	2	2
CO3	3	3	-	-	-	3	-	-	2	-	2	1	-	-
CO4	2	-	-	-	-	2	-	-	2	2	2	1	-	-
CO5	-	2	2	2	-	2	-	-	2	2	2	-	2	-

Course Title/Code	**Pedagogy of Mathematics (EDH110-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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)		Mapping
CO1	To appreciate the role and contribution of eminent mathematicians.	Employability
CO2	To develop correlation of mathematics with other subjects	Employability
CO3	To design instructional objectives for chosen content.	Skill Development
CO4	Apply innovative methods of teachings to teach mathematics at middle school level.	Entrepreneurship
CO5	Create content appropriate evaluation tools in mathematics.	Entrepreneurship
CO6	To reflect the skill set of an effective mathematics teacher in the classroom.	Skill Development
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, Aryabhata, Bhaskar Acharya, 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

1. Carey, L.M. (1988). Measuring and Evaluating School Learning, Boston: Allyn and Bacon.
2. Chambers, P. (2010).Teaching Mathematics, Sage Publication, New Delhi.
3. Chapman, L.R. (1970). The Process of Learning Mathematics, New York: Pregamon Press.
4. David, A.H., Maggie, M.K., & Louann, H.L. (2007). Teaching Mathematics
5. Meaningfully: Solutions for Reaching Struggling Learners, Canada: Amazon Books.
6. David, W. (1988). How Children Think and Learn, New York: Blackwell Publishers Ltd.
7. Gupta, H. N., & Shankaran, V. (Ed.), (1984). Content-Cum-Methodology of Teaching Mathematics. NCERT, New Delhi.
8. James, A. (2005). Teaching of Mathematics, New Delhi: Neelkamal Publication.
9. Kumar, S. (2009). Teaching of Mathematics, New Delhi: Anmol Publications.
10. Mangal, S.K. (1993). Teaching of Mathematics, New Delhi: Arya Book Depot.

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	2	3	2	3	3	2	3	2
CO2	2	2	3	2	2	2	2	0	2	3	3	2	3	2
CO3	2	2	3	2	2	2	2	3	2	3	3	2	3	2
CO4	2	2	3	2	3	2	2	3	2	3	3	2	3	2
CO5	2	2	3	2	2	2	2	3	2	3	3	2	3	2
CO6	3	3	3	2	2	2	2	3	2	3	3	2	3	2

Course Title/Code	**Pedagogy of Mathematics Lab (EDH110-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-PStructure	0-0-2	
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)		Mapping
CO1	Develop Lesson Plan incorporating the core components.	Skill Development
CO2	Make use of innovative methods of teachings to teach mathematics at middle school level.	Entrepreneurship
CO3	Design appropriate evaluation tools for effective evaluation of learning of Mathematical concepts.	Entrepreneurship
CO4	To demonstrate skill set of an effective Mathematics teacher in the classroom.	Skill Development
Prerequisites (if any)	NA	

Practical Activities

1. Pedagogical analysis of a unit of content from secondary school Mathematics SylLabus
2. Critically evaluate the present curriculum in mathematics at the secondary stageaccording to NCF
3. Preparation of a multimedia presentation on a topic with special reference to students with disabilities
4. Construction of a question paper based on current CBSE format/concerned State Board of education, preparing its Scoring key, and marking scheme
5. Analyzing errors committed by school children in Mathematics and preparing a remedial plan
6. Developing an Action Research proposal for a problem related to teaching and learning of Mathematics with reference to students with disabilities
7. Prepare an achievement test of mathematics
8. Develop a multimedia lesson plan using appropriate ICT resources and transactingthe same in class
9. Prepare teaching aid for teaching of mathematics at secondary school level
10. 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.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1		2	1		3		3	3	2	3	2
CO2	2			2	3	2	2		2	1	3	2	3	2
CO3	2	2	1	2		1	2	3		3	3	2	3	2
CO4	1	1	3		2		2			3	3	2	3	2

Course Title/Code	Pedagogy of Biological Science (EDH109-T)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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, andaesthetic 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)		Mapping
CO1	Understand and appreciate the nature of Science and contributions by eminent Biologists.	Skill Development
CO2	Design learning objectives for content related to Biological Sciences.	Skill Development
CO3	Explain a Constructivist approach of building knowledge.	Employability
CO4	Apply different pedagogical approaches to design lesson plans.	Entrepreneurship
CO5	Design effective assessment strategies related to Biological Sciences and ICT mediated online assessment sheets.	Entrepreneurship & Skill Development
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 andgrading.

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.

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	2	2	3	2	2	2	2	3	2	3	3	2	3	2
CO 2	2	2	3	2	2	2	2	3	2	3	3	2	3	2
CO 3	3	2	2	2	3	3	3	3	2	2	2	2	3	2
CO 4	3	3	3	2	3	3	3	3	2	3	3	2	3	2
CO 5	2	2	3	2	2	2	2	3	2	3	3	2	3	2

Course Title/Code	**Pedagogy of Biological Science Lab (EDH109-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	Understand the Bloom's Taxonomy of Instructional Objectives and design learning objectives for content related to Biological Sciences.	Skill Development
CO2	Understand the micro teaching skills and prepare the micro lesson plans for each skill.	Skill Development
CO3	Learn about the Herbartian lesson plan and prepare the lesson plans for teaching Biological Science.	Employability
CO4	Apply different pedagogical approaches to design lesson plans.	Entrepreneurship
CO5	Learn about the test construction and construct a test paper for students' assessment.	Entrepreneurship & Skill Development
Prerequisites(if any)	Basic knowledge of Biological Science	

Pedagogy of Biological Science Practical (EDH 109)

1. Critical review of a Textbook of Science/ Biology.
2. Planning and conducting awareness programs/ camps.
3. Diagnosis and preventive measures of Epidemics.
4. Report of one Action Research carried out in the practicing school.
5. Concept mapping in selected units in Biological Sciences Planning learning situations for constructing knowledge in Biological Sciences.
6. Group Discussion on pedagogical issues.
7. *Hands-on experience through visits to botanical gardens/ flower shows/ garden of five senses/Department of Science Education at NCERT/SCERT.
8. Report on measures being taken for inclusive teaching-learning in practicing schools.
9. Exploration of alternative conceptions held commonly by students and planning of approaches towards re-conceptualizations – Project

*Field activity

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	3	3	2	3	3	2	3	2
CO2	3	3	3	2	3	3	3	3	2	3	3	2	3	2
CO3	3	2	2	2	3	3	3	3	2	2	2	2	3	2
CO4	2	2	3	2	2	2	2	3	2	3	2	2	3	2
CO5	2	2	3	2	2	2	2	3	1	3	1	2	3	2

Course Title/Code	e-learning (EDW228)	
Course Type	Core	
Course Nature	Workshop	
L-T-P Structure	0-0-3	
Credits	1.5	
Course Objective	Student Readiness regarding E-learning	
Course Outcomes (COs)		Mapping
CO1	Understand concept of e-learning and key concepts	Employability
CO2	Use blended learning approach in e-learning	Skill Development
CO3	Use different online tools and resources in assessment	Skill Development
CO4	Explore and use the potentialities of Information Communication Technology for colLaborative, constructive & inquiry-based learning	Entrepreneurship
Prerequisites (if any)	NA	

SECTION A

Basic of e-learning

- Concept of e-learning
- Types of e-learning

- Terminologie srelated to e-learning

Activity

- Learners create mindmap of e-learning

SECTION B

Useof ICT for learning management

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

Activity

- Use Google classroom, create classroom, createassignment
- Use google drive and dropbox for storing document

SECTION C

ICT for teaching learning process

Blended learning approach for e-learning

- Tools fo rconducting online classes
- Digital toolsforcolLaborative&constructivelearning-Googledoc, Discussionforum,

Activity:

- Prepareaweek planofteachingusingblended learningapproach
- Analyseonlineplatformsforonlineclasses

- Conducta seminarusingonlineplatform
- Discuss anyICT related issueusinganymodeof online discussion forum.

SECTION D

ICT in Assessment

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

Activity

- Createeportfolioof thisworkshop
- Createrubrictoassessgroupdiscussion
- Generateatest

Create crosswords puzzles etc.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	3	1	1	1	1	3	1	1	1	1	1	1
CO2	3	2	2	2	3	3	1	3	1	2	2	1	3	2
CO3	2	3	3	3	3	1	3	1	2	1	2	1	1	1
CO4	2	3	2	3	3	2	3	1	2	2	2	1	3	2

Course Title/Code	Phase-1 (Field Engagement)(EDO209)	
Course Type	Core	
Course NAture	NTCC	
L-T-P Structure	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)		Mapping
CO1	Recognise the contribution of psychological, philosophical and socio - economic factors in optimizing teaching and learning	Skill Development
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	Skill Development
CO3	Present the observations of internship period in a systematic and structured manner in the form of individual and/or Group Tasks	Skill Development
CO4	Appreciate importance of school engagement program as a integral component of teacher training programme	Skill Development
CO5	Demonstrate an understanding of the differences between government and private school settings and ways of functioning.	Skill Development
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

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3	----	----	----	----	3	----	3	3	3	3	----	3	3
CO 2	3	3	3	3	3	3	----	3	----	3	3	----	2	2
CO 3	3	3	3	3	3	3	----	3	----	3	3	----	2	2
CO 4	3	3	----	----	----	3	----	3	----	3	3	----	3	3
CO 5	3	3	----	3	----	----	----	3	----	3	3	----	2	2

SEMESTER - 6								
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective / University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH314B-T	Electrochemistry and Chemical Kinetics	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH314B-P	Electrochemistry and Chemical Kinetics Lab			0	0	2		
MAH321B-T	COMPLEX ANALYSIS & NUMERICAL ANALYSIS	APPLIED SCIENCE	CORE	3	0	0	5	4
MAH321B-P	COMPLEX ANALYSIS & NUMERICAL ANALYSIS Lab			0	0	2		
PHH433-T	Solid State Physics	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH433-P	Solid State Physics Lab			0	0	2		
EDH128-T	Pedagogy of Physical Sciences	EDU	CORE	3	0	0	5	4
EDH128-P	Pedagogy of Physical Sciences Lab			0	0	2		
EDW254	Basic Research and Statistics (EPC)	EDU	CORE	0	0	3	3	1.5
EDW104	Reading And Reflection On Texts	EDU	CORE	0	0	3	3	1.5
EDO258	Phase-II Field Engagement	EDU	CORE					2
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			12	1	14	27	22

	SEMESTER - 6							
SUBJECT CODES	SUBJECT NAME	**OFFERING DEPARTMENT	COURSE TYPE (Core/Elective /University Compulsory)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH314BT	Electrochemistry and Chemical Kinetics	APPLIED SCIENCE	CORE	3	0	0	5	4
CHH314BP	Electrochemistry and Chemical Kinetics Lab			0	0	2		
EDH402-T	Molecular biology, immunology and cancer	EDU	CORE	3	0	0	5	4
EDH402-P	Molecular biology, immunology and cancer Lab			0	0	2		
EDH311-T	Developmental Biology and Applied Zoology	EDU	CORE	3	0	0	5	4
EDH311-P	Developmental Biology and Applied Zoology Lab			0	0	2		
EDH128-T	Pedagogy of Physical Sciences	EDU	CORE	3	0	0	5	4

EDH128-P	Pedagogy of Physical Sciences Lab			0	0	2		
EDW254	Basic Research and Statistics (EPC)	EDU	CORE	0	0	3	3	1.5
EDW104	Reading And Reflection On Texts	EDU	CORE	0	0	3	3	1.5
EDO258	Phase-II Field Engagement	EDU	CORE	0	0	0	0	2
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			18	0	12	26	21

Course Title/Code	Electrochemistry and Chemical Kinetics (CHH314B-T)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
Credits	3	
Course Objective	To give an in-depth exposure of Electrochemistry and familiarize the students with basic concepts of Photochemistry	
Course Outcomes (COs)		Mapping
CO1	Explain the nature of Electrolytic conduction involving theories of electrolytes.	Skill Development
CO2	Understand the processes that occur at electrodes and in electrolytes and to apply emf methods to study different types of reactions.	Skill Development
CO3	Describe the basic principles of battery design and understand the chemical reactions used in a lead-acid battery.	Skill Development
CO4	Explain and discuss theories for photoinduced electron transfer and excitation energy transfer, and apply these methods in quantitative calculations	Skill Development
Prerequisites	NA	

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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	2	1	-	3	3	3
CO2	3	3	3	3	-	-	-	-	2	1	-	---------	3	3
CO3	3	3	3	3	-	-	-	-	2	1	-	---------	3	3
CO4	3	3	3	3	-	-	-	-	2	1	-	---------	3	3

Course Title/Code	Electrochemistry and Chemistry Kinetics Lab (CHH314B-P)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To give an in-depth exposure of Electrochemistry and familiarize the students with basic concepts of Photochemistry	
Course Outcomes (COs)		Mapping
CO1	Explain the nature of Electrolytic conduction using different electrolytes	Skill Development
CO2	Understand the calculation of free energy change for an electrochemical cell using the measured cell potential value.	Skill Development
CO3	To be able to Measure the cell potential for an electrochemical cell.	Skill Development
CO4	Able to explain theory and practice of common photochemical and photophysical methods, and be able to execute these experimentally	Skill Development
Prerequisites	NA	

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
10. Preparation of *p*-bromoacetanilide from acetanilide by bromination

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	3	1	-	1	1	
CO2	3	2	3	3	-	-	-	-	3	1	-	2	1	1
CO3	3	2	3	3	-	-	-	-	3	1	-		2	1
CO4	3	2	3	3	-	-	-	-	3	1	-	1	1	2

Course Title/Code	COMPLEX ANALYSIS & NUMERICAL ANALYSIS (MAH321B-T)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To develop the understanding & application of the concepts of function of complex variable & Numerical methods in problem solving situations.	
Course Outcomes (COs)		**Mapping**
CO1	Explain different kinds of functions of complex variables and apply them for solving mathematical problems.	**Skill Development**
CO2	Demonstrate and apply the concept of analytic functions for solving mathematical problems.	**Skill Development**
CO3	Demonstrate understanding & usage of common numerical methods to obtain approximate solutions to otherwise intractable mathematical problems.	**Skill Development**
CO4	Analyse and evaluate the accuracy of common numerical methods	**Skill Development**
CO5	Solve & analyze the Mathematical problems related to Numerical Analysis and its applications using software	**Skill Development**
Prerequisites (if any)	NA	

Section A

Numerical Methods: Numerical Solutions of Algebraic and Transcendental equations, Bisection Method, Method of false position, Newton-Raphson method. Finite differences, Forward and Backward differences, Interpolation, Newton-Gregory forward and backward interpolation formula, Divided differences, Lagrange's interpolation formula.

Section B

Numerical Differentiation: Finding first and second derivatives using interpolation formulae, Integration: General quadrature formula, Newton-Cotes quadrature formula, Trapezoidal Rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddle's rule, Gauss quadrature.

Section C

Functions of a Complex Variable: Limits, Continuous Functions, Differentiability, The Cauchy-Riemann Equations, Analytic Functions, Harmonic Functions. Conformal Mappings: Elementary Transformations, Bilinear Transformations, Cross ratio, Fixed Points of Bilinear Transformations.

Section D

Complex Integration: Introduction, Definite Integral, Cauchy's Theorem, Cauchy's integral Formula. Higher Derivatives. Power Series: Introduction, Sequences and Series, Sequences and Series of Functions, Power Series, Elementary Functions. (Remove) Add: - Taylor and Laurent Series, singularities and their types, Residue Theorem Application of residue theorem.

COMPLEX ANALYSIS & NUMERICAL ANALYSIS / LAB MAH401B-P

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.

References:

1. Theory of Functions of a Complex Variable by Shanti Narayan, S. Chand and Co. Ltd.
2. Foundations of Complex Analysis by Ponnuswamy, Narosa Publishing House.
3. Complex Variables and Applications by Churchill, Brown and Verhey, McGraw Hill International Book Company.
4. Functions of One Complex Variable by Conway, Narosa Publishing House.
5. Complex Variables, Murray R. Spiegel, Schaum Outline Series, McGraw Hill Book Company.
6. Complex Analysis by Armugam, Tangapandi, Somasundaram, Scitech Publications Pvt. Ltd.
7. Numerical Analysis by Gupta, S. Chand and Co. Ltd.
8. Finite Difference and Numerical Analysis by Saxena, S.Chand and Co. Ltd.
9. Introductory Methods of Numerical Analysis by Shastry, PHI.
10. Numerical Methods for Scientists and Engineers, Grewal, Wiley Eastern Ltd.
11. Higher Engineering Mathematics by Grewal, Wiley Eastern Ltd.
12. Numerical Calculus by William Edmund Milne, Princeton University Press.
13. Introduction to Numerical Analysis by Hildebrand, Tata McGraw Hill Publishing Ltd.
14. Numerical Analysis by Schield, Schaum's Outline Series.
15. Introduction to Numerical Methods by Peter A. Stark, MacMillan Co. Ltd.

Course Title/Code	**Complex Analysis & Numerical Analysis (MAH321B-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P-Structure	3-1-0	
Credits	3	
Course Objective	Students would be able to understand and apply the concepts of complex analysis and numerical techniques for solving the mathematical problems and their applications.	
Course Outcomes (COs)		Mapping
CO1	Demonstrate understanding of the basic concepts underlying complex analysis.	Skill Development
CO2	Apply the methods of complex analysis to evaluate definite integrals and infinite series.	Skill Development
CO3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, and the solution of nonlinear equations.	Skill Development
CO4	Apply numerical methods in Real Life problems.	Skill Development
CO5	Solve & analyze the Mathematical problems related to Numerical Analysis and its applications using software.	Skill Development
Prerequisites (if any)	NA	

SECTION A

Numerical Methods: Numerical Solutions of Algebraic and Transcendental equations, Bisection Method, Method of false position, Newton-Raphson method. Finite differences, Forward and Backward differences, Interpolation, Newton-Gregory forward and backward interpolation formula, Divided differences, Lagrange's interpolation formula.

SECTION B

Numerical Differentiation: Finding first and second derivatives using interpolation formulae, Integration: General quadrature formula, Newton-Cotes quadrature formula, Trapezoidal Rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddle's rule, Gauss quadrature.

SECTION C

Functions of a Complex Variable: Limits, Continuous Functions, Differentiability, The Cauchy-Riemann Equations, Analytic Functions, Harmonic Functions. Conformal Mappings: Elementary Transformations, Bilinear Transformations, Cross ratio, Fixed Points of Bilinear Transformations.

SECTION D

Complex Integration: Introduction, Definite Integral, Cauchy's Theorem, Cauchy's integral Formula. Higher Derivatives. Power Series: Introduction, Sequences and Series, Sequences and Series of Functions, Power Series, Elementary Functions. (Remove) Add: - Taylor and Laurent Series, singularities and their types, Residue Theorem Application of residue theorem.

References:

1. Theory of Functions of a Complex Variable by Shanti Narayan, S. Chand and Co. Ltd.
2. Foundations of Complex Analysis by Ponnuswamy, Narosa Publishing House.
3. Complex Variables and Applications by Churchill, Brown and Verhey, McGraw Hill International Book Company.
4. Functions of One Complex Variable by Conway, Narosa Publishing House.
5. Complex Variables, Murray R. Spiegel, Schaum Outline Series, McGraw Hill Book Company.

6. Complex Analysis by Armugam, Tangapandi, Somasundaram, Scitech Publications Pvt. Ltd.
7. Numerical Analysis by Gupta, S. Chand and Co. Ltd.
8. Finite Difference and Numerical Analysis by Saxena, S.Chand and Co. Ltd.
9. Introductory Methods of Numerical Analysis by Shastry, PHI.
10. Numerical Methods for Scientists and Engineers, Grewal, Wiley Eastern Ltd.
11. Higher Engineering Mathematics by Grewal, Wiley Eastern Ltd.
12. Numerical Calculus by William Edmund Milne, Princeton University Press.
13. Introduction to Numerical Analysis by Hildebrand, Tata McGraw Hill Publishing Ltd.
14. Numerical Analysis by Schield, Schaum's Outline Series.
15. Introduction to Numerical Methods by Peter A. Stark, MacMillan Co. Ltd.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1			2	3				2	3		1	1	3	1
CO2	2		2	3				2	3		1	3	3	1
CO3			3	2				2	3		1	2	2	1
CO4			3	3				2	3		1	3	2	1
CO5	1		2	3				2	3		1	2	3	1

Course Title/Code	**Complex Analysis & Numerical Analysis Lab (MAH321B-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	Students would be able to develop the skills for solving the mathematical problems and their applications.	
Course Outcomes (COs)		Mapping
CO1	Apply the methods of complex analysis to evaluate definite integrals and infinite series.	Skill Development
Prerequisites (if any)	NA	

List of Programmes

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.

References:

14. Theory of Functions of a Complex Variable by Shanti Narayan, S. Chand and Co. Ltd.

15. Foundations of Complex Analysis by Ponnuswamy, Narosa Publishing House.

16. Complex Variables and Applications by Churchill, Brown and Verhey, McGraw Hill International Book Company.

17. Functions of One Complex Variable by Conway, Narosa Publishing House.

18. Complex Variables, Murray R. Spiegel, Schaum Outline Series, McGraw Hill Book Company.

CO PO Mapping

Course Outcomes	Program Outcomes													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1:	----	2	3	----	3	2	3	2	----	----	----	----	----	1
CO2:	----	2	3	----	2	2	2	1	----	----	----	----	----	2
CO3:	----	1	2	----	2	2	1	3	----	----	----	----	----	1
CO4:	----	1	1	----	2	2	2	2	----	----	----	----	----	1
CO5:	----	2	3	----	3	2	3	2	----	----	----	----	----	1

Course Title/Code	**Solid-State Physics (PHH433-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
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)		Mapping
CO1	Students would be able to describe the nuclear structure on the basis of different nuclear model.	Skill Development
CO2	Students would be able to describe radioactive elements and half-life of the elements and familiar with nuclear Reactors/ Detectors	Skill Development & Employability Development
CO3	Students would be able to explain and analyze the different crystal structures and different models for thermal properties of solids	Employability Development
CO4	Students would be able to determine the electrical, magnetic and superconducting properties of materials	Entrepreneurship & Skill Development
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:

(i) Perspectives of Modern Physics, Beiser
(ii) Nuclear Physics, Kaplan.
(iii) Nuclear Physics, Subramanyam and Brijlal.
(iv) Concepts of Nuclear Physics, Cohen.
(v) Solid State Physics, A J Dekker.
(vi) Introduction to Solid State Physics, C Kittel.
(vii) Modern Physics, Kiein

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	2	1	2	1	-	1	3	3	1	3	3	2
CO2	-	-	2	1	2	1	-	1	3	3	1	3	3	2
CO3	-	-	2	1	2	1	-	1	3	3	1	3	3	2
CO4	-	-	2	1	2	1	-	1	3	3	1	3	3	2

Course Title/Code	**Solid-State Physics Lab (PHH433-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	Students would be able to understand of the fundamental concepts and techniques used in Nuclear Physics.	Skill Development
CO2	Students would be able to examine the electronic charge and specific charge of electron, i.e., charge mass ratio	Skill & Employability Development
CO3	Students would be able to measure of energy band gap of semi-conductor materials and charge carrier concentrations	Skill & Employability Development
CO4	Students would be able to verify the value of various Physical constant like Rydberg constant, Planck constant, Hall coefficient etc.	Skill & Employability Development
Prerequisites (if any)	NA	

1. Magnetic susceptibility
2. e/m of electrons by helical method
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.

CO-PO Mapping

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3				3	3	3		3			3	
CO2	3	3				3	3	3		3			3	
CO3	3	3				3	3	3		3			3	
CO4	3	3				3	3	3		3			3	

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

SECTION A

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.

b) 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

a) 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.

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

c) 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

a) Innate, Adaptive (cell mediated and humoral) - Immunity. Cells and Organs of the Immune System, Primary and

Secondary lymphoid organs, Lymphatic system.

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

Factors influencing immunogenicity,B and T-cell epitopes.

c) 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

a) Major Histocompatibility Complex- Structure, polymorphism and functions, MHC and immune responsiveness. Cytokines: properties and functions, Complement system: components, activation and functions.

b) Hypersensitivity, Immune System in Health & Disease, Vaccines: bacterial, viral, toxoid and III generation vaccines, Immunodeficiency, Autoimmunity.

c) 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 WB

Saunders 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 Press.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	----	2	----	----	----	----	1	2	1	1	3	1	1
CO2	1	----	2	----	----	----	----	1	2	1	1	3	3	3
CO3	1	----	2	----	----	----	----	1	2	1	1	3	3	3
CO4	1		2	----	2	----	----	1	2	1	1	3	3	3
CO5	1	1	2	----	2	----	----	1	2	1	1	3	3	3
CO6	1	1	2	----	2	----	----	1	2	1	1	3	3	3

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

Practical (EDH402-P)

1. Staining of mitochondria in the buccal epithelial cells of man and ovary ofearthworm using vital stain.
2. Study of mitosis in onion root tips.
3. Micrometry: Use of ocular and stage micrometers to measure cell and nucleardimensions of human buccal epithelial cells.
4. Study of slides of grasshopper (Poecilocerapicta) testis for the various stagesof meiosis.
5. Study of salivary gland chromosomes of Drosophila for banding patterns.
6. Study of salivary gland chromosomes of chironomous 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)
11.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	1	----	2	----	1	2	1	1	3	1	3
CO2	1	1	2	1--	----	----	----	1	2	1	1	3	1	3
CO3	1	1	2	----	----	----	----	1	2	1	1	3	1	3
CO4	1	1	2		2			1	2	1	1	3	1	3

Course Title/Code	**Developmental Biology and Applied Zoology (EDH311-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-0-0	
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 physiologicalroles.	
Course Outcomes (COs)		Mapping
CO1	Explain the process of the development, organization and functions of developmental steps in mammals	Skill Development
CO2	To conceptualize the concept of the diversity and systemic complexity in neurulation and gastrulation	Skill Development
CO3	Analyse the developmental stages of chick embryo	Employability/Skill Development
CO4	To have the Knowledge of mechanism of regeneration	Skill Development
CO5	To have the knowledge of harmful animals and critically analyze the IPM	Entrepreneurship & Skill Development
CO6	To have the knowledge of harmful animals and critically analyze the IPM	Skill Development
Prerequisite (if any)	NA	

SECTION A

GAMETOGENESIS AND EARLY DEVELOPMENT

a) Historical perspective, aim and scope of developmental biology

b) Gametogenesis – Differentiation of spermatozoa and oocyte in mammals Different types of eggs, classification based on amount and distribution of yolk(deutoplasm)

c) Fertilization– external (amphibians) and internal (mammals), interaction of gametes, monospermy, polyspermy; Parthenogenesis and its significance

d) Types of cleavage and fate map – Types of cleavages – holoblastic, meroblastic, radial, spiral, discoidal, superficial; planes of cleavages – meridional,vertical, equatorial, latitudinal.

SECTION B

DEVELOPMENT OF FROG AND REGENERATION

a) Gastrulation – Morphogenetic movement of cells, mechanism of gastrulation and change in cell shape

b) Neurulation– Formation, position and fate of three germinal layers

c) Primary organizer in frog – Organizer concept of Spemann, chemical nature and distribution of inductors – competence, determination and differentiation; metamorphosis of tadpole .

c) Gastrulation in frog and chick up to the formation of three germ layers.

SECTION C

DEVELOPMENT OF CHICK AND MAMMAL

a) Development of Chick: Overview of early development; formation of primitivestreak and germinal layers ; Salient features of chick embryos of 13 hrs, 19 hrs, 24 hrs, 33hrs and 48 hrs of incubation

b) Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology;

a) Foetal membranes – Development, structure and functions of a) amnion, b) chorion, c) yolk sac, d) allantois. Placenta in mammals – Structure, classification, physiology.

b) Concept of competence, determination and differentiation.

c) Regeneration: morpholaxis and epimorphosis; regeneration in Dugesia and salamander; Factors influencing regeneration .

SECTION D

APPLIED ZOOLOGY

a) Beneficial animals: Basic principles of practices in culturing of i) silkworms (Sericulture), ii) bees (Apiculture), iii) Aquaculture – fish, prawn and shell fish

b) Harmful animals: Pests- 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) .

c) Animal Husbandry : Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle

References:

1. Vertebrate Embryology by R.S.McEwen (Oxford & IBM Publishing CO.,New Delhi)
2. C.S.I.R. Wealth of India (Supplement) on Fish and Fisheries. (CSIR, NewDelhi).
3. Bee keeping by J.E.Eckert and F.R.Shaw.
4. Developmental Biology by J.W.Brookbank.
5. Patterns and Principles of Animal Development by J.W. Saunders. Jr.
6. Fish and Fisheries of India by V.G.Jhingran (Hindustan Publishing Corpn;New Delhi)
7. Economic Zoology by G.S. Shukla& V.B. Upadhyay.Elements of Entomology by Rajendra Singh.
8. Embryology by Barth IG (1966) – Holt Rinehart & Winston.
9. Development by Berril N & Karp G (1978) – Tata McGraw Hill Publ. Co.

CO PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	1	1	2	----	2	----	----	2	2	1	1	3	3	3
CO 2	1	1	2	----	2	----	----	2	2	1	1	3	3	3
CO 3	1	1	2	----	2	----	----	2	2	1	1	3	3	3
CO4		1	2	----	2	----	----	2	2	1	1	3	3	3
CO5	1	1	2	----	2	-	-	2	2	1	1	3	3	3
CO6	1	1	2	----	2	-	-	2	2	1	1	3	3	3

Course Tite	**Developmental Biology and Applied Zoology Lab (EDH311-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To enable students to comprehend the modern concepts of developmental biology; to understand the developmental sequences in vertebrates; to compare the development of organs and systems; to identify the useful animals for harvesting the benefits and preventing the harmfulness with effective control measures.	
Course Outcomes (COs)		Mapping
CO1	To study the different permanent slides of developmental stages of frog	Skill Development
CO2	To study the permanent slides of chick embryos	Skill Development
CO3	To Study the common insect pests of stored grains and crops, Study of common nematode pests of crops and Study of common insect vectors.	Employability/Entrepreneurship
CO4	To Study the economically important a) Fishes, b) crustaceans, c) molluscs	Employability /Skill Development
Prerequisites (if any)	NA	

Practical (EDH311-P)

i) Study of different types of eggs (Insect, Frog, Hen).
ii) Study of permanent slides of different developmental stages in Frog
a) Section of egg, b) early cleavage, c) blastula, d) morula, e) Gastrula
i) Study of permanent slides of a) neural plate, b) neural fold of Frog.
ii) Study of different developmental stages of Frog tadpole:
a) Early tadpole, b) hind limb stage, c) hind limb and fore limb stage, d) shorttailed stage, e) young Frog.
Preparation of window on hen's egg to study development of embryo.
Incubation of fertilized egg of chick, preparation of permanent mounting of embryo from incubated egg and identification of age of the embryo.
i)Study of permanent slides of chick embryos of
a) 13 hrs, b) 19 hrs, c) 24 hrs, d) 33 hrs, e) 48 hrs of incubation
Study of sections of chick embryos of
a) 19 hrs, b) 24 hrs, iii) 48 hrs of incubation
Rearing of two races of silkworm from egg to cocoon stages – conditions required, quality and quantity of food provided, precaution taken duringfeeding, moulting and spinning.
Harvesting cocoons, reeling of silk from the cocoons, study of some economic traits – fecundity, larval duration, cocoon weight, shell weight and silk weight. 9.a.Study of common insect pests of stored grains and crops.
b.Study of common nematode pests of crops. c.Study of common insect vectors.

10. Study of economically important
a) Fishes, b) crustaceans, c) molluscs Field Visit- Agricultural college or farm

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	-	-	3	1	2	-	-	-	3	--	3
CO2	1	1	2	-	-	-	2	-	2	--	-	3	-	3
CO3	1	-	2	--	-	1	2	-	2	-	-	3	-	-
CO4	1	1	2	--	-	1	2	--	-	3	-	3	-	-

Course Title/Code	**Pedagogy of Physical Sciences (EDH128-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-PStructure	3-0-0	
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)		Mapping
CO1	To understand the epistemology of science as a school subject in the school curriculum.	Skill Development
CO2	To implement various pedagogical approaches to teaching of science at different stages of school.	Skill Development
CO3	To plan units and lessons through thematic approach in a holistic manner.	Employability
CO4	To critically examine teaching-learning processes that incorporate enquiry, discovery, activity-based learning, problem solving situations and investigatory projects etc. within the classroom.	Entrepreneurship
CO5	To integrate knowledge of science with other school subjects.	Entrepreneurship & Skill Development
CO6	To integrate knowledge of science in day-to-day life.	Employability

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:

1. Alsop, S. and Hicks, K. (2007): *Teaching Science: A Handbook for Primary and Secondary school teachers,* Kogan Page, N. Delhi.
2. CBSE (2009). Teacher's manual on CCE. New Delhi: CBSE.
3. Chikara, M.S. and Sarma, S. (1985). Teaching Science. Ludhiana: Prakash Brothers.
4. Das, R.C. (1985). *Science teaching in Schools.* New Delhi: Sterling Publications Private Ltd.
5. Krathwohl, D.R., Bloom B.S. and Maria B.B. (1964) *Taxonomy of Educational Objectives, Handbook II, Affective Domain,* New York: David McKay.
6. Lindfors, J. (1984). *How do children learn or how 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 Integrated Sciences.* New Delhi: Pearson.
9. Steffe, L. and Gale, J. (Eds.) 1995). *Constructivism in Education*, New Jersey: Lawrence Erlbaum Associates Inc.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	3	2	1	1	3	2	1	2	2	1	2
CO2	3	3	3	--	2	2	---	2	1	--	---	1	--	---
CO3	--	--	3	3	3	2	---	3	1	2	---	1	2	---
CO4	---	3	---	2	2	1	2	---	2	--	1	2	--	1
CO5	--	3	2	1	2	1	---	--	3	2		3	2	
CO6	1	---	1	---	3	---	3	2	2	3	3	2	3	3

Course Title/Code	**Pedagogy of Physical Sciences (EDH128-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	Understand the Bloom's Taxonomy of Instructional Objectives and design learning objectives for content related to Physical Sciences.	Skill Development
CO2	Understand the micro teaching skills and prepare the micro lesson plans for each skill.	Skill Development
CO3	Learn about the Herbartian lesson plan and prepare the lesson plans for teaching Physical Science.	Employability
CO4	Apply different pedagogical approaches to design lesson plans.	Entrepreneurship
CO5	Learn about the test construction and construct a test paper for students' assessment.	Entrepreneurship & Skill Development
Prerequisites (if any)	Basic knowledge of Physical Science	

Pedagogy of Physical Sciences Practical (EDH 128)

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.

CO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO 10	PO 11	PSO1	PSO	PSO3
CO1	2	2	3	2	2	2	3	3	2	3	3	2	1	2
CO2	3	3	3	2	3	3	3	3	2	3	3	1	--	---
CO3	3	2	2	2	3	3	3	3	2	2	2	1	2	---
CO4	2	2	3	2	2	2	2	3	2	3	2	2	--	1
CO5	2	2	3	2	2	2	2	3	1	3	1	3	2	
CO6												2	3	3

Course Title/Code	**Basic Research and Statistics (EPC) (EDW254)**	
Course Type	**Core**	
Course Nature	**Workshop**	
L-T-P Structure	**(0-0-3)**	
Credits	**2**	
Course Objective	**To develop an understanding of the research process and acquire competencies for conducting a research.**	
CO1	**To describe the concept and relevance of research in education and special education**	**Skill Development**
CO2	**To develop tools for conducting research**	**Employability**
CO3	**To identify the problem and formulate hypothesis**	**Employability**
CO4	**To develop skills for data analysis**	**Skill Development**

Research in Education and special Education

SECTION -A INTRODUCTION TO RESEARCH

Scientific Method

Research: Concept and Definition Application of Scientific Method in Research Purpose of Research

SECTION B

TOOLS AND TYPES OF RESEARCH

Types of Research

- Basic/Fundamental

- Applied

- Action

Tools of Research: Tests, Questionnaire, Checklist and Rating Scale. Action Research in Teaching Learning Environment

Professional Competencies for Research

SECTION C

PROCESS OF RESEARCH

- Selection of Problem

- Formulation of Hypothesis

- Collection of Data

- Analysis of Data & Conclusion

SECTION D

MEASUREMENT AND ANALYSIS OF DATA

Scale for measurement: Nominal, Ordinal, Interval and Ratio

Organization of data: Array, Grouped distribution

Measures of central tendency and Dispersion: Mean, Median and Mode, Standard deviation and Quartile Deviation

Correlation : Product Moment and Rank Order Correlation

Graphic Represenation of data

Reference Books and Readings

1. **Best, J. W., & Kahn, J. V. (1996). Research in Education Prentice-Hall of India New Delhi.**
2. **Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences. Academic Press, New York.**
3. **Dooley, D. (1997). Social Research Methods. Prentice-Hall of India, New Delhi.**
4. **Greene, S., & Hogan, D. (2005). Researching children's experience. Sage Publication: London.**
5. **Grewal, P.S. (1990). Methods of Statistical Analysis. Sterling Publishers, New Delhi.**
6. **Guptha, S. (2003). Research Methodology and Statistical Techniques. Deep & Deep Publishing, New Delhi.**
7. **Koul, L. (1996). Methodology of Educational Research. Vikas Publishing House, New Delhi.**
8. **Potti, L.R. (2004). Research Methodology. Yamuna Publications, Thiruvananathapuram.**

Activities

1. **Develop a teacher made test for a given subject matter**
2. **Develop a questionnaire/checklist**
3. **Develop an outline for conducting action research**
4. **Any othe**

*Field activity

CO	Course Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	To describe the concept and relevance of research in education and special education	---	---	1	2	1	2	3	3	3	2	2	3	3	1	3	3	---
CO2	To develop tools for conducting research	---	---	1	2	1	2	3	3	3	2	2	3	3	1	3	3	---
CO3	To identify the problem and formulate hypothesis	1	1	1	3	1	2	3	3	3	2	2	3	3	1	3	3	---
CO4	To develop skills for data analysis	1	1	1	2	1	2	3	3	3	2	2	3	3	1	3	3	---

Course Title/Code	**Reading and Reflecting on Texts (EDW104)**	
Course Type	Core	
Course Nature	Workshop	
L-T-P Structure	0-0-3	
Credits	1.5	
Course Objective	Comprehend and think reflectively on spoken or written texts	
Course Outcomes (COs)		Mapping
CO1	Explain the concept and importance of Reflection through reading especially in the context of the teaching profession.	Employability
CO2	Read and respond to a variety of texts in different ways as reader and writer.	Skill Development
CO3	Engage in Interactive groups discussions with respect to reading and reflection activities.	Skill Development
CO4	Explore different ways of developing reflective and critical thinking in personal and professional spaces.	Entrepreneurship

SECTION A

Reading a wide variety of texts such as Descriptive, Narrative, Literary, Historical work, Policy documents with special focus on NEP 2020, Ethnographies. Process of critical and reflective reading. Importance of reflection for teachers

SECTION B

Concept and distinguishing features of reflective writing, writing with a sense of purpose
Writing Skills for Teachers: reports, minutes, writing about research; Steps in writing a research proposal; writing annotations, references and bibliography; Difference between references and bibliography; writing journals and reflective diaries, Difference between reflective diary and journa

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 comprehensionexercises. 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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	3	-	1	-	2	-	-	3	-	-	3
CO2	2	3	-	2	-	1	-	2	-	-	2	-	-	2
CO3	2	2	-	2	-	1	-	2	-	-	2	-	-	2
CO4	3	3	-	2	-	1	-	3	-	-	3	-	-	3

Course Title/Code	**Phase-II Field Engagement (EDO258)**	
Course Type	Core	
Course Nature	Outcome	
L-T-P Structure	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)		Mapping
CO1	Recognise the contribution of psychological, philosophical and socio - economic factors in optimizing teaching and learning	Skill Development
CO2	Articulate experiences of observing the teaching of mentor teacher/ teachers and peers	Skill Development
CO3	Present the observations of internship period in a systematic and structured manner in the form of individual and/or Group Tasks	Skill Development
CO4	Provide constructive feedback to the peers and accept feedback from them with respect to their teaching	Skill Development
CO5	Appreciate importance of school engagement program as a integral component of teacher training programme	Skill Development
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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	3	-	-	-	-	3	3	3	3
CO2	3	-	-	-	-	3	-	-	-	-	3	3	3	3
CO3	3	-	-	-	-	3	-	-	-	-	3	3	3	3
CO4	3	3	-	-	-	3	3	-	-	-	3	-	-	3
CO4	3	3	-	-	-	3	-	-	-	-	3	-	3	3
CO5	3	3	-	3	-	-	-	-	-	-	3	-	3	3

SEMESTER - 7								
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH315B-T	Spectroscopy and Natural Products	APPLIED SCIENCE	CORE	3	1	0	6	5
CHH315B-P	Spectroscopy and Natural Products Lab			0	0	2		
PHH331-T	Relativity and Quantum Mechanics	APPLIED SCIENCE	CORE	3	1	0	6	5
PHH331-P	Relativity and Quantum Mechanics Lab			0	0	2		
MAH401B	Linear Algebra	APPLIED SCIENCE	ELECTIVE CORE	3	1	0	4	4
LWS121	General Laws for Educators	LAW/NPTEL	Elective	2	0	0	2	2
LWS125	Women and Child Laws							
CDO432	Professional Competency Education			2	0	0	2	2
EDS236B	School Leadership and Management	EDU	ELECTIVE CORE	1	0	2	3	2
EDS207B	Peace and Value Education							
EDS220B	Human Rights in Education							
EDS221B	Guidance and Counselling							
EDS223B	Environmental Education							
MOOC-210-EDS-401	Educational Leadership							
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			**14**	**3**	**6**	**23**	**20**

Course Title/Code	**Spectroscopy and Natural Products (CHH315B-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
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)		Mapping
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	Employability
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.	Skill Development
CO3	Describe the chemistry of biomolecules like carbohydrates, lipids, proteins and amino acids	Skill Development
CO4	Use fundamental polymer chemistry to explain and predict the synthesis of polymers as well as the resultant structure and properties.	Skill Development
CO5	To understand the chemistry of drugs with respect to their pharmacological activity. To understand the fundamentals of Dyes.	Skill Development
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.	Skill Development
Prerequisites	NA	

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.
(10 L)

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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	3	3	3	-	-	-	-	2	1	-	2	1	-
CO2	-	3	3	3	-	-	-	-	2	1	-	2	1	-
CO3	-	3	3	3	-	-	-	-	2	1	-	2	1	-
CO4	-	3	3	3	-	-	-	-	2	1	-	2	1	-
CO5	-	3	3	3	-	-	-	-	2	1	-	2	1	-
CO6	-	3	3	3	-	-	-	-	2	1	-	2	1	-

Course Title/Code	Spectroscopy, Natural Products and Heterocycles (CHH315B-P)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	Study and understand the working of instrumentation techniques like UV, FTIR and NMR	Skill Development
CO2	Hands-on-training on the synthesis and structure elucidation of natural products	Skill Development
CO3	Synthesis of drug and macromolecules	Skill Development
CO4	Experimental understanding of heterocyclic compounds with structure elucidation	Skill Development
Prerequisites	NA	

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

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	2	3	3	-	-	-	-	3	1	-	2	1	-
CO2	-	2	3	3	-	-	-	-	3	1	-	2	1	-
CO3	-	2	3	3	-	-	-	-	3	1	-	2	1	-
CO4	-	2	3	3	-	-	-	-	3	1	-	2	1	-

Course Title/Code	Relativity and Quantum Mechanics (PHH331-T)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To enable students to understand the essentials of relativity and quantum mechanics, the two theories of 20th century.	
Course Outcomes (COs)		Mapping
CO1	Discuss and interpret the experiments that reveal the relativistic properties of matter.	Skill Development
CO2	Discuss and interpret the experiments that reveal the wave properties and particle properties of matter.	Skill Development
CO3	Understand the central concepts and principles in quantum mechanics, such as the Schrödinger wave equation, the wave function and their statistical interpretation.	Skill Development
CO4	Understand the basic building blocks of quantum behavior by correlating the classical statistical mechanics and various distributions.	Employability
CO5	Demonstrate an ability to conduct investigations of practical/technical issues consistent with their level of knowledge.	Employability
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:

(i) Mechanics, by Prof. D.S. Mathur, P.S. Hemne, S. Chand and Company Ltd.
(ii) Perspectives of Modern Physics, Arthur Beiser.
(iii) Introduction to Quantum Mechanics,Pauling and Wilson.
(iv) Statistical Mechanics, K Huang.
(v) David Griffiths, Introduction to Quantum Physics.
(vi) Quantum Physics by Ishwar Singh Tyagi (Pearson Publication)

Reference books:

(i) Halliday and Resnick, Physics
(ii) Introduction to Quantum Mechanics, 2nd Ed. by David J. Griffiths, Cambridge India, 2016.
(iii) Quantum Mechanics: Concepts and Applications, 2nd Ed. by Nouredine Zettili, Wiley India, 2016.
(iv) Quantum Mechanics for Engineers by J.J. Sakurai

MANAV RACHNA
Vidyanatariksha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

CO PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	3	3	3				2	3		1	3	3	1
CO2	2	3	3	3				2	3		1	3	3	1
CO3	2	3	3	3				2	3		1	3	3	1
CO4	2	3	3	3				2	3		1	3	3	1
CO5	2	3	3	3				2	3		1	3	3	1

Course Title/Code	**Relativity and Quantum Mechanics Lab (PHH331-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
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)		Mapping
CO1	Demonstrate an ability to conduct investigations of practical/technical issues.	Employability
Prerequisites (if any)	Mathematical knowledge and experimental understanding of electronics components and their behaviour is required	

The list of experiments is:

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

CO PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	3	3	3	-	2	-	3	3	2	1	3	1	2

Course Title/Code	LINEAR ALGEBRA (MAH401B)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To enable the students to understand and apply the concepts of linear algebra in solving appropriate problems.	
Course Outcomes (COs)		**Mapping**
CO1	Interpret vector space and its properties along with examples and solve the related problems	**Skill Development**
CO2	Distinguish between nonlinear and linear transformations on vector spaces and their properties	**Skill Development**
CO3	Apply the concept of Eigen values, Eigen vectors and Eigen spaces in real life application	**Skill Development**

CO4	Implement the concept of inner product space and its properties along with examples and solve the related problems	**Skill Development**
Prerequisites (if any)	NA	

SECTION A

Rank of a matrix, Elementary row / column operations, Invariance of rank under elementary operations, Inverse of a non-singular matrix by elementary operations. 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
Vector spaces, Subspaces, Linear Combinations, Linear span, Linear dependence and Linear independence of vectors, Basis and Dimension,

SECTION B

Finite dimensional vector space – some properties. Quotient spaces, Homomorphisms and Isomorphisms of vector spaces, Direct sums. Matrices of Linear maps, Change of basis and the effect of associated matrices, Kernel and Image of a linear transformation, Rank and Nullity theorems.

SECTION C

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

SECTION D

Inner product spaces, Euclidean vector spaces, Distance, Length, Properties, Cauchy Schwarz inequality, Orthogonal and orthonormal vectors, Gram Schmidt Orthogonalization Process, Orthogonal complement.

References :

1. Theory and Problems of Linear Algebra, Saymour Lipschitz, Schaum Outline Series.
2. Introduction to Linear Algebra by Stewart, Van Nostrand Co. Ltd.
3. Modern Algebra, Vol.II, by Narayanan and Manicavachagam Pillay, S. Vishwanathan and Co.
4. Brief Survey of Modern Algebra, Brikhoff and Maclane, IBH
5. Linear Algebra by Serge Lang, Addison Wesley Publishing company Inc.
6. Linear Algebra by Larry Smith, Spinger Verlag.
7. Elementary Linear Algebra with Applications, Keith Nicholson, PWS – Kent Publishing Company
8. Linear Algebra, Surjith Sinth, Vikas Publishing House Pvt. Ltd.
9. Modern Algebra by Vasishta, Krishna Prakashan Media Ltd.
10. Linear algebra – a geometric approach by Kumaresan. S

Course Outcomes	Program Outcomes													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1:		2	3	----	3	2	3	2	----	----	----	----	----	1
CO2:		2	3	----	2	2	2	1	----	----	----	----	----	2
CO3:		1	2	----	2	2	1	3	----	----	----	----	----	1
CO4:		1	1	----	2	2	2	2	----	----	----	----	----	1
CO5:		2	3	----	3	2	3	2	----	----	----	----	----	1

Course Title/Code	**Biochemistry, Plant tissue culture and Biotechnology (EDH410-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-PStructure	(3-0-0)	
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)		Mapping
CO1	understand the structure and functions of biological macromolecules	Skill Development
CO2	get acquainted with the techniques, branches and applications of plant tissue culture	Skill Development
CO3	get acquainted with the tools and techniques of biotechnology, the processes involving gene manipulation and their applications	Skill Development/Employability
Prerequisites(if any)	NA	

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 ofenzyme 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

a) Brief history, cellular totipotency, culture media and techniques
b) Brief account of anther/ pollen culture, endosperm, embryo and protoplast culture.
c) Applications of tissue culture.

SECTION C

BIOTECHNOLOGY

a) Tools and techniques, cloning vectors,

b) Brief account of genomics and c-DNA library,

c) Interferons, transposable elements

d) PCR, Bio-Informatics.

SECTION D

a) Applications of Biotechnology – functional definition and applications.

a.) Brief account of DNA finger printing

b.) Agrobacterium – mediated gene transfer

c.) 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.
7. Old, R.W. and Primrose, S.B. (1989). *Principles of Gene Manipulation*. Oxford: Blackwell Scientific Publication

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	----	2	----	----	----	----	3	3	1	1	3	1	1
CO2	1	----	2	----	----	----	----	3	3	2	2	3	2	2
CO3	1	----	2	----	----	----	----	3	3	2	2	3	2	2

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

Biochemistry, Plant tissue culture and Biotechnology Practical (EDH410)

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.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	-	-	-	-	2	3	1	1	3	--	3
CO2	1	1	2	-	-	-	-	2	2	1	1	3	-	3
CO3	1	1	2	--	-	-	-	2	2	1	1	3	-	3
CO4	1	2	3	-	-	-	-	2	2	1	1	3	-	3

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

c) 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

a) Geological time and its significance in evolution

b) 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

c) 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).

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO2	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO3	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO4	2	1	2	--	3	----	--	2	1	1	1	3	3	3
CO5	2	1	2	---	3	----	--	2	1	1	1	3	3	3
CO6	2	1	2	---	3	----	--	2	1	1	1	3	3	3

Course Title/Code	**Genetics and Paleontology Lab EDH411-P**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To enable the students to identify and study drosophila and various fossils	
Course Outcomes (COs)		Mapping
CO1	To identify and study drosophila	Skill Development
CO2	To identify blood groups and Rh factor in man	Employability
CO3	To study various fossils models and living fossils	Employability
Prerequisites (if any)	NA	

Practicals (EDH411-P)

1. a) Fruit flies – Collection, handling, rearing and maintenance of culture.

a) Identification of sexes of Drosophila.
b) Study of the life cycle of Drosophila.

2. Sorting out and study of mutant flies of Drosophila with reference to their various contrasting characters in comparison with normal flies- vestigial wings, ebonybody, curled wing, sepia eye, white eye and bar eye.

3. Study of Barr body in human buccal epithelial cells.

4. Identification of blood groups (ABO) and Rh factor in man.
5. Study of various types of beaks of local birds.
6. Study of five animals for mimicry.
7. Study of fossil models of Trilobites and fishes.
8. Study of teeth and skulls of horse, elephant and man.
9. Study of vestigial organs, models of dinosaurs, living fossils.

Field visit to Natural Science Centre, Delhi.

References Books and Readings:

2. Genetics by Stricksberger – (MacMillan).
3. Principles of Genetics by Sinnott, Dunn and Dobzhansky – (McGraw Hill).
4. Genetics by E. Altenberg – (Holt, Rinehart & Winston, New York).
5. Principles of Genetics by Gardner – (John Willey).
6. Principles of Genetics by Irwin H. Herskowitz – (Little Brown &Co.,Boston).

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO2	2	1	2	----	3	----	----	2	1	1	1	3	3	3
CO3	2	1	2	----	3	----	----	2	1	1	1	3	3	3

Course Title/Code	General Laws for Educators (LWS121)	
Course Type	Elective	
Course Nature	Soft	
L-T-P Structure	2-0-0	
Credits	2	
Course Objective	The objective of this paper is to orient the students with laws relating toeducation, women, child and industry with reference to acts.	
Course Outcomes (COs)		Mapping
CO1	Understand the historical background and the salient features of the Constitution of India	Employability
CO2	Explain and summarize the major commercial laws in India	Entrepreneurship
CO3	Identify and explain the laws protecting rights of Children in India	Skill Development
CO4	Identify and explain the laws protecting rights of Women in India	Skill Development
Prerequisites (if any)	NA	

SECTION A

LAWS RELATING TO EDUCATION

An Overview of right to education, education initiatives by the Government.Mid-day Meal – Schemes by the Government.

SECTION B

LAWS RELATING TO WOMEN

Sexual Harassment including workplaces.

An Overview of Domestic Violence laws in India with reference to domestic Violence Act.

SECTION C

LAWS RELATING TO CHILD

Conceptual understanding of the Juvenile Justice system with reference to the Juvenile JusticeAct.

Protection of Children from Sexual Offences Act.(POCSO)

SECTION D

INDUSTRIAL LAWS

1. Maternity Benefit laws with reference to Maternity Benefit Act
2. Overview of the provisions of the payment of gratuity Act.
1. Overview of the provisions of Minimum wages Act.

Reference Books and Readings

1. Taxmann, Labour Laws, Taxmann Publications Ltd, 2016
2. Manjula Batra , Women and law (Law relating to Children)in India, Allahabad Law Agency,Second Edition, 2015.
3. Donald J. Shoemaker & Timothy W. Wolfe , Contemporary World Issues , Juvenile Justice,3rd Edition, Oxford paperback.2014.
4. S.C Shrivastava ,Industrial Relations & Labour laws , Sixth Revised Edition, 2015
5. Taxmann, Payment of Gratituty Act, 1972.
6. Dr S.K Chatterjee, Offences against children , Central Law Publications, Second Edn, 2016
7. Dr. S.C Tripathi and Vibha Arora, Law relating to women and children, Central LawPublications, Sixth Edn, 2015
8. Ved Kumari, Juvenile Justice System in India Oxford India Paperbacks, Second Edn, 2010.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	1	1	1	1	2	2	1
CO2	3	2	1	1	1	1	1	1	2	2	1
CO3	3	2	1	1	1	1	1	1	2	2	1
CO4	3	2	1	1	1	1	1	1	2	2	1

Course Title/ Code	**Women and Child Laws (LWS125)**
Course Type:	Elective
Course Nature:	Soft
L-T-P-Structure	2-0-0
Credits	2
Objectives	The objective of this paper is to orient the students with laws relating to protection of women and children with reference to acts.

Course Outcomes (COs)		Mapping (Employment, Skill Development/Entrepreneurship)
CO1	To make students aware of basic human rights of women	Employability
CO2	To make students aware of the laws for protection of women against exploitation	Employability
CO3	To make students aware of rights of children against exploitation and constitutional provisions	Skill development

UNIT-A Laws relating to Protection of Women

1. An overview of Human Rights with respect to Constitution of India.
2. Rights relating to protection of women with special reference to right to property

UNIT B Laws relating to Women

1 Laws related to rights of women with respect to marriage, divorce and maintenance.
2 An Overview of Violence against women and rights for protection against sexual exploitation, rape and other offences

UNIT C Laws relating to Child

a. Under Indian Penal Code (with relevant sections from supporting statutes)

i. General Exemptions
ii. Offences against child
iii. Cyber-crimes against children

b. Sexual offences against children under POCSO

UNIT D Child and Criminal Justice Administration

a. Judicial activism towards protection of children
b. Special provisions under Juvenile Justice Act 2015

Relevant Statutes:

1. The Constitution of India, 1950
2. Child Rights Convention, 1989
3. Indian Contract Act, 1872
4. Hindu marriage Act, 1955
5. Hindu Adoptions and Maintenance Act, 1956
6. Code of Criminal Procedure,

7.Indian Penal Code, 1860
8.The Hindu Minority and Guardianship Act, 1956
9.Guardianship and Wards Act, 1869
10.Juvenile Justice (Care and Protection) Act, 2015
11.Child Labour (Prohibition and Regulations) Act, 1986

Text Books:

- Asha Bajpai, Child Rights in India: Law, Policy and Practice, 2003 (3rd Edn.) (Oxford University Press)
- Ved Kumari, The Juvenile Justice (Care and Protection of Children) Act 2015 – Critical Analysis, 2017 (Universal Law Publications)
- Mamta Rao, Law Relating to Women and Children, 2012 (3rd Edn.) (Eastern Book Publications)

- Dr S.K Chatterjee, *Offences against children*, Central Law Publications, Second Edn, 2016
- Dr. S.C Tripathi and Vibha Arora, *Law relating to women and children*, Central Law Publications, Sixth Edn, 2015
- Ved Kumari, *Juvenile Justice System in India* Oxford India Paperbacks, Second Edn, 2010.

Reference Books:

- Anjani Kant, The Law relating to Women and Children, 2003 (Central Law Publications)
- Child Labour: A textbook for University Students, International Labour Organisation, 2004.
- Taxmann, Labour Laws, Taxmann Publications Ltd, 2016
- Manjula Batra , Women and law (Law relating to Children)in India, Allahabad Law Agency, Second Edition, 2015.
- Donald J. Shoemaker & Timothy W. Wolfe , Contemporary World Issues , Juvenile Justice, 3rd Edition, Oxford paperback.2014.
- S.C Shrivastava, Industrial Relations & Labour laws , Sixth Revised Edition, 2015.
- Taxmann, Payment of Gratituty Act, 1972.

Co-Po Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	1	1	1	1	2	2	1
CO2	3	2	1	1	1	1	1	1	2	2	1
CO3	3	2	1	1	1	1	1	1	2	2	1

Course Title/Code	Professional Competency Education (CDO432)	
Course Type/ Semester	Core	
Course Nature	Outcome	
L-P-O Structure	0-0-2	
Credits	1	
Course Objective	To familiarize students with the basic knowledge of Quantitative Aptitude & Logical Reasoning	
Course Outcomes (COs)		**Mapping**
CO1	Develop proficiency in resume building and drafting effective cover letters	**Skill Development**
CO2	Enhance their ability to write, read, comprehend and communicate effectively to increase the productivity of business.	**Skill Development**
CO3	Students will be able to learn grammatically correct formal writing skills.	**Skill Development**
Prerequisites (if any)	**N.A**	

Section A

Unit I: Advanced Vocabulary, Synonym & Antonym, One Word Substitution, Ordering of Words

Section B

Unit II: Sentence Construction & Syntax, Sentence Improvement, Spotting Errors, Ordering of Sentences, Change of Voice/ Direct & Indirect speech, Completing Statements/Sentences

Section C

Unit III: Managing Interviews – I, Developing the employability mindset, Preparing for Self –Introduction, Researching the employer, Portfolio Management, Types of Interviews & Interview etiquette

Section D

Unit IV: Managing Interviews – II, Professional Attire, Dressing, Body Language in interviews, Resume Check, Answering Difficult Questions in an Interview, Mock Interviews

CO PO Mapping

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO2	-	3	-	-	-	-	-	-	-	2	-	1	-	-	-
CO3	-	2	-	-	-	-	-	-	-	2	-	1	-	-	-

Course Title/Code	**School Leadership and Management (EDH236B)**	
Course Type	Elective Core	
Course Nature	Soft	
L-T-P Structure	1-0-2	
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)		Mapping
CO1	understand key leadership theories and ideas, from inside and outside education, and apply these to thinking about their own practice	Employability Development
CO2	draw on evidence from research and practice to develop knowledge with an understanding of what is known about effective leadership	Employability & Entrepreneurship Development
CO3	relate these to their own leadership context in planning actions	Skill Development
CO4	undertake practice-based tasks enabling self-evaluation of their leadership in action.	Skill Development &Employability Development
CO5	develop their reflective practice skills to help them to evaluate and	Entrepreneurship & Skill

	improve their own leadership practice	Development
CO6	learn colLaboratively, supported by a mentor, to share insights, and develop knowledge and skills.	Skill Development &Employability Development
Prerequisites (if any)		

Syllabus

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	3	--	3	-	-	3	**3**		**3**
CO2	2	-	-	-	-	3	--	3	-	-	3	**3**		**3**
CO3	3	-	-	-	-	3	--	3	-	-	3	**3**		**3**
CO4	3	-	3	-	-	3	--	3	-	-	3	**3**		**3**
CO5	3	-	3	-	-	3	--	3	2	-	3	**3**		**3**
CO6	3	-	3	-	-	3	--	3	-	-	3	**3**		**3**

Course Title/Code	**Peace and Value Education (EDS207B)**	
Course Type	Elective	
Course Nature	Soft	
L-T-P Structure	1-0-2	
Credits	2	
Course Objective	Student Readiness for value education	
Course Outcomes (COs)		Mapping
CO1	To understand the nature of values and importance of value education in present day Indian society	Employability
CO2	To get oriented with the need and role of yoga and meditation for innerharmony	Skill Development
CO3	To understand impact of social processes on moral development	Entrepreneurship
CO4	To get oriented with various strategies of value orientation	Skill Development
Prerequisites (if any)	NA	

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 Pub.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	---	2	2	2	-----	1	2	2	2	2	2	2
CO2	----	3	---	2	3	2	---	1	2	2	2	2	2	2
CO3	1	2	1	1	1	2	2	1	2	2	2	2	2	2
CO4	2	2	3	2	3	2	1	1	2	2	2	2	2	2
CO5	2	2	2	1	1	2	1	1	2		2	2		2

Course Title/Code	**Human Rights in Education (EDS2220B)**	
Course Type	Elective Core	
Course Nature	Soft	
L-T-P Structure	1-0-2	
Credits	2	
Course Objective	Student Readiness for Human Rights Values	
Course Outcomes (COs)		Mapping
CO1	The students will apply the knowledge of guidance and counselling in real life situations	Skill Development
CO2	The student will imbibe and demonstrate qualities of an effective counsellor	Employability
CO3	The student will demonstrate various approaches of guidance and counselling	Skill Development
CO4	The student will effectively use tools for testing and evaluating different techniques for assessment	Entrepreneurship
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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	------	2	2	2	-----	1	2	2	2	1	2	1
CO2	----	3	------	2	3	2	------	1	2	2	2	-	-	1
CO3	1	2	1	1	1	2	2	1	2	2	2	-	2	-
CO4	2	2	3	2	3	2	1	1	2	2	2	-	-	-

Course Title/Code	**Guidance and Counselling (EDS221B)**	
Course Type	Elective	
Course Nature	Soft	
L-T-P-Structure	1-0-2	
Credits	2	
Course Objective	To enable a learner to apply the knowledge of guidance and counselling in real life situations	
Course Outcomes (COs)		Mapping
CO1	The students will apply the knowledge of guidance and counselling in real life situations	Employability
CO2	The student will imbibe and demonstrate qualities of an effective counsellor	Skill Development
CO3	The student will demonstrate various approaches of guidance and counselling	Entrepreneurship
CO4	The student will effectively use tools for testing and evaluating different techniques for assessment	Employability
Prerequisites (if any)	NA	

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

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	2	2	2	2	2	2	2	2
CO2	3	3	2	-	-	-	3	3	1	2	2	1	2	2
CO3	2	2	2	-	-	-	2	2	2	1	2	2	1	2
CO4	1	1	1	-	-	-	2	3	1	1	2	1	1	2

Course Title/Code	**Environmental Education (EDS223B)**	
Course Type	Elective Core	
Course Nature	Soft	
L-T-P Structure	1-0-2	
Credits	2	
Course Objective	To develop student Awareness Regarding Environment	
Course Outcomes (COs)		Mapping
CO1	To understand about the concept of environmental education	Skill Development
CO2	To develop sense of awareness about the environmental pollution, and possible hazards and its causes and remedies.	Employability
CO3	To build up a sense of responsibility towards conservation of environment, bio-diversity and sustainable development.	Skill 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.	Entrepreneurship
Prerequisites (if any)	NA	

SECTION A

Multidisciplinary nature of environmental studies

Definition, scope and importance. Need for public awareness.

SECTION B

Natural Resources: Renewable and non-renewable resources

Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies.Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects ofextracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture andovergrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, 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 anecosystem.
- Producers, consumers anddecomposers.

- Energy flow in theecosystem.
- Ecological succession.
- Food chains, food webs and ecologicalpyramids.
- Introduction, types, characteristic features, structure and function ofthe following ecosystem: -

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. 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-diversitynation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlifeconflicts.
- Endangered and endemic species ofIndia
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Reference Books and Readings:

a) Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd.Bikaner.

b) BharuchaErach, The Biodiversity of India, Mapin 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 Encyclopedia, Jaico Publ. House, Mumabai, 1196p

f) De A.K., *Environmental Chemistry*, Wiley EasternLtd.

g) *Down to Earth*, Centre for Science and Environment(R)

Environment and Education Practical (EDS223)

- 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)

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	2	2	2	----	----	2	2	1	3
CO2	2	2	2	3	2	2	1	2	----	----	2	2	1	3
CO3	2	2	2	1	3	2	2	1	----	----	2	2	2	1
CO4	1	1	2	2	2	2	1	2	----	----	2	2	2	3

Course Title/Code	**Educational Leadership (MOOC-21O-EDS-401)**	
Course Type	Elective Core	
Course Nature	NTCC	
L-T-P Structure	1-0-2	
Credits	2	
Course Objective	Student Readiness in leadership skills	
Course Outcomes (COs)		Mapping
CO1	understand key leadership theories and ideas, from inside and outsideeducation, and apply these to thinking about their own practice	Employability
CO2	draw on evidence from research and practice to develop knowledge with an understanding of what is known about effective leadership	Skill Development
CO3	relate these to their own leadership context in planning actions	Entrepreneurship
CO4	undertake practice-based tasks enabling self-evaluation of their leadership inaction	Skill Development
Prerequisites (if any)	NA	

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 Press
2) Educational Leadership: Context, Strategy and ColLaboration; Author- Margaret Preedy, Nigel Bennett and Christine Wise, SAGE publication

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	3	--	3	-	-	-	3	--	3
CO2	2	2	-	-	-	3	--	3	-	-	-	3	--	3
CO3	3	3	-	-	-	3	--	3	-	-	-	3	--	3
CO4	3	3	3	-	-	3	--	3	-	-	-	3	--	3

SEMESTER - 8								
SUBJECT CODES	**SUBJECT NAME**	****OFFERING DEPARTMENT**	**COURSE TYPE (Core/Elective / University Compulsory)**	**L**	**T**	**P**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
EDN403	Reflective Journal	EDU	CORE					2
EDO404B	School Internship Pedagogy-I	EDU	CORE					12
EDO405B	School Internship Pedagogy-II	EDU	CORE					12
EDO415	Action Research	EDU	CORE					2
EDO416	Case Study	EDU	CORE					2
	TOTAL (LTP-O/CONTACT HOURS/CREDITS)			**0**	**0**	**0**	**0**	**30**

Course Title/Code	Reflective Journal EDN403	
Course Type	Core	
Course Nature	NTCC	
L-T-P Structure	0-0-0	
Credits	2	
Course Objective	The course aims at developing skill related to Reflective Journal	
Course Outcomes (COs)		Mapping
CO1	Introspect one's strength and weakness during classroom teaching	Employability
CO2	Develop a plan of action to channelize one's strength and improve upon the area of concerns	Skill Development
CO3	Envision himself/ herself as an effective prospective teacher	Entrepreneurship
CO4	Imbibe the values essential for becoming the reflective and humane practitioner	Skill development
Prerequisites (if any)		

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO 1	3	2	2					2			3			3
CO 2	3	2	2					2			3			3
CO 3	3	2	2					2			3			3
CO 4	3	2	2					2			3			3

Course Title/Code	School Internship Pedagogy-I EDO404B	
Course Type	Core	
Course Nature	Outcome	
L-T-P Structure	0-0-0	
Credits	12	
Course Objective	The course aims at developing skill related to Pedagogy 1	
Course Outcomes (COs)		Mapping
CO1	Prepare mega lesson plan incorporating essential maxims and principles of teaching	Employability
CO2	Deliver the lesson plan in the classroom demonstrating desired pedagogical skills and competencies	Skill Development
CO3	Prepare and utilize the appropriate TLM to facilitate effective teaching	Entrepreneurship
CO4	Make appropriate use of tools and techniques for effective evaluation of students learning	Skill development
CO5	Make appropriate use of tools and techniques for effective evaluation of students learning	Skill development
CO6	Utilize peer feedback as a tool to enhance the teaching effectiveness	Skill development
Prerequisites (if any)		

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO 1	2	2		2	3									2
CO 2	2	2		1	3	3								2
CO 3	2	2			3	2								2
CO 4	2	2			3	2								2
CO 5	2	2	3				3							2
CO 6	2	2						3			2			2

Course Title/Code	**School Internship Pedagogy-II (EDO405B)**	
Course Type	**Core**	
Course Nature	**Outcome**	
L-T-P Structure	**0-0-0**	
Credits	**12**	
Course Objective	**The course aims at developing skill related to Pedagogy 2**	
Course Outcomes (COs)		**Mapping**
CO1	Prepare mega lesson plan incorporating essential maxims and principles of teaching	**Employability**
CO2	Deliver the lesson plan in the classroom demonstrating desired pedagogical skills and competencies	**Skill Development**
CO3	Prepare and utilize the appropriate TLM to facilitate effective teaching	**Entrepreneurship**
CO4	Demonstrate effective use of ICT in transacting the curriculum	**Skill development**
CO5	Make appropriate use of tools and techniques for effective evaluation of students learning	**Skill development**
CO6	Utilize peer feedback as a tool to enhance the teaching effectiveness	**Skill development**
Prerequisites (if any)		

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2		2	3									2
CO2	2	2		1	3	3								2
CO3	2	2			3	2								2
CO4	2	2			3	2								2
CO5	2	2	3				3							2
CO6	2	2						3			2			2

Course Title/Code	Action Research EDO415	
Course Type	Core	
Course Nature	Outcome	
L-T-P Structure	0-0-0	
Credits	2	
Course Objective	The course aims at developing skill related to Action Research	
Course Outcomes (COs)		Mapping
CO1	Identity problems faced during the real classroom situation	Skill development
CO2	Offer tentative solutions for the identified problems	Skill Development
CO3	Develop a research based systematic plan of action to solve the problem	Entrepreneurship
CO4	Execute and evaluate the effectiveness of the solution	Skill development
Prerequisites (if any)		

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2					1	3			3		
CO2	2	2	2					1	3			3		
CO3	2	2	2					1	3			3		
CO4	2	2	2				1	1	3			3		

Course Title/Code	**Case Study (EDO416)**	
Course Type	**Core**	
Course Nature	**Outcome**	
L-T-P Structure	**0-0-0**	
Credits	**2**	
Course Objective	**The course aims at developing skill related to Case Study**	
Course Outcomes (COs)		**Mapping**
CO1	Execute and evaluate the effectiveness of the solution	**Employability**
CO2	Collect relevant information about the case identified	**Skill Development**
CO3	Explore the probable causes for the present conditions of the identified case	**Entrepreneurship**
CO4	Propose a plan of action for the improvement/ restoration of the subject	**Skill development**
Prerequisites (if any)		

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3				1	1	3	1		3		
CO2	3	1	3				1	1	3	1		3		
CO3	3	1	3				1	1	3	1		3		
CO4	3	1	3				1	1	3	1		3		

0

CONSOLIDATED CO-PO MAPPING																
Course Title/Course Code	**CO**	**Course Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
Atomic Structure & Bonding (CHH135-T)	**CO 1**	Students Will be able to skilled in critical thinking and reasoning for different phenomenon related to structure of atom.	1	1	----	3	----	----	----	----	2	1	----	3	1	----
	CO 2	Students Will be able to use various periodic trends having a firm foundation in the fundamentals and application of current chemical and scientific theories.	1	1	----	3	----	----	----	----	2	1	----	3	1	----
	CO 3	Students will be Able to develop confidence for self-education and long learning w.r.t. properties of elements	1	1	----	3	----	----	----	----	2	1	----	3	1	----
	CO 4	Students will be Able to evaluate and solve chemical problems involving the features of chemical bonding.	1	1	----	3	----	----	----	----	2	1	----	3	1	----
	CO 5	Students will be Able to analyze concept and application of MOT and participate and succeed in competitive exams.	1	1	----	3	----	----	----	----	2	1	----	3	1	----
Atomic Structure & Bonding Lab	**CO 1**	Learn to run simulation experiment to understand the physical and chemical	1	1	----	3	----	----	----	----	2	1	----	3	1	----

(CHH135-P)		parameters determination for water														
	CO 2	To develop understanding of Acid Base titration	1	1	----	3	----	----	----	----	2	1	----	3	1	----
	CO 3	To analyze the concept behind the formation of some organic compounds.	1	1	----	3	----	----	----	----	2	1	----	3	1	----
	CO 4	To familiarize students with various spectroscopic instruments, their principle and applications like UV-VIS, IR, NMR and fluoresecence spectroscopy.	1	1	----	3	----	----	----	----	2	1	----	3	1	----
Physics-I (PHH121-T)	**CO 1**	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	1	2	3	2	----	1	2	2	3	----	1	3	1	1
	CO 2	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	1	2	3	2	----	1	2	2	3	----	1	3	1	1
	CO 3	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	1	2	3	2	----	1	2	2	3	----	1	3	3	3

		related to central forces														
	CO 4	Students would be able to explain and analyze rotational dynamics. They would also be able to formulate and construct a solution pertaining to it	1	2	3	2	----	1	2	2	3	----	1	3	1	1
Physics-I Lab (PHH121-P)	**CO 1**	Students would be able to demonstrate an ability to conduct investigations of practical/technical issues consistent with their level of knowledge and understanding	3	-	-	3	-	3	3	-	-	3	-	-	2	-
	CO 2	Demonstrate an ability to analyze data and reach a valid conclusion.	3	-	-	3	-	3	3	-	-	3	-	1	-	-
	CO 3	Designing/performing/resolving the experiments to develop their individual capabilities and representing the collective team work.	3	-	-	3	-	3	3	-	-	3	-	-	2	-
Diversity of Microbes and Thallophytes (EDH113-T)	CO 1	Understand the basis and principles of classification of living organisms	2	1	2	--	--	--	--	2	1	1	1	3	1	1
	CO 2	Understand the diversity that exists in microorganisms	2	2	2	-----	---	----	---	2	1	1	1	3	1	2
	CO 3	Understand the organization, morphological features and various modes of reproduction in Viruses, Bacteria, Algae and	2	1	2	-----	---	----	---	2	3	1	1	3	3	2

		Fungi														
	CO 4	Understand the structural diversity in Lichens and their ecological and economic importance	2	1	2	-----	---	----	---	2	3	1	1	3	1	2
	CO 5	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	2	1	2	-----	---	----	---	2	3	2	2	3	3	3
Diversity of Microbes and Thallophytes Lab (EDH113-P)	CO 1	To enable students to develop the skills of staining and mounting microbes.	-	2	3	-	-	2	1	-	-	-	-	3	--	3
	CO 2	To enable students to develop the skill of preparing bacterial cultures	1	1	2	-	-	-	2	-	-	--	-	3	-	3
	CO 3	To develop in the student's skill of identifying diseases caused by microorganisms based on their symptoms.	1	-	2	--	-	2	1	-	-	-	-	3	-	3
	CO 4	To develop the skill of observing and identifying microbes using temporary and permanent slides.	-	2	3			1	2	--	-	3	-	1	-	-
Geometry and Calculus (MAH121B)	CO 1	Understand and apply the notion of conics and confocal conics to solve various mathematical problems.	----	2	3	----	3	2	3	2	----	----	----	----	----	1

	CO 2	Apply the concept of limit, continuity and differentiability of the function of one variable to solve mathematical problems	----	2	3	----	2	2	2	1	----	----	----	----	----	2
	CO 3	Demonstrate the applications of single integrals.	----	1	2	----	2	2	1	3	----	----	----	----	----	1
Animal Diversity-I (EDH114-T)	CO 1	Explain the basis and principles of classification of living organisms	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
	CO 2	Evaluate and understand the diversity that exists in Protozoa and Porifera	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
	CO 3	Remember the organization, morphological features and various modes of reproduction in Cnidaria and Acnidaria	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
	CO 4	Explain the morphology and various mode of reproduction in Helminthes.	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
	CO 5	Able to identify some of the diseases caused by Helminthes and study their symptoms	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
	CO 6	Analyze and understand the diversity of phylum Annelida	2	1	2	-	-	-------	-	2	1	1	1	3	1	1
Animal Diversity -I Lab (EDH114-P)	CO 1	To familiarize the students with the basic knowledge and working of microscope	-	2	3	-	-	2	1	-	-	-	-	1	--	--
	CO 2	To develop in the students the ability to spot the specimens of various organisms belonging to different phyla	1	1	2	-	-	-	2	-	-	--	-	1	-	-

	CO 3	To study the permanent slides of the lower invertebrate phyla	1	-	2	--	-	2	1	-	-	-	-	1	-	-
	CO 4	To prepare the temporary mount slides of amoeba and paramecium	-	2	3			1	2	--	-	-	-	1	-	-
Foundations of Education (EDH102B)	CO 1	Assimilate the concept of Education and Its philosophical aspects	---	---	2	3	---	2	----	2	3	3	3	---	3	---
	CO 2	Comprehend the Socio Cultural aspect of Education	3	1	2	3	---	3	----	2	3	3	1	---	1	1
	CO 3	Discuss the Interdiscilpinary nature of Education	3	3	3	----	---	3	----	2	3	3	---	---	---	3
	CO 4	Analyse the contribution of various Indian and western Educationists to Indian Education System	2	----	1	2	3	3	----	2	3	3	3	---	2	2
	CO 5	Reflect on the Educational concerns and Issues in the Indian context	1	----	2	3	---	3	---	2	3	2	3	---	1	2
ICT in Education-I (EDW168)	CO 1	Demonstrate an awareness of the main processes and components used in ICT systems.	-	2	3	-	3	2	3	2	-	3	-	-	-	1
	CO 2	Describe and apply emerging technologies in teaching and learning environments	-	2	3	-	2	2	2	1	-	2	-	-	-	2
	CO 3	Create/Develop technology-enabled assessment and evaluation strategies	-	1	2	-	2	2	1	3	-	1	-	-	-	1
	CO 4	Describe the role of information and communication technology (ICT) in educational administration and management	-	1	1	-	2	2	2	2	-	1	-	-	-	1

Professional Communication-I (CDO105)	CO 1	Students will be able to develop all-round personality by mastering interpersonal skills to function effectively in different circumstances.	-	3	1	-	-	-	-	-	-	-	-	1	-	-
	CO 2	Students will be able to demonstrate effective communication through grammatically correct language	-	3	2		-	-	-	-	-	2	-	1	-	-
	CO 3	Students will be able to apply effective listening and speaking skills in real life scenarios.	2	3	-	-	-	-	-	-	-	2	-	1	-	-

Environmental Science (CHH137)	CO 1	Understand and explain the multidisciplinary dimensions of environmental issues.	2	2	1	1	2	2	2	2	----	----	2	2	1	3
	CO 2	Understand the primary environmental problelms and and suggest potential solutions	2	2	2	3	2	2	1	2	----	----	2	2	1	3
	CO 3	understand and explain about the various groups of plants and animals and their interaction with various ecosystem	2	2	2	1	3	2	2	1	----	----	2	2	2	1
	CO 4	Appreciate the principles governing the interactions between social and environmental factors	1	1	2	2	2	2	1	2	----	----	2	2	2	3
Thermodynamics, Equilibrium	**CO 1**	To develop the understanding of the chemistry heat of neutralization of acids and bases.	1	1	1	--										

and Solutions (CHH238B-T)							--	--	--				1		1	
	CO 2	To develop basic skills for verification of Hess's law of constant heat summation.	1	1	2	--	--	-2	--				1		1	
	CO 3	Learn determination of dissociation constant of a weak acid in physical chemistry laboraroty.	1	1		--	-1	--	--		1	--	1		1	
	CO 4	Perform determination of dissociation constant of phenolphathalein/methyl orange by colorimeter.	1	1	1	--	3	1	--		1		1		1	
Thermodynamics, Equilibrium and Solutions (CHH238B-P)	**CO 1**	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.		---	11	---	--1	--- --- ---	---	---	---	---	1 --- ---	---	1	
					1	---	2	---	---	2	---	---	---	---	---	1
					1	---	-	---	1	---	---	---	---	1	---	1
	CO 2	Explain the origin of the driving force of physical and chemical changesand evolution of second law of thermodynamics and related concepts	1	---	2	---	---	2	---	---	---	---	1	---	1	--
	CO 3	To apply the concept of equilibrium to construct and interpret the phasediagrams.	1	---	-	---	1	---	---	---	1	---	1	---	1	---

	CO 4	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	1	---	1	---	3	1	---	---	1	---	1	---	1	---
Elasticity Waves and Heat	**CO1**	Students would be able to explain, demonstrate the concepts of elasticity, oscillations and waves and solve problems related	-	-	2	1	2	1	-	1	3	3	1	3	3	2
(PHH122-T)																
	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.	-	-	2	1	2	1	-	1	3	3	1	3	3	2
	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	-	-	2	1	2	1	-	1	3	3	1	3	3	2
	CO4	Students would be able to compare and apply the concepts of entropy and hypothesize problems related to entropy	-	-	2	1	2	1	-	1	3	3	1	3	3	2

Elasticity Waves and Heat Lab (PHH122-P)	**CO1**	Students will be able to demonstrate an ability to conduct investigations of practical/technical issues	3	-	-	3	-	3	3	-	-	3	-	3	-	1
	CO2	they will demonstrate an ability to analyze data and reach a valid conclusion.	3	-	-	3	-	3	3	-	-	3	-	-	2	1
Bryophytes and	CO 1	To get acquainted with the structure, classification, and life	2	1	2	---	----	----	---	2	1	1	1	3	1	1
Pteridophytes (EDH132-T)		history of Bryophytes.														
	CO 2	To understand the Geological time scale and the importance of fossils.	2	1	2	---	----	----	---	2	1	1	1	3	1	1
	CO 3	To get acquainted with the structure, classification, and life history of Pteridophytes.	2	1	2	---	----	----	---	2	1	1	1	3	1	1
	CO 4	To analyse the evolutionary trends among Pteridophytes.	2	1	2	---	----	----	---	2	1	1	1	3	1	1
Bryophytes and Pteridophytes Lab (EDH132-P)	CO 1	To observe and identify temporary micro-preparations and permanent slides.	2	2	3	-	2	2	-	-	2	3	-	3	-	2
	CO 2	Study of the taxa included under Bryophytes and Pteridophytes by observing temporary micro-preparations and permanent slides.	3	3	3	-	3	3	-	-	2	3	-	3	-	-
	CO 3	Study of the morphology, thallus organization and reproductive structures of taxa studied in Bryophytes and Pteridophytes through permanent slides.	3	2	2	-	3	3	-	-	2	2	-	2	2	-
	CO 4	To prepare temporary, double-stained micro-preparations.	2	2	3	-	2	2	-	-	2	3	-	3	2	-

Number Theory and Real Analysis (MAH122B)	**CO1**	Understand the concept of numberssystem and axioms defined.		2	3	----	3	2	3	2	----	----	----	----	----	1
	CO2	Understand the properties of the real line R and lit's topology		2	3	----	2	2	2	1	----	----	----	----	----	2
	CO3	Recognize different types of sequences and calculate the limit of a sequence.		1	2	----	2	2	1	3	----	----	----	----	----	1
	CO4	Examine the convergence or divergence of infinite series through application of various tests.		1	1	----	2	2	2	2	----	----	----	----	----	1
Animal Diversity-II (EDH131-T)	CO 1	Critically analyse the basic structure, classification and life history of Arthropoda, Mollusca and Echinodermata	2	1	1	-----	3	1	-----	2	1	1	1	3	3	3
	CO 2	Comprehend the systemic position and phylogeny of Onychophoran	2	1	1	-----	3	1	-----	2	1	1	1	3	3	3
	CO 3	Reflect upon the classification of Mollusca and to gain the knowledge of formation of the pearl	2	1	1	-----	3	1	-----	2	1	1	3	3	3	3
	CO 4	To have the Knowledge of the evolutionary trends among arthropoda, mollusca and echinodermata	2	1	1	-----	3	1	-----	2	1	1	1	3	3	3
	CO 5	Critically analyze the classification Of Protochordata	2	1	1		2	1		2	1	1	3	3	3	3

	CO 6	Critically analyze the classification and life history of Cylostomata	2	1	1		2	1		2	1	1	1	3	3	3
Animal Diversity-II Lab (EDH131-P)	CO 1	To develop in the students the skills of staining and mounting of materials (temporary and permanent); of dissection, display and Labelling	-	2	3	-	-	2	1	-	-	-	-	1	3	2
	CO 2	To develop in the students the skills of collection, preservation, mounting of specimens	1	1	2	-	-	-	2	-	-	--	-	1	3	3
	CO 3	To develop in the students the skills of identification and Labelling of collected specimens	1	-	2	--	-	2	1	-	-	-	-	1	3	3
	CO 4	To develop in the students the skills of field observation of animals	-	2	3			1	2	--	-	3	-	-	2	3
Maths Lab (MAH120BP)	CO 1	get the basic understanding of Mathematical software		2	3	----	3	2	-	2	----	----	----	----	----	1
	CO 2	use various commands avaiLable in Mathematical software to find limit continuity and differentiability		2	3	----	2	2	-	1	----	----	----	----	----	2
	CO 3	implement the commands in Mathematical problems.to compute differentiation ,integration		1	2	----	2	2	-	3	----	----	----	----	----	1

	CO 4	implement the commands in finding maxima, minima, application of integrals	1	1	----	2	2	-	2	----	----	----	----	----	1	3
Creating An Inclusive Classroom (EDH167B)	CO 1	To understand the meaning and need of inclusion in education	3	1	1	2	---	---	1	1	2	2	1	3	--	2
	CO 2	To get familiarized with various policies, programmes and schemes promoting inclusive education	2	2	1	2	---	1	1	---	2	1	1	2	--	3
	CO 3	To identify the social, economic, and physical diversity that exists amongst learners	2	3	2	3	1	3	2	1	2	3	1	3	1	-
	CO 4	To recognize the challenges in Inclusive Education	3	3	1	2	2	2	2	2	2	2	1	2	1	-
Learner and Learning Process (EDH133-T)	CO 1	Comprehend the Nature of both the Psychology of the learner and Learning	2	1	1	1	1	1	2	2	3	3	----	3	----	----
	CO 2	Assimilate the nature of different components of cognition and their role in producing learning	3	2	1	1	1	1	2	2	3	3	3	----	3	2
	CO 3	Apply the knowledge of concepts and principles of growth in the classroom situation	---	1	1	1	1	1	2	1	2	3	3	3	---	2
	CO 4	Elucidate the concept of Group dynamics in their day-to-day activities.	2	1	1	1	1	1	1	1	2	3	3	---	2	2
	CO 5	Exhibit all the traits of an effective teacher	1	1	1	1	1	1	2	1	2	3	3	---	2	2
Learner and Learning	CO 1	To develop teaching aids as per interests and capabilities of the	3	2	3	2	3	---	2	2	1	2	------ ---	3	----- --	----- --

Process Lab (EDH133-P)		learners														
	CO 2	To assign tasks /develop assignments as per the abilities of the learners	1	2	2	3	3	2	1	2	1	1	3	-------	3	2
	CO 3	To enable a learner to test various factors of personality of an individual	3	2	3	2	1	----	1	3	1	2	3	3	------ ---	2
Professional Communication II. CDO109	CO 1	Students will be able to exhibit effective reading and writing skills in a professionally stimulated environment..	3	1	-	-	-	-	-	-	-	-	-	1	-	- -
	CO 2	Students will be able to enhance skills to effectively deliver formal and informal presentations to a variety of audiences in multiple contexts.	1	2	-	-	-	-	-	-	-	2	-	1	-	- -
	CO 3	Students will be able to learn grammatically correct formal writing skills.	2	2	-	-	-	-	-	-	-	2	-	1	-	- -
Drama and Arts in Education (EDW125)	CO 1	To develop the skills to use visual art in teaching learning process effectively.	1	2	1	3	2	1	1	2	1	1	2	-	-	1
	CO 2	To develop the skills to use literary art in teaching learning process effectively.	1	2	1	3	2	1	1	2	1	1	2	1	-	2
	CO 3	To develop the skills to use performing art in teaching learning process effectively.	1	2	1	3	2	1	1	2	1	1	2	1	-	1

	CO 4	To develop the skills to integrate technology and art in teaching learning process effectively.	1	2	1	3	3	1	1	2	1	1	2	-	-	1
Post Second Semester Summer Training (EDO165)	**CO 1**	To develop skills like school sensitization and solving imminent problems	1	3	___	___	___	___	___	___	___	___	___	2	1	___
	CO 2	To develop skills like team work, co-operation and leadership	1	3	___	___	___	___	___	___	___	___	___	_	3	___
Organic Chemistry-I (CHH237B-T)	CO 1	To Understand the stereo-chemistry of organic compounds and its applications.	2	1	2	-	-	-		2	1	1	1	2	1	1
	CO 2	To establish a basic concept for structure, properties and reactivity of aliphatic hydrocarbons.	2	1	2	--	--	--	--	2	1	1	1	2	1	1
	CO 3	To develop a firm foundation for scientific application of aromatic hydrocarbons	1	1	2	--	--	--	--	2	1	1	1	2	1	1
	CO 4	To apply knowledge to communicate reactions and mechanism in alkyl halides	2	1	2	--	--	--	--	2	1	1		3	1	1
Organic Chemistry I Lab	**CO1**	To Understand the stereo-chemistry of organic compounds and its applications.	**-**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	2	1	-

(CHH237B-P																
	CO2	To establish a basic concept for structure, properties and reactivity of aliphatic hydrocarbons.	**-**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	1	-	3
	CO3	To develop a firm foundation for scientific application of aromatic hydrocarbons	**-**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	3	**1**	**-**	-	2	1
	CO4	To apply knowledge to communicate reactions and mechanism in alkyl halides	**-**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	1	1	2
Electricity and Electromagnetism (PHH226-T)	CO 1	Students would be able to understand, explain and demonstrate about vector calculus, Gauss law and its application to determined D with problems and diagrams.	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
	CO 2	Students would be able to understand, construction and working of different types of capacitors. Also they will able to understand polarization phenomenon.	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
	CO 3	Students would be able to understand about Biot Savarts law, Ampers law and different types of forces in magnetostatics.	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
	CO 4	Students would be able to understand about propagation of	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1

		electromagnetic waves and electromagnetic induction.														
Electricity and Electromagnetism Lab (PHH226-P)	CO 1	Students would be able to understand, explain and demonstrate about vector calculus, Gauss law and its application to determined with problems and diagrams.	-	2	3	-	-	2	1	-	-	-	-	1	--	--
	CO 2	Students would be able to understand, construction and working of different types of capacitors. Also they will able to understand polarization phenomenon.	1	1	2	-	-	-	2	-	-	--	-	1	-	-
	CO 3	Students would be able to understand about Biot Savarts law, Amperes law and different types of forces in magnetostatics.	1	-	2	--	-	2	1	-	-	-	-	1	-	-
	CO 4	Students would be able to understand about propogation of electromagnetic waves and electromagnetic induction.	-	2	3			1	2	--	-	-	-	1	-	-
Gymnosperms and Reproduction in Angiosperms (EDH204-T)	CO 1	Understand the General characteristics, classification and economic importance of Gymnosperms	2	1	1	----	-----	----	-----	2	2	1	1	3	1	2
	CO 2	Understand the diverse structural and morphological	2	1	1	----	-----	----	-----	2	3	1	1	3	1	1

		characteristic features of Angiosperm Flower														
	CO 3	Understand the development of male and female gametophyte	2	1	1	----	-----	----	-----	2	1	1	1	3	1	1
	CO 4	Describe Pollination and Fertilization. Different types of Endosperm, Fruit and Seed	2	1	1	----	-----	----	-----	2	2	1	1	3	1	1
Gymnosperms and Reproduction in Angiosperms Lab (EDH204-P)	CO 1	To enable students to identify temporary slides of Gymnosperms and Angiosperm Embryology.	2	2	3	-	-	-	-	3	2	2	-	3	--	3
	CO 2	To enable students to identify permanent slides of Gymnosperms and Angiosperm Embryology.	1	1	2	-	-	-	-	3	3	--	1	3	-	3
	CO 3	To develop among students skills of free hand sectioning, staining and mounting embryological materials.	1	1	2	--	-	-	-	3	3	1	1	3	-	3
	CO 4	To describe characteristics of Gymnosperms and Angiosperms on basis of slide studies	1	2	3			-	-	2	2	2	2	1	-	1
Animal Diversity III and Comparative Anatomy Of	CO 1	To understand and analyse characteristics of Pisces	2	1	2	-----	3	----	-----	2	1	1	1	3	3	3
	CO 2	To Understand basic characteristics of amphibians and parental care	2	1	2	-----	3	----	-----	2	1	1	1	3	3	3
	CO 3	To understand and analyse hierarchy in reptiles and aves	2	1	2	-----	3	----	-----	2	1	1	1	3	3	3

Vertebrates (EDH205-T)	CO 4	To develop the understanding of evolutionary trends in Mammalia	2	1	2	-----	3	----	-----	2	1	1	1	3	3	3
	CO 5	To develop the understanding of heart and aortic arches	2	1	2	-----	3	--	--	2	1	1	1	3	3	3
	CO 6	To understand the structure and evolution of kidneys and gonads in vertebrates	2	1	2	-----	3	-----	-	2	1	1	1	3	3	3
Animal Diversity III and	CO 1	To develop in the students the skills of staining and mounting of materials (temporary and	-	2	3	-	-	2	1	-	-	-	-	1	--	--
Comparative Anatomy of Vertebrates Lab (EDH205-P)		permanent); of dissection														
	CO 2	To develop in the students the skills of display and Labelling; of micro techniques of fixing, embedding, section cutting, staining and mounting	1	1	2	-	-	-	2	-	-	--	-	1	-	-
	CO 3	To develop in the students the skills of collection, preservation, mounting, identification and Labelling of collected specimens	1	-	2	--	-	2	1	-	-	-	-	1	-	-
	CO 4	To develop in the students the skills of field observation of animals	-	2	3			1	2	--	-	-	-	1	-	-
Angiosperm Anatomy, Evolution and Ecology (EDH224-T)	CO 1	Understand the development, organization and functions of various plant tissues in angiosperms	1		2	----	----	----	----	1	2	1	1	3	1	1

	CO 2	Understand the diversity of histological complexity in Angiosperms.	1		2	----	----	----	----	1	2	1	1	3	1	1
	CO 3	Understand Evolution and economic importance of plants	1		2	----	----	----	----	1	2	1	1	3	1	1
	CO 4	Understand the secondary growthin root and stem.	1		2	----	----	----	----	1	2	1	_	2	3	1
Angiosperm Anatomy, Evolution and Ecology (EDH224-P)	CO 1	To develop the skill of free hand sectioning, staining and mounting of plant parts for anatomical study.	2	2	3	2	2	2	3	3	2	3	3	3	1	1
	CO 2	To observe and identify different types of tissues using temporary and permanent slides.	3	3	3	2	3	3	3	3	2	3	3	3	1	1
	CO 3	To study the anomalous secondary growth of Bougainvillea.	3	2	2	2	3	3	3	3	2	2	2	3	1	1
	CO 4	To give a brief account (botanical name, family, extraction/ processing where necessary) and uses of various economically beneficial plants.	2	2	3	2	2	2	2	3	2	3	2	2	3	1
Multivariate Calculus & Vector Calculus (MAH220B)	CO 1	Apply change of variables, change of order of integration involving double and triple integrals.	3	1	3	1	----	----	----	----	----	----	----	3	----	----

	CO2	Apply the concept of triple integral to evaluate volume of region.	3	1	3	1	----	----	----	----	----	----	----	3	----	----
	CO3	Analyse problems related to improper integrals.	3	1	3	1	----	----	----	----	----	----	----	3	----	----
	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, surfaceintegrals and volume integrals	3	1	3	1	----	----	----	----	----	----	----	3	----	----
	CO5	Solve & analyze the Mathematical problems related to Integral calculus & vector calculus and its applications using mathematical software.	3	1	3	1	3	----	----	----	----	----	----	3	----	----
Probability & Statistics (MAH221B-T)	CO1	Compute measures of central tendency & measures of dispersion and solve related problems in the real world.	1	1	2	---	---	---	---	1	1	2	---	3	2	1
	CO2	Assess the shape and peakness of data and calculate the various methods of measurements	1	1	2	---	---	---	---	1	1	2	---	3	2	1
	CO	Apply correlation and regression techniques to check the dependency of data	1	1	2	---	---	---	---	1	1	2	---	3	2	1
	CO	Apply the concept of probability theory and probability distributions to solve related	1	1	2	---	---	---	---	1	1	2	---	3	2	1

	4	problems.														
	CO5	Apply the knowledge of sampling theory to analyse andinterpret given data.	1	1	2	---	---	---	---	1	1	2	---	3	2	1
Probability & Statistics Lab (MAH221B-P)	CO1	Create graphical representationof Data using Charts & Diagrams in Excel	1	1	2	---	---	---	---	2	---	---	---	3	2	1
	CO2	Compute Measures of Central Tendency, measures of Dispersion and coefficient of skewness in Excel	1	1	2	---	---	---	---	2	---	---	---	3	2	1
	CO3	Analyse data dependency usingcorrelation & regression techniques in excel	1	1	2	---	---	---	---	2	---	---	---	3	2	1
	CO4	Calculate probability of variousdistributions	1	1	2	---	---	---	---	2	---	---	---	3	2	1
	CO5	Apply Statistical and probabilitydistributions on Real time data and analyse the same.	1	1	2	---	---	---	---	2	---	---	---	3	2	1
Knowledge and	CO1	Explain the concept of knowledge and its relationship with various aspects of curriculum Development	2	3	2	3	-	1	-----	2	1	2	2	3	3	3

Curriculum (EDH216B)	CO 2	Analyse epistemological thoughts of various Indian and western educationists with regard to significant aspects of curriculum	3	2	2	3	1	2	-	2	1	2	2	3	3	3
	CO 3	Infer the interrelationship among Eduation,social forces and curriculum development	2	3	3	2	-	1	------	2	3	3	3	3	2	1
	CO 4	Assimilate the process of curriculum development with all its significant components	1	2	2	3	-	1	2	1	2	2	2	----	-----	----
	CO 5	Reflect on the role of National Level institutions in curriculum Planning	1	2	1	1	-	-------	1	1	2	1	2	------	3	3
Gender,	CO	To develop a positive notion on	2	2	2	2	2	2	3	3	3	3	3	1	-	2
School and Society (EDS222B)	1	sexuality amongst young people.														
	CO 2	To identify social construction of gender under the lens of class and caste intersectionality	3	2	3	1	2	2	1	2	3	1	2	2	2	-
	CO 3	To analyse the role of schools in promoting gender equality through value education.	1	3	2	2	1	3	2	1	3	2	3	2	1	1
	CO 4	To develop a strategic approach towards women empowerment with the support of government agencies	1	1	3	2	1	2	2	1	3	2	3	3	-	-
Understanding the Self EDW217	CO 1	Assimilate the concept of Self Identity	2	2	-	2	2	2	-	1	2	2	2			
	CO 2	Reflect on the factors which influence one's selfIdentity	-	3	-	2	3	2	-	1	2	2	2			
	CO 3	Analyse the factors which positively enhance one's professional Identity	1	2	1	1	1	2	2	1	2	2	2			

	CO 4	Appreciate the teacher's role as a facilitator to build students self identity and professional identity	2	2	3	2	3	2	1	1	2	2	2			
	CO5	showcase qualities of teacher as a reflective practitioner	2	2	2	1	1	2	1	1	2		2			
Yoga and Health Education EDW304	CO 1	Acquire knowledge of theoretical concepts of Yoga and Meditation inrelation to holistichealth	2	2	3	.....	.....	2	.....	2	2	2	3	1	2	2
	CO 2	Apply knowledge of Yogic and meditation-based practices indeveloping sound physical andmental wellbeing	2	2	3	.....	.....	2	.....	3	2	3	3	1	2	2
	CO 3	Develop their personality with a sense of identity and meaning throughthe practice of Meditation	3	3	3	.....	.....	2	.....	3	2	3	3	1	2	2
	CO 4	Build awareness of the importance of Yoga and Meditation ineducational context	3	3	3	.....	.....	2	.....	2	2	2	3	1	2	2

Organic Chemistry-II (CHH313-T)	CO 1	To develop an understanding of the chemistry of Functional groups and mechanisms of Organic Reactions.	1	2	2	2	1	1	--	1	--	--	--	3	2	1

	CO 2	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	1	2	2	2	2	1	--	1	--	--	--	2	2	1
	CO 3	Learn the properties, synthesis and chemical reactions of halogen and/or oxygen containing functional groups in organic chemistry	1	2	2	1	2	1	--	1	--	--	--	1	2	1
	CO 4	Perform inter-conversions of various functional groups in organic chemistry.	1	2	2	2	2	1	--	1	--	--	--	1	1	1
Organic Chemistry-II Lab	CO 1	To develop an understanding of the chemistry of Functional groups and mechanisms of	2	2	3	3	-	-	-	-	3	1	-	-	2	3

(CHH313-P)		Organic Reactions.														
	CO 2	To develop basic skills for the analysis of organic compounds based on properties of functional groups for identification	2	2	3	3	-	-	-	-	3	1	-	-	2	3
	CO 3	Learn the properties, synthesis and chemical reactions of halogen and/or oxygen containing functional groups in organic chemistry Laboratory	2	2	3	3	-	-	-	-	3	1	-	-	2	3
	CO 4	Perform inter-conversions of various functional groups experimentally	2	2	3	3	-	-	-	-	3	1		-	2	3
Optics (PHH227-T)	CO 1	Students would be able to understand about interference of light.	3	1	2	-----	1	-------	------	2					1	
	CO 2	Students would be able to understand about diffraction of light.	2	1	2	-----	1	-------	------	2	1	1	1	3	1	1
	CO 3	Students would be able to understand about polarisation of light.	2	1	2	1	------	1	------	2	1		1	3		1
	CO 4	Students would be able to understand about LASER and Optical fiber.	2	1	2	-----	------	-------	------	2	1	1	1	3	1	1
Optics Lab (PHH227-P)	CO 1	Students would be able to understand about interference of light.	2	2	3	-	-	2	1	-	-	-	-	1	--	--
	CO 2	Students would be able to understand about diffraction of light.	1	1	2	-	-	-	2	-	-	--	-	1	-	-

	CO 3	Students would be able to understand about polarisation of light.	1	-	2	--	-	2	1	-	-	-	-	1	-	-
	CO 4	Students would be able to understand about LASER and Optical fiber.	2	2	3			1	2	--	-	-	-	1	-	-
Groups and Rings (MAH320B)	CO 1	Recognize the mathematical objects called groups & rings and apply the fundamental concepts of these algebraic structures	2	3	1	2	----	----	2	1	2	----	2	2	----	----
	CO 2	Explain the significance of the notions of cosets, normal subgroups, and factor groups and analyze consequences of Lagrange's theorem.	2	3	1	2	----	----	2	1	2	----	2	2	----	----
	CO 3	Illustrate structure preserving maps between different algebraic structures & its consequences.	2	3	1	2	----	----	2	1	2	----	2	2	----	----
	CO 4	Apply the basic concepts of ring of polynomials and irreducibility tests for polynomials over ring of integers.	2	3	1	2	----	----	2	1	2	----	2	2	----	----
	CO 5	Appreciate the significance of unique factorization in rings and integral domains							2							
Plant Systematics ,and Angiosperm Phylogeny (EDH301-	C O 1	Understand the basis, aim andprinciples of classification of Angiosperms	2	1	3	----	----	----	----	2	2	2	2	3	1	1

T)																
	CO 2	Understand the salient featuresof Bentham and Hooker Classification	2	1	3	----	----	----	----	2	2	2	2	3	1	1
	CO 3	Understand the diagonistic features, salient vegetative and floral characteristics and economically important plant of various Angiosperm (dicot) families.	2	1	3	----	----	----	----	2	2	2	2	3	1	1
	CO 4	Understand the diagonistic features, salient vegetative and floral characteristics and economically important plant of various Angiosperm (monocot) families.	2	1	3	----	----	----	----	2	2	2	3	3	1	1
Plant Systematics and Angiosperm Phylogeny Lab (EDH301-P)	CO 1	To acquaint students with the technical terms and identification keys for describing and identifying angiosperms.	1	2	3	-	-	1	-	2	2	1	-	3	--	3
	CO 2	To familiarize the students with local plants belonging to families included in the study (only those avaiLable during the season).	1	1	2	-	-	-	1	2	2	1	1	3	-	3
	CO 3	To enable the students to describe the vegetative and floral characteristics,	1	1	2	--	-	-	-	2	2	-	1	3	-	3

		draw floral diagram and write floral formulae of angiosperms.														
	CO 4	To develop the skill of undertaking field study and preparingherbarium sheets.	1	2	2	-	-	-	-	1	2	1	1	1	-	2

Cell Biology and Genetics EDH303-T Cell Biology and Genetics Lab (EDH303-T)	CO 1	To understand the structural complexity of a eukaryotic cell	2	1	2	----	3	----	----	2	1	1	1	**3**	**3**	**3**
	CO 2	To understand the structure and function of various cell organelles	2	1	2	----	3	----	----	2	1	1	1	**3**	**3**	**3**
	CO 3	To get acquainted with the structure and significance of nucleus and chromosomes	2	1	2	----	3	----	----	2	1	1	1	**3**	**3**	**3**
	CO 4	To review Mendelian inheritancein the light of gene interactions	2	1	2	----	3	----	----	2	1	1	1	**3**	**3**	**2**
	CO 1	To develop skills of staining cells and observing cell organelles	2	2	3	2	2	2	3	3	2	3	3	**1**	**-**	**2**
Cell Biology and Genetics EDH303-T Cell Biology and Genetics Lab (EDH303-P	CO 2	To prepare temporary and permanent cytological preparations of suitable plant materials to study mitosis and meiosis	3	3	3	2	3	3	3	3	2	3	3	**2**	**2**	
	CO 3	To verify Mendelian laws of inheritance	3	2	2	2	3	3	3	3	2	2	2		**1**	**1**
	CO	To understand the cell structure in													**3**	

	4	details	2	2	3	2	2	2	2	3	2	3	2			
Animal Physiology and Endocrinology (EDH225-T)	CO 1	Comprehend the enzyme action and physiology of digestion	1	1	2	-----	3	----	-----	2	3	1	1	3	3	3
	CO 2	Critically analyse the complexity of respiration and understand the mechanism of transport of gases	1	1	2	-----	3	----	-----	2	1	1	1	3	3	3
	CO 3	Reflect upon the mechanism of blood circulation, blood clotting and functioning of human heart	1	1	2	-----	--	2	-----	2	1	1	1	3	2	3
	CO 4	Explain the process of excretion and homeostasis	1	1	2	-----	1	----	-----	2	1	1	1	3	3	3
	CO 5	Explain the process of excretion and homeostasis	1	1	2	-	1	-	-----	2	1	1	1	3	3	3
	CO 6	To conceptualize the mechanism of endocrine and exocrine glands	2	1	2	-	1	-	-----	2	1	1	1	3	3	3
Animal Physiology and Endocrinology Lab (EDH225-P)	CO 1	To enable students to analyse biochemically the foodstuffs and urine	1	2	3	---	---	2	1	---	---	---	---	3	---	3
	CO 2	To enable students to analyse the biochemical action of enzymes	1	1	2	---	---	-	2	---	---	---	---	3	---	3
	CO 3	To develop in the students the skills of separation of macro molecules using chromatography and electrophoresis	1	---	2	---	---	2	1	---	---	---	---	3	---	3

	CO 4	To demonstrate physiological experiments and the skills of haematology and endocrinology	1	2	3	---	---	1	2	---	---	3	---	1	---	---
Assessment for Learning (EDH122-T)	CO 1	To develop a critical understanding of issues in assessment and evaluation	2	1	1	1	1	1	2	2	3	3	----	3	----	----
	CO 2	To justify the role of continuous and comprehensive assessment in holistic development	3	2	1	1	1	1	2	2	3	3	3	----	3	2
	CO	To choose appropriate assessment	----	1	1	1	1	1	2	1	2	3	3	3	----	2
	3	methods														
	CO 4	To design learning indicators and rubrics as a part of assessment	2	1	1	1	1	1	1	1	2	3	3	----	2	2
	CO 5	To devise ways to record and report learning landmarks to be supported by feedback	1	1	1	1	1	1	2	1	2	3	3	----	2	2
	CO 6	To develop the habit of self-critiquing to improve performance.														
Assessment for Learning Lab (EDH122-P)	CO 1	Develop critical thinking and scientific temper	3	3	2	1	1	1		1	2	1	3			
	CO 2	To justify the role of continuous and comprehensive assessment in holistic development	1	3	3	2	1	---	1	3	1	2	----			
	CO 3	Acquire skills to develop digital assessment tools for various learner groups	2	3	2	1	3	2	3	--	2	----	3			
School Organisation	**CO1**	Use various strategies to create positive school climate	3	3	3	2	---	2	----	3	---	2	2	----	2	3

and Management (EDS227B)	**CO2**	Analyse various features of school as an organization.	----	----	3	3	---	3	---	3	----	2	2	-----	2	3
	CO3	Discuss different components of school management	----	----	3	3	----	3	----	3	----	2	2	---	2	3
	CO4	Assimilate the concept and process of educational administration	1	1	3	2	---	2	----	3	---	2	2	----	2	3
Principles of Human Resource Management		To know about staffing/recruitment	1	1	----	----	----	----	----	----	----	1	1	1	1	1
		To explore performance management and appraisal process	1	1	----	----	----	----	----	----	----	2	1	1	1	1
		To explore training and development	1	1	----	----	----	----	----	----	----	2	1	1	1	1
		To evaluate processes of career management	1	1	----	----	----	----	----	----	----	2	1	1	1	1
Design Thinking: A Primer	CO1	To know about design thinking	1	1	1	0	0	1	---	0	---	0	0	---	1	1
	CO2	To learn about customer journey mapping	1	1	1	0	0	0	0	0	0	0	---	---	2	2
	CO3	To know about the analysis phase of design thinking	1	1	2	0	0	1	0	1	0	0	---	---	2	1
	CO4	To know about the ideation phase of design thinking	1	1	2	0	0	1	0	0	0	0	---	---	2	2
Principles of Management/	CO1	To know about staffing/recruitment	1	1	----	----	----	----	----	----	----	1	1	1	1	1

	CO 2	To explore performance management and appraisal process	1	1	----	----	----	----	----	----	----	2	1	1	1	1
	CO 3	To explore training and development	1	1	----	----	----	----	----	----	----	2	1	1	1	1
	CO 4	To evaluate processes of career management	1	1	----	----	----	----	----	----	----	2	1	1	1	1
Basics of Economics / MCS231	CO 1	To comprehend the economic problems of the society.	2	1	1	1	---	---	---	---	3	2	2	---	2	2
	CO 2	To Enlighten the laws of utility, demand and supply and their measurement.	1	1	1	1	---	---	---	---	1	1	1	---	1	1
	CO 3	To Explain the laws of production and various concepts of costs.	2	1	2	1	---	---	---	---	1	2	3	---	2	3
	CO 4	To eLaborate the various market forms	2	1	---	---	---	---	---	---	3	1	1	---	1	1
Introduction to Finance (MCS232)	CO 1	To take an overview of Financial management and its need to take financial decisions.	3	2	1	---	3	2	1	---	---	---	---	---	2	2
	CO 2	To understand financial statements and distinguishes between profit & loss and Balance sheet of different business organizations.	3	2	1	---	3	2	1	---	---	---	---	---	1	1
	CO 3	To identify the different sources of long term finance and differentiate amongst equity, preference and Debt	3	2	1	---	3	2	1	---	---	---	---	---	2	3

	CO 4	To eLaborate and apply various techniques of capital budgeting and analyse cost of capital and capital structure	3	2	1	---	3	2	1	---	---	---	---	---	1	1
Basics of Entrepreneurship MCS368	CO 1	Students will be able to identify a problem worth solving using Jobs-to-be-Done (JTBD) methodology and empathize with the customer to further define the problem using Design Thinking.	3	2	1	---	3	2	1	---	---	---	---	---	2	2
	CO 2	Students will be able to craft their solutions using the Value Proposition Canvas by defining the gain creators and pain relievers	3	2	1	---	3	2	1	---	---	---	---	---	1	1
	CO 3	Students will be able to create your own business model using the Lean Canvas template	3	2	1	---	3	2	1	---	---	---	---	---	2	3
	CO 4	Students will be able to build solution demo, validate solution demo, build and validate MVP or pivot through MVP interviews	3	2	1	---	3	2	1	---	---	---	---	---	1	1
Community Connect Program (EDO239)	**CO 1**	Become sensitive towards the prevailing socio-economic conditions	3	-	-	-	-	-	-	-	-	3	2			
	CO 2	Imbibe the universal values of humanity, love and compassion	3	-	-	-	-	-	-	-	-	3	2			

	CO 3	Appreciate interdependence of various components of society	3	-	-	-	-	-	-	1	-	3	2			
	CO 4	Contribute to the social welfare by participating in community-based activities	3	-	-	-	-	-	-	1	-	3	2			
Transition Elements, Coordination Compounds (CHH312B-T)	**CO 1**	**Interpret the properties of d and f block elements and their compounds in terms of their electronic configuration and bonding.**	1	2	--	--	--	--	--	--	2	--	--	3	2	--
	CO 2	**Identify the properties of coordination compounds in terms of bonding theories**	2	2	--	--	--	--	--	--	2	--	--	3	2	1
	CO 3	**Develop knowledge on Principles of Chemical Kinetics**	--	3	--	--	--	--	--	--	2	--	--	3	2	1
	CO 4	**Develop knowledge on Principles of Surface**	1	--	--	--	--	--	--	--	2	--	1	3	2	1

		Chemistry														
Transition Elements, Coordination Compounds Lab (CHH312B-P)	**CO 1**	**To familiarize the transition metals and estimating them by gravimetric analysis**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**1**
	CO 2	**To familiarize the properties of coordination compounds and determine the crystal field stabilization energy of metal complexes**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**1**
	CO 3	**To explore the kinetics of a reaction by titrimetric and spectrophotometric methods**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**1**
	CO 4	**To understand surface chemistry by adsorption, viscosity and partition coefficient experiments**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**1**
Basic Electronics (PHH330-T)	CO 1	Recognize a variety of exciting high-tech products, systems and their technology enabled by electronics	1	2	3	3	1	1	1	3	1	2	2	3	1	3
	CO 2	Manipulate voltages, currents and resistances in electronic circuits	1	2	3	3	1	1	1	3	1	2	2	3	1	2
	CO 3	Demonstrate familiarity with basic electronic components and use them to design simple electronic circuits	1	2	3	3	1	1	1	3	1	2	2	3	1	2
	CO 4	Record, analyze and filter audio signals to improve their fidelity.	1	2	3	3	1	1	1	3	3	3	2	3	3	3
Basic	**C**	Demonstrate an ability to		3	3		2		3	3	2	1	3	1	2	

Electronics Lab(PHH330-P)	**O1**	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.														
Differential Equations (MAH319B)	CO 1	explain and solve some standard types of linear differential equations and its applications.	2	3	1	2	----	----	----	1	2	----	2	2	----	----
	CO 2	explain and solve the differential equations of 1 st order and 1 st degree and its applications.	2	3	1	2	----	----	----	1	2	----	2	2	----	----
	CO 3	explain and solve higher order linear differential equations and simultaneous linear differential equations.	2	3	1	2	----	----	----	1	2	----	2	2	----	----
	CO 4	explain and solve some special types of ordinary differential equations.	2	3	1	2	----	----	----	1	2	----	2	2	----	----

	CO 5	formulate and solve the linear and non-linear PDE.	2	3	1	2	----	----	----	1	2	----	2	2	----	----
	CO 6	solve & analyze the differential equations using OCTAVE.	----	----	----	----	----	----	2	----	----	----	----	----	----	----
Plant Physiology and Metabolism (EDH310-T)	CO 1	Recognise the water relationships of plants and transpiration.	1	2	2	----	----	----	----	3	2	1	1	3	1	1
	CO2	Understand the ascent of sap and transpiration.	1	2	2	----	----	----	----	3	2	2	1	3	1	1
	CO 3	Comprehend the process of absorption and mineral nutrition.	1	2	2	----	----	----	----	3	2	2	1	3	1	1
	CO4	Explain the process of photosynthesis and its significance.	1	2	2	----	----	----	----	3	2	2	2	3	1	1
Plant Physiology and Metabolism (EDH310-P)	**CO 1**	To understand the functioning of a plant from the physiological point of view.	2	2	3	2	2	2	3	3	2	3	3		1	1
	CO 2	To enable students to handle glassware and equipment for setting up physiology experiments.	3	3	3	2	3	3	3	3	2	3	3		2	1
	CO 3	To study responses of plants by manipulating the variables.	3	2	2	2	3	3	3	3	2	2	2		2	1
	CO 4	To study the role of N, P, K, Ca, Mg, Fe, N & Zn in plant metabolism.	2	2	3	2	2	2	2	3	2	3	2		2	2

Ecology and Animal Behavior (EDH302-T)	CO 1	To understand the concept of population dispersal and distribution pattern	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 2	To understand the dynamics of community Diversity	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 3	To understand the dynamics of Ecosystem	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 4	To develop understanding of the animal behaviour	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 5	To understand the evolution of society	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 6	To develop the understanding of biological rhythm	2	1	2	----	3	----	----	2	1	1	1	3	3	3
Ecology and Animal Behavior Lab/(EDH302-P)	CO 1	To enable students to understand Animal adaptation in different habitats	-	2	3	-	-	2	1	-	-	-	-	1	--	--
	CO 2	To enable students to study Collection and qualitative and quantitative analysis of soil organisms	1	1	2	-	-	-	2	-	-	--	-	1	-	-
	CO 3	To enable students to study Estimation of dissolved oxygen, alkalinity and salinity in the pond water	1	-	2	--	-	2	1	-	-	-	-	1	-	-
	CO 4	To enable students to study Experiments with maze for studying behavioural motivation	-	2	3			1	2	--	-	-	-	1	-	-

Education in ContemporaryIndia (EDH214B	**CO 1**	Explain diverse social realities and challenges faced by Indian Education System	3	-	3	-	1	-	-	-	-	2	2	1	1	1
	CO 2	Examine constitutional provisions and safeguards avaiLable for Indian citizen particularly in context of contemporary Educational set up for bringing social equality	3	-	3	-	1	-	-	-	-	2	2	1	2	2
	CO 3	Analyze current educational scenario in light of the recommendations of various Committees, Commissions and	3	3	-	-	-	3	-	-	2	-	2	1	-	-

		National Policies														
	CO 4	Appreciate the role of nodal educational agencies and policy making institutions in national development.	2	-	-	-	-	2	-	-	2	2	2	1	-	-
	CO 5	Reflect upon the structural organization of Indian education system and role of teacher in inclusive education	-	2	2	2	-	2	-	-	2	2	2	-	2	-
Pedagogy of Biological Science (EDH109-T)	CO 1	Understand and appreciate the nature of Science and contributions by eminent Biologists.	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**
	CO 2	Design learning objectives for content related to Biological Sciences.	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**
	CO 3	Explain Constructivist approach of building knowledge.	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
	CO 4	Apply different pedagogical approaches to design lesson plans.	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**2**

	CO 5	Design effective assessment strategies related to Biological Sciences and ICT mediated online assessment sheets.	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**
Pedagogy of Biological Science Lab (EDH109-P)	CO 1	Understand the Bloom's Taxonomy of Instructional Objectives and design learning objectives for content related to Biological Sciences.	2	2	3	2	2	2	3	3	2	3	3	**2**	**3**	**2**
	CO 2	Understand the micro teaching skills and prepare the micro lesson plans for each skill.	3	3	3	2	3	3	3	3	2	3	3	**2**	**3**	**2**
	CO 3	Learn about the Herbartian lesson plan and prepare the lesson plans for teaching Biological Science.	3	2	2	2	3	3	3	3	2	2	2	**2**	**3**	**2**
	CO 4	Apply different pedagogical approaches to design lesson plans.	2	2	3	2	2	2	2	3	2	3	2	**2**	**3**	**2**
	CO 5	Learn about the test construction and construct a test paper for students' assessment.	2	2	3	2	2	2	2	3	1	3	1	**2**	**3**	**2**
Pedagogy of Mathematics (EDH110-T)	CO 1	To appreciate the role and contribution of eminent mathematicians.	2	2	3	2	2	2	2	3	2	3	3	2	3	2
	CO 2	develop correlation of mathematics with other subjects	2	2	3	2	2	2	2	0	2	3	3	2	3	2
	CO 3	To design instructional objectives for chosen content.	2	2	3	2	2	2	2	3	2	3	3	2	3	2
	CO 4	Apply innovative methods of teachings to teach mathematics at middle school level.	2	2	3	2	3	2	2	3	2	3	3	2	3	2
	CO 5	to Create content appropriate evaluation tools in mathematics.	2	2	3	2	2	2	2	3	2	3	3	2	3	2
	CO	To reflect the skill set of an	3	3	3	2	2	2	2	3	2	3	3	2	3	2

	6	effective mathematics teacher in classroom.														
Pedagogy of Mathematics Lab (EDH110-P)	CO 1	Develop Lesson Plan incorporating the core components.	2	2	1		2	1		3		3	3	2	3	2
	CO 2	Make use of innovative methods of teachings to teach mathematics at middle school level.	2			2	3	2	2		2	1	3	2	3	2
	CO 3	Design appropriate evaluation tools for effective evaluation of learning of Mathematical concepts.	2	2	1	2		1	2	3		3	3	2	3	2
	CO 4	To demonstrate skill set of an effective Mathematics teacher in the classroom.	1	1	3		2		2			3	3	2	3	2
E-Learning (EDW228)	CO 1	Understand concept of e-learning and key concepts	1	1	3	1	1	1	1	3	1	1	1	1	1	1
	CO 2	Use blended learning approach in e-learning	3	2	2	2	3	3	1	3	1	2	2	1	3	2
	CO 3	Use different online tools and resources in assessment	2	3	3	3	3	1	3	1	2	1	2	1	1	1
	CO 4	Explore and use the potentialities of Information Communication Technology for colLaborative, constructive &inquiry based learning	2	3	2	3	3	2	3	1	2	2	2	1	3	2
Phase-1 Field Engagement(EDO209)	CO 1	Recognise the contribution of psychological, philosophical and socio - economic factors in optimizing teaching and learning	3	----	----	----	----	3	----	3	3	3	3	----	3	3

	CO 2	Articulate experiences of observing various components of the particular school set up as part of internship including the aspects of Infrastructure and Human Resources	3	3	3	3	3	3	----	3	----	3	3	----	2	2
	CO 3	Present the observations of internship period in a systematic and structured manner in the form of individual and/or Group Tasks	3	3	3	3	3	3	----	3	----	3	3	----	2	2
	CO 4	Appreciate importance of school engagement program as a integral	3	3	----	----	----	3	----	3	----	3	3	----	3	3

		component of teacher training programme														
	CO 5	Demonstrate an understanding of the differences between government and private school settings and ways of functioning.	3	3	----	3	----	----	----	3	----	3	3	----	2	2
Electrochemistry and Chemical Kinetics (CHH314B-T)	CO 1	Explain the nature of Electrolytic conduction involving theories of electrolytes.	3	3	3	3	-	-	-	-	2	1	-	3	3	3
	CO 2	Understand the processes that occur at electrodes and in electrolytes and to apply emf methods to study different types of reactions.	3	3	3	3	-	-	-	-	2	1	-	----------	3	3
	CO 3	Describe the basic principles of battery design and understand the chemical reactions used in a lead-acid battery.	3	3	3	3	-	-	-	-	2	1	-	----------	3	3
	CO 4	Explain and discuss theories for photoinduced electron transfer and excitation energy transfer, and apply these methods in quantitative calculations	3	3	3	3	-	-	-	-	2	1	-	----------	3	3
Electrochemistry and Chemical Kinetics Lab (CHH314B-P)	CO 1	Explain the nature of Electrolytic conduction using different electrolytes	3	2	3	3	-	-	-	-	3	1	-	1	1	
	CO 2	Understand the calculation of free energy change for an	3	2	3	3	-	-	-	-	3	1	-	2	1	1

		electrochemical cell using the measured cell potential value.														
	CO 3	To be able to Measure the cell potential for an electrochemical cell.	3	2	3	3	-	-	-	-	3	1	-		2	1
	CO 4	Able to explain theory and practice of common photochemical and photophysical methods, and be able to execute these experimentally	3	2	3	3	-	-	-	-	3	1	-	1	1	2
Complex Analysis & Numerical Analysis (MAH321B-T)	CO 1	Demonstrate understanding of the basic concepts underlying complex analysis .			**2**	**3**				**2**	**3**		**1**	**1**	**3**	**1**
	CO 2	Apply the methods of complex analysis to evaluate definite integrals and infinite series.	**2**		**2**	**3**				**2**	**3**		**1**	**3**	**3**	**1**
	CO 3	Derive numerical methods for various mathematical operationsand tasks, such as interpolation, differentiation, integration, and the solution of nonlinear equations.			**3**	**2**				**2**	**3**		**1**	**2**	**2**	**1**
	CO 4	Apply numerical methods in Real Life problems.			**3**	**3**				**2**	**3**		**1**	**3**	**2**	**1**

	CO 5	Solve & analyze the Mathematical problems related to Numerical Analysis and its applications using software	**1**		**2**	**3**				**2**	**3**		**1**	**2**	**3**	**1**
Complex Analysis & Numerical Analysis Lab (MAH321B-P)	CO 1	Apply numerical methods in Real Life problems.	2	2	2	2								3		
Solid state Physics(PH H433-T)	CO 1	Students would be able to describe the nuclear structure on the basis ofdifferent nuclear model.	-	-	2	1	2	1	-	1	3	3	1	3	3	2
	CO 2	Students would be able to describe radioactive elements and half-life of the elements and familiar with nuclear Reactors/ Detectors	-	-	2	1	2	1	-	1	3	3	1	3	3	2
	CO 3	Students would be able to explain and analyze the different crystal structures and different models forthermal properties of solids	-	-	2	1	2	1	-	1	3	3	1	3	3	2
	CO 4	Students would be able to determine the electrical, magnetic and superconducting properties ofmaterials	-	-	2	1	2	1	-	1	3	3	1	3	3	2
Solid state Physics(PH H433-T)	CO 1	Students would be able to understand of the fundamental concepts and techniques used in Nuclear Physics.	3	3				3	3	3		3			3	

	CO 2	Students would be able to examine the electronic charge and specific charge of electron, i.e. charge mass ratio	3	3				3	3	3		3			3	
	CO 3	Students would be able to measure of energy band gap of semi-conductor materials and charge carreir concentrations	3	3				3	3	3		3			3	
	CO 4	Students would be able to verify the value of verious Physical constant like Rydburg constant, Planck constant, Hall coeficent etc	3	3				3	3	3		3			3	
Molecular Biology and Immunology EDH402-T	CO 1	To Understand the development, organizatio,n and functions of genes	1	----	2	----	----	----	----	1	2	1	1	3	1	1
	CO 2	To develop understanding of transcription and translation	1	----	2	----	----	----	----	1	2	1	1	3	3	3
	CO 3	To develop an understanding of techniques of immunology	1	----	2	----	----	----	----	1	2	1	1	3	3	3
	CO 4	To develop the skills required for designing the immune techniques	1		2		2			1	2	1	1	3	3	3
	CO 5	To analyze and apply third generation vaccine	1	1	2		2			1	2	1	1	3	3	3

	CO 6	To analyze and apply skills and tools to design the drugs against cancer	1	1	2		2			1	2	1	1	3	3	3
Molecular biology and Immunology Lab (EDH402-P)	CO 1	To study the staining of Mitochondria	1	1	2	1	----	2	----	1	2	1	1	3	1	3
	CO 2	Study of slides of grasshopper	1	1	2	1--	----	----	----	1	2	1	1	3	1	3
	CO 3	study of Karyotype of man	1	1	2	----	----	----	----	1	2	1	1	3	1	3
	CO 4	Study of antigen antibody reaction	1	1	2		2			1	2	1	1	3	1	3
Developmental Biology and Applied Zoology (EDH311-T)	CO 1	Explain the process of the development, organization and functions of developmental steps in mammals	1	1	2	----	2	----	----	2	2	1	1	3	3	3
	CO 2	To conceptualize the concept of the diversity and systemic complexity in neurulation and gastrulation.	1	1	2	----	2	----	----	2	2	1	1	3	3	3
	CO 3	Analyze the developmental stages of chick embryo	1	1	2	----	2	----	----	2	2	1	1	3	3	3
	CO 4	To have the Knowledge of mechanism of regeneration		1	2	----	2	----	----	2	2	1	1	3	3	3
	CO 5	Develop the skill to judicially use beneficial animals for human population	1	1	2	----	2	-	-	2	2	1	1	3	3	3

	CO 6	To have the knowledge of harmful animals and critically analyze the IPM	1	1	2	----	2	-	-	2	2	1	1	3	3	3
Developmental Biology and Applied Zoology Lab (EDH311-P)	CO 1	To study the different permanent slides of developmental stages of frog	1	1	2	-	-	3	1	2	-	-	-	3	--	3
	CO 2	To study the permanent slides of chick embryos	1	1	2	-	-	-	2	-	2	--	-	3	-	3

	CO 3	To Study the common insect pests of stored grains and crops, Study of common nematode pests of crops and Study of common insect vectors.	1	-	2	--	-	1	2	-	2	-	-	3	-	-
	CO 4	To Study the economically important a) Fishes, b) crustaceans, c) molluscs	1	1	2			1	2	--	-	3	-	3	-	-
Pedagogy of Physical Sciences (EDH128-T)	CO 1	To understand the epistemology of science as a school subject in the school curriculum.	1	2	3	3	2	1	1	3	2	1	2	2	1	2
	CO 2	To implement various pedagogical approaches to teaching of science at different stages of school.	3	3	3	--	2	2	---	2	1	--	---	1	--	---
	CO 3	To plan units and lessons through thematic approach in a holistic manner.	--	--	3	3	3	2	---	3	1	2	---	1	2	---
	CO 4	To critically examine teaching-learning process that incorporate enquiry, discovery, activity-based learning, problem solving situations and investigatory projects etc. within the classroom.	---	3	---	2	2	1	2	---	2	--	1	2	--	1
	CO	To integrate knowledge of science	--	3	2	1	2	1	---	--	3	2		3	2	

	5	with other school subjects														
	CO 6	To integrate knowledge of science in day-to-day life	1	---	1	---	3	---	3	2	2	3	3	2	3	3
Pedagogy of Physical Sciences (EDH128-P)	CO 1	Undeístand the Bloom's Ɪ'axonomy of Instíuctional Objectives and design leaíning objectives foí content íelated to Physical Science.	2	2	3	2	2	2	3	3	2	3	3	3	2	1
	CO 2	Undeístand the micío teaching skills and píepaíe the micío lesson plans foí each skill.	3	3	3	2	3	3	3	3	2	3	3	3	1	--
	CO 3	Leaín about the Heíbaítian lesson plan and píepaíe the lesson plans foí teaching Physical Science.	3	2	2	2	3	3	3	3	2	2	2	2	1	2
	CO 4	Apply diffeíent pedagogical appíoaches to design lesson plans.	2	2	3	2	2	2	2	3	2	3	2	2	2	--
	CO 5	Leaín about the test constíuction and constíuct a test papeí foí students' assessment.	2	2	3	2	2	2	2	3	1	3	1	1	3	2
Basic Research and Statistics (EPC)(EDW254)	CO 1	To describe the concept and relevance of research in education and special education	---	---	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**1**			---
	CO 2	To develop tools for conducting research	---	---	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**1**			---
	CO 3	To identify the problem and formulate hypothesis	**1**	**1**	**1**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**1**			---
	CO 4	To develop skills for data analysis	**1**	**1**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**1**			---

Reading and Reflecting on Texts (EDW104)	CO 1	Explain concept and imporatnce of Reflection through reading especially in context of teaching profession.	2	2	-	3	-	1	-	2	-	-	3	-	-	3
	CO 2	Read and respond to a variety of texts in different ways as reader and writer.	2	3	-	2	-	1	-	2	-	-	2	-	-	2
	CO 3	Engage in Interactive groups discussions with respect to reading and reflection activities.	2	2	-	2	-	1	-	2	-	-	2	-	-	2
	CO 4	Explore different ways of developing reflective and critical thinking in personal and	3	3	-	2	-	1	-	3	-	-	3	-	-	3

		professional spaces.														
Phase-II Field Engagement (EDO258)	CO 1	Recognise the contribution of psychological, philosophical and socio - economic factors in optimizing teaching and learning	3	------ ---	------ ---	------ ---	------ ---	3	------ ---	3	3	3	3			
	CO 2	Articulate experiences of observing the teaching of mentor teacher/ teachers and peers	3	------ ---	------ ---	------ ---	------ ---	3	------ ---	3	3	3	3			
	CO 3	Present the observations of internship period in a systematic and structured manner in the form of individual and/or Group Tasks	3	------ ---	------ ---	------ ---	------ ---	3	------ ---	3	3	3	3			
	CO 4	Provide constructive feedback to the peers and accept feedback from them with respect to their teaching	3	3	------ ---	------ ---	------ ---	3	3	------ ---	------ ---	------ ---	------- --			
	CO 5	Appreciate importance of school engagement program as a integral component of teacher training programme	3	3	------ ---	------ ---	------ ---	3	------ ---	3	------ ---	3	3			
	CO 6	Demonstrate an understanding of the differences between government and private school settings and ways of functioning.	3	3	------ ---	3	------ ---	------ ---	------ ---	3	------ ---	3	3			
Spectroscopy, Natural Products and Heterocycles (CHH315B-T)	**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	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**	**-**

	CO2	Learn the different types of alkaloids and terpenoids, their chemistry and medicinal importance and be able to apply knowledge of natural compounds	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**	**-**

		as lead molecules for new drug discovery.														
	CO3	Describe the chemistry of biomolecules like carbohydrates, lipids, proteins and amino acids	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**	**-**
	CO4	Use fundamental polymer chemistry to explain and predict the synthesis of polymers as well as the resultant structure and properties.	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**	**-**
	CO5	To understand the chemistry of drugs with respect to their pharmacological activity. To understand the fundamentals of Dyes.	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**	**-**
	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.	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**	**-**
Spectroscopy, Natural Products and Heterocycles (CHH315B-P)	CO1	Study and understand the working of instrumentation techniques like UV, FTIR and NMR	-	2	3	3	-	-	-	-	3	1	-	2	1	-
	CO2	Hands-on-training on the synthesis and structure elucidation of natural products	-	2	3	3	-	-	-	-	3	1	-	2	1	-

	CO 3	Synthesis of drug and macromolecules	-	2	3	3	-	-	-	-	3	1	-	2	1	-

	CO 4	Experimental understanding of heterocyclic compounds with structure elucidation	-	2	3	3	-	-	-	-	3	1	-	2	1	-
Relativity and Quantum Mechanics (PHH331-T)	**CO 1**	Discuss and interpret the experiments that reveal the relativistic properties of matter.	2	3	3	3				2	3		1	3	3	1
	CO 2	Discuss and interpret the experiments that reveal the wave properties and particle properties of matter.	2	3	3	3				2	3		1	3	3	1
	CO 3	Understand the central concepts and principles in quantum mechanics, such as the Schrödinger wave equation, the wave function and their statistical interpretation.	2	3	3	3				2	3		1	3	3	1
	CO 4	Understand the basic building blocks of quantum behavior by correlating the classical statistical mechanics and various distributions.	2	3	3	3				2	3		1	3	3	1
	CO 5	Demonstrate an ability to conduct investigations of practical/technical issues consistent with their level of knowledge.	2	3	3	3				2	3		1	3	3	1
Relativity and Quantum Mechanics Lab		Demonstrate an ability to conduct investigations of practical/technical issues.												3	1	2

(PHH331-P)	**CO 1**		2	3	3	3		2		3	3	2	1			
Biochemistry, Plant tissue culture and Biotechnology (EDH410-T)	CO 1	understand the structure and functions of biological macromolecules	1	----	2	----	----	----	----	3	3	1	1	3	1	1
	CO 2	get acquainted with the techniques, branches and applications of plant tissue culture	1	----	2	----	----	----	----	3	3	2	2	3	2	2
	CO 3	get acquainted with the tools and techniques of biotechnology, the processes involving gene manipulation and their applications	1	----	2	----	----	----	----	3	3	2	2	3	2	2
Biochemistry, Plant tissue culture and Biotechnology Lab (EDH410-P)	CO 1	• To understand the molecular mechanisms operating in cells.	1	2	3	-	-	-	-	2	3	1	1	3	--	3
	CO 2	• To familiarize with techniques in biochemistry and biotechnology.	1	1	2	-	-	-	-	2	2	1	1	3	-	3
	CO 3	To develop in the students the understanding of biochemical pathways inside an organism	1	1	2	--	-	-	-	2	2	1	1	3	-	3
	CO 4	To demonstrate effect of environmental factors such as pH and temperature on various biomolecules.	1	2	3	-	-	-	-	2	2	1	1	3	-	3

Genetics and Paleontology EDH411-T	CO 1	To understand the genetic composition of drosophila, Human population and learn method of genetic mapping	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 2	To understand the diversity of human genetic diseases.	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 3	To learn transgenic animal techniques	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 4	To develop the understanding of molecular bases of various genetic diseases	2	1	2	--	3	----	--	2	1	1	1	3	3	3
	CO 5	To develop the understanding of Palentology	2	1	2	---	3	----	--	2	1	1	1	3	3	3
	CO 6	To understand Zoogeography	2	1	2	---	3	----	--	2	1	1	1	3	3	3
Genetics and Paleontology Lab EDH411-P	CO 1	To identify and study drosophila	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 2	To identify blood groups and Rh factor in man	2	1	2	----	3	----	----	2	1	1	1	3	3	3
	CO 3	To study various fossils models and living fossils	2	1	2	----	3	----	----	2	1	1	1	3	3	3
Linear Algebra (MAH401B)	CO 1	Interpret vector space and its properties along with examples and solve the related problems	2	3	1	2			3	1	2		1	2		
	CO 2	Distinguish between nonlinear and linear transformations on vector spaces and their properties	2	3	1	2			3	1	2		1	2		
	CO	Apply the concept of Eigen	2	3	1	2			3	1	2		1	2		

	3	values, Eigen vectors and Eigen spaces in real life application														
	CO 4	Analyze and solve the problems on bilinear and quadratic forms	2	3	1	2			3	1	2		1	2		
	CO 5	implement the concept of inner product space and its properties along with examples and solve the related problems	2	3	1	2			3	1	2		1	2		
	CO 6	analyze the Mathematical problems using OCTAVE software.						3								
General Laws for Educators. (LWS121)	C O1	Understand the historical background and the salient featuresof the Constitution of India	3	2	1	1	1	1	1	1	2	2	1			
	C O2	Explain and summarize the major commercial laws in India	3	2	1	1	1	1	1	1	2	2	1			
	C O3	Identify and explain the laws protecting rights of Children in India	3	2	1	1	1	1	1	1	2	2	1			
	C O4	Identify and explain the laws protecting rights of Women in India	3	2	1	1	1	1	1	1	2	2	1			
Women and Child Laws (LWS125)	C O1	To make students aware of basic human rights of women	3	2	1	1	1	1	1	1	2	2	1			
	C O2	To make students aware of the laws for protection of women against exploitation	3	2	1	1	1	1	1	1	2	2	1			
	C O3	To make students aware of rights of children against exploitation and constitutional provisions	3	2	1	1	1	1	1	1	2	2	1			

Professional Competency Education (CDO432)	**CO1**	Develop proficiency in resume building and drafting effective cover letters	-	2	1	-	-	-	-	-	-	-	-	1	-	-	-
	CO2	Enhance their ability to write, read, comprehend and communicate effectively to increase the productivity of business.	-	3	-	-	-	-	-	-	-	2	-	1	-	-	-
	CO3	Students will be able to learn grammatically correct formal writing skills.	-	2	-	-	-	-	-	-	-	2	-	1	-	-	-
School Leadership and Management (EDH236B)	CO 1	understand key leadership theories and ideas, from inside and outside education, and apply these to thinking about their own practice	2	-	2	-	-	3	--	3	-	-	3	**3**		**3**	
	CO 2	draw on evidence from research and practice to develop knowledge with an understanding of what is known about effective leadership	2	-	-	-	-	3	--	3	-	-	3	**3**		**3**	
	CO 3	relate these to their own leadership context in planning actions	3	-	-	-	-	3	--	3	-	-	3	**3**		**3**	
	CO 4	undertake practice-based tasks enabling self-evaluation of their leadership in action	3	-	3	-	-	3	--	3	-	-	3	**3**		**3**	

	CO 5	develop their reflective practice skills to help them to evaluate and improve their own leadership practice	3	-	3	-	-	3	--	3	2	-	3	**3**		**3**
	CO 6	learn colLaboratively, supported by a mentor, to share insights, and develop knowledge and skills.	3	-	3	-	-	3	--	3	-	-	3	**3**		**3**
Peace and Value Education (EDS207B)	CO 1	Assimilate the concept of Self Identity	2	2	---	2	2	2	-----	1	2	2	2	2	2	2
	CO 2	Reflect on the factors which influence ones self Identity	----	3	---	2	3	2	---	1	2	2	2	2	2	2
	CO 3	Analyse the factors which positively enhance one's professional Identity	1	2	1	1	1	2	2	1	2	2	2	2	2	2
	CO 4	Appreciate the teaches role as a facilitator to build students self identity and professional identity	2	2	3	2	3	2	1	1	2	2	2	2	2	2
	CO 5	showcase qualities of teacher as areflective practioner	2	2	2	1	1	2	1	1	2		2	2		2
Human Rights in Education (EDS220B)	**CO1**	To inculcate the knowledge of the Human Rights.	2	2	------	2	2	2	-----	1	2	2	2	1	2	1

	CO 2	To Realize the importance andneed of human rights	----	3	----- -	2	3	2	------	1	2	2	2	-	-	1
	CO 3	To Comprehend the role of the Constitution in human rights	1	2	1	1	1	2	2	1	2	2	2	-	2	-
	CO 4	To Comprehend the role of humanrights in their life	2	2	3	2	3	2	1	1	2	2	2	-	-	-

Guidance and Counselling EDS221B	CO 1	The students will apply the knowledge of guidance and counselling in real life situations	3	3	3	-	-	-	2	2	2	2	2	2	2	2
	CO 2	The student will imbibe and demonstrate qualities of an effective counsellor	3	3	2	-	-	-	3	3	1	2	2	1	2	2
	CO 3	The student will demonstrate various approaches of guidance and counselling	2	2	2	-	-	-	2	2	2	1	2	2	1	2
	CO 4	The student will effectively use tools for testing and evaluating different techniques for assessment	1	1	1	-	-	-	2	3	1	1	2	1	1	2
Environmental Education (EDS223B)	CO 1	To understand about the concept of environmental education.	2	2	1	1	2	2	2	2	----	----	2	2	1	3
	CO 2	-To develop sense of awareness about the environmental pollution, and possible hazards and its causes	2	2	2	3	2	2	1	2	----	----	2	2	1	3

		and remedies.														
	CO 3	-To build up a sense of responsibility towards conservation of environment, bio-diversity, and sustainable development.	2	2	2	1	3	2	2	1	----	----	2	2	2	1
	CO 4	-To widen reasonable understanding about the role of school and education in fostering the idea and learning to live in harmony with nature.	1	1	2	2	2	2	1	2	----	----	2	2	2	3
Educational leadership (MOOC-210-EDS-401)	CO1	understand key leadership theories and ideas, from inside and outside education, and apply these to thinking about their own practice	2	2	2	-	-	3	--	3	-	-	-	3	--	3
	CO2	draw on evidence from research and practice to develop knowledge with an understanding of what is known about effective leadership	2	2	-	-	-	3	--	3	-	-	-	3	--	3
	CO3	relate these to their own leadership context in planning actions	3	3	-	-	-	3	--	3	-	-	-	3	--	3
	CO4	undertake practice-based tasks enabling self-evaluation of their leadership in action	3	3	3	-	-	3	--	3	-	-	-	3	--	3
	CO4	Imbibe the values essential for becoming the reflective and humane practitioner	3	3	------ ---	------ ---	------ ---	3	3	------ ---	------ ---	------ ---	------- --	1	2	2
School Internship Pedagogy-I EDO404B	CO1	Prepare mega lesson plan incorporating essential maxims and principles of teaching	1	-	-	2	3	-	1	2	-	-	-	1	2	-
	CO2	Deliver the lesson plan in the classroom demonstrating desired pedagogical skills and														

		competencies	1	3	-	1	3	3	1	2	-	-	-	1	2	-
	CO3	Prepare and utilize the appropriate TLM to facilitate effective teaching	1	1	-	-	3	2	-	1	-	-	-	2	1	-
	CO4	Make appropriate use of tools and techniques for effective evaluation of students learning	1	-	-	-	3	2	-	1	-	-	-	2	1	-
	CO5	Make appropriate use of tools and techniques for effective evaluation of students learning	-	2	3	-	1	1	3	-	-	-	-	1	1	-
	CO6	Utilize peer feedback as a tool to enhance the teaching effectiveness	1	2	-	-	-	-	-	3	-	-	2	1	1	1
School Internship Pedagogy-I EDO405B	CO1	Prepare mega lesson plan incorporating essential maxims and principles of teaching	1	-	-	2	3	-	-	-	-	-	-	1	-	-
	CO2	Deliver the lesson plan in the classroom demonstrating desired pedagogical skills and competencies	1	3	1	1	3	3	-	1	-	-	-	1	-	-
	CO3	Prepare and utilize the appropriate TLM to facilitate effective teaching	1	-	1	-	3	2	-	-	-	1	-	1	1	1
	CO4	Demonstrate effective use of ICTin transacting the curriculum	1	-	1	-	3	2	-	1	-	-	-	1	1	-
	CO5	Make appropriate use of tools and techniques for effective evaluation of student learning.	1	2	3	-	-	-	3	-	1	2	-	2	2	-
	CO6	Utilize peer feedback as a tool to enhance the teaching effectiveness	2	-	-	-	-	-	-	3	-	2	2	2	1	1
Action Research EDO415	CO 1	Identity problems faced during the real classroom situation	2	2	2	-	-	-	-	1	3	-	1	-	-	-
	CO 2	Offer tentative solutions for the identified problems	2	2	2	-	-	-	-	1	3	-	1	1	1	-

	CO 3	Develop a research based systematic plan of action to solve the problem	2	2	2	-	-	-	-	1	3	-	2	-	1	2
	CO4	Execute and evaluate the effectiveness of the solution	2	2	2	-	-	-	1	1	3	-	1	2	2	-
Case Study EDO416	CO1	Execute and evaluate the effectiveness of the solution	3	1	3	-	-	-	1	1	3	1	-	1	-	-
	CO 2	Collect relevant information about the case identified	3	1	3	-	-	-	1	1	3	1	-	-	2	_
	CO 3	Explore the probable causes for the present conditions of the identified case	3	1	3	-	-	-	1	1	3	1	-	_	-	3
	CO4	Propose a plan of action for the improvement/ restoration of the subject	3	1	3	-	-	-	1	1	3	1	-	_	_	2