Learning Outcomes based Curriculum

Department of Mathematical Sciences
Tezpur University
Integrated B.Sc.B.Ed. (Major in Mathematics)

Preamble

Department of Mathematical Sciences, Tezpur University strives to implement LOCF (Learning Outcomes based Curriculum Framework) as suggested by University Grants Commission (UGC) and proposed to be implemented by Tezpur University.

1. Introduction

The Integrated B.Sc. B.Ed. course in Mathematics consists of 8 semesters comprising 180 credits in all. Besides the prescribed compulsory papers and one paper on Disaster Management, each student has to opt for at one open elective paper during the course of study. The course has been designed to equip the students with theoretical knowledge as well as problem solving and teaching techniques. The academic curriculum requires each final year student to undertake a School Internship of 16 credit in any nearby schools to have a compulsory teaching exposure. The basic structure of the Integrated B.Sc. B.Ed. Programme in Mathematics is designed keeping in mind the following facts:

1. The learning outcomes of each paper are designed so that these may help learners to understand the main objectives of studying the course and to motivate them for a future teacher.

2. This will enable learners to select elective papers depending on the individual inclinations and contemporary requirements.

3. The papers are organized among eight semesters, considering the credit load in a particular semester. The elementary papers of Physics, Chemistry, Mathematics and Education are incorporated in semester I to III. Intensive courses in Mathematics and Education are proposed from semester IV onwards. Courses from education like classroom organization and management, seminar, teaching padagogy are slowly incorporated from third semester and school internship is introduced towards the end.

4. These syllabi in Mathematics under CBCS are implemented keeping in view the diverse applications of Mathematics in Science, Engineering, Social Science, Business and a host of other areas.

The objective is to prepare the students to learn Mathematics leading to B.Sc. B.Ed. Degree and equip them to become good Mathematics teachers with a passion for research and innovations.

2. **Qualification descriptors for the graduates**

Knowledge & Understanding

i.   Demonstrate fundamental systematic knowledge of mathematics and its applications.

Skills & Techniques

i.   Demonstrate educational skills in areas of analysis, geometry, algebra, mechanics, differential equations etc.

ii.   Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self learning and transform the knowledge to student through different teaching learning pedagogy.

Competence

i.   Exhibit subject-specific transferable knowledge in mathematics relevant to job trends and employment opportunities.

3. **Graduates Attributes**

i.   Capability of demonstrating comprehensive knowledge of mathematics and understanding of one or more disciplines of mathematics.

ii.   Ability to communicate various concepts of mathematics effectively using examples and their geometrical visualizations.

iii. Ability to use mathematics as a precise language of communication in other branches of human knowledge.

iv.   Ability to provide new solutions using the domain knowledge of mathematics by framing appropriate questions relating to the concepts in various fields of mathematics.

v.   To know about the advances in various branches of mathematics.

vi.   Capability to understand and apply the programming concepts of C to small mathematical investigations.

vii. Ability to read independently and do in-depth study of various notions of mathematics.

4. Program Outcomes

B.Sc. B.Ed. (major in mathematics)

PO1: Graduate has gained thorough understanding of the subject reflected in the curriculum.

PO2: Graduate has gained the required skills in modern teaching tools incorporating ICT

PO3: Graduate has gained awareness and sensitivity to the issues of development and environment, and the society at large

PO4: Graduate has acquired competence in the domain subject.

5. Programme structure

Programme Name: Integrated B.Sc. B.Ed. (major in mathematics)

Total Credits: 180

Structure of the curriculum

Course category	No of courses	Credits per Course	Total Credits
I. Core courses	38	2 to 8	141
II. Elective courses			
Department Specific Elective (DSE)/GE	12	2 to 4	36
Open Elective	01	03	03
Total credits	**51**	**2 to 8**	**180**

6. SEMESTER-WISE SCHEDULE

SEMESTER I

Course Type	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Contact Hour(CH)	Credits
Core	PD 101: Physics-I	2	1	0	3	3
	CD 101: Chemistry-I	3	0	0	3	3
	CD 107: Chemistry-Lab	0	0	3	6	3
	ED 105: Basics in Computer Applications	2	0	1	4	3
	ED 106: Education:An Evolutionary Perspective	2	0	1	4	3
	MD 103: Foundation of Mathematics	2	1	0	3	3
	MD 105: Real Analysis-I	2	1	0	3	3
	ED 104: Communicative English	3	0	0	3	3

SEMESTER II

Course Type	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Contact Hour(CH)	Credits
Core	PD 102: Physics-II	2	1	0	3	3
	PD 197: Physics-Lab	0	0	3	6	3
	CD 102: Chemistry-II	3	0	0	3	3
	ED 107: Education and Development	2	0	1	4	3
	MD 104: Real Analysis-II	2	1	0	3	3
	MD 106: Group Theory	2	1	0	3	3
	NS 102: National Service Scheme	0	0	2	4	2
	ES 103: Environmental Studies	4	0	0	4	4

SEMESTER III

Course Type	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Contact Hour(CH)	Credits
Core	MD 221: Introductory Statistics & Probability	2	1	0	3	3
	MD 223: Calculus-I	3	1	0	3	3
	PD 201: Physics-III	2	1	0	3	3
	CD 201: Chemistry-III	3	0	0	6	3
	ED 205: Environmental Education	2	0	1	4	3
	ED 202: Learner and Learning	2	0	1	4	3
Elective	DM 301: Fundamentals of Disaster Management	3	0	0	3	3

SEMESTER IV

Course Type	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Contact Hour(CH)	Credits
Core	MD 218: Introductory ODE & PDE	3	1	0	4	4
	MD 220: Linear Algebra-I	3	1	0	4	4
	MD 222: Co-ordinate Geometry	3	1	0	4	4
	MD 224: Numerical Methods and Boolean Algebra	3	1	0	4	4
	ED 203: Contemporary Issues in Education	2	0	1	4	3
	ED 204: Assessment and Evaluation	2	0	1	4	3

SEMESTER V

Course Type	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Contact Hour(CH)	Credits
Core	MD 311: Calculus-II	3	1	0	4	4
	MD 313: Programming Algorithm and Mathematical Software	2	0	2	6	4
	MD 315: Statics and Dynamics	3	1	0	4	4
	MD 317: Elementary Complex Analysis	3	1	0	4	4
	ED 301: Teaching Approaches and Strategies	2	0	1	4	3
	ED 302: Classroom Organization and Management	2	0	1	4	3

SEMESTER VI

Course Type	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Contact Hour(CH)	Credits
Core	MD 318: Introductory Topology	3	1	0	4	4
	MD 314: Elementary Number Theory	3	1	0	4	4
	MD 316: Introduction to Optimization	3	1	0	4	4
	MD 322: Seminar	0	0	3	6	3
	ED 308: Pedagogy A: Physical Science-I	2	0	1	4	3
	ED 307: Pedagogy B: Mathematics I	2	0	1	4	3
	ED 303: School Education in North East India	2	0	0	2	2

SEMESTER VII

Course Type	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Contact Hour(CH)	Credits
Core	MD 425: Combinatorics	3	1	0	4	4
	MD 414: Computer Programming+	3	1	0	4	4
	MD 421: Computer Lab	0	0	2	4	2
	ED 408: Pedagogy B: Physical Science-II	2	0	1	4	3
	ED 407: Pedagogy B: Mathematics II	2	0	1	4	3
	ED 404: Initial School Experience/ School Internship-I	0	0	4	8	4
Elective	Open Elective I	2	1	0	3	3

SEMESTER VIII

Course Type	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Contact Hour(CH)	Credits
Core	MD 422: Elementary Coding and Information Theory	3	1	0	4	4
	ED 405: School Internship	0	0	16	32	16

7. Mapping of course with program outcomes (POs)

(Mapping of POs for courses offered by the department other than Mathematical Sciences are to be filled by the corresponding department)

Course Code	Course Title	PO1	PO2	PO3	PO4
PD 101	Physics-I	√		√	√
CD 101	Chemistry-I	√	√		√
CD 107	Chemistry-Lab	√	√		√
ED 105	Basics in Computer Applications			√	√
ED 106	Education: An Evolutionary Perspective	√	√		
MD 103	Foundation of Mathematics	√	√		√
MD 105	Real Analysis-I	√	√	√	
ED 104	Communicative English	√	√	√	
PD 102	Physics-II	√		√	√
PD 197	Physics-Lab	√		√	√
CD 102	Chemistry-II	√	√		√
ED 107	Education and Development	√	√		
MD 104	Real Analysis-II	√		√	√
MD 106	Group Theory	√	√	√	
NS 102	National Service Scheme	√	√		√
ES 103	Environmental Studies	√		√	√
MD 221	Introductory Statistics & Probability	√	√		√
MD 223	Calculus-I	√	√		√
PD 201	Physics-III	√		√	√
CD 201	Chemistry-III	√	√		√
ED 205	Environmental Education	√	√		√
ED 202	Learner and Learning		√	√	√
DM 301	Fundamentals of Disaster Management	√		√	√
MD 218	Introductory ODE & PDE	√	√	√	

MD 220	Linear Algebra-I	√		√	√
MD 222	Co-ordinate Geometry	√	√	√	√
MD 224	Numerical Methods and Boolean Algebra	√		√	√
ED 203	Contemporary Issues in Education	√		√	
ED 204	Assessment and Evaluation		√	√	√
MD 311	Calculus-II	√	√	√	√
MD 313	Programming Algorithm and Mathematical Software	√	√	√	√
MD 315	Statics and Dynamics	√	√	√	√
MD 317	Elementary Complex Analysis	√	√		√
ED 301	Teaching Approaches and Strategies		√		√
ED 302	Classroom Organization and Management		√		√
MD 318	Introductory Topology	√	√	√	√
MD 314	Elementary Number Theory	√		√	√
MD 316	Introduction to Optimization	√	√	√	
MD 322	Seminar	√	√	√	√
ED 308	Pedagogy A: Physical Science-I		√	√	√
ED 307	Pedagogy B: Mathematics I		√	√	
ED 303	School Education in North East India	√	√		
MD 425	Combinatorics	√		√	√
MD 414	Computer Programming+	√	√		√
MD 421	Computer Lab	√	√		√
ED 408	Pedagogy B: Physical Science-II		√	√	√
ED 407	Pedagogy B: Mathematics II		√	√	√
ED 404	Initial School Experience/ School Internship-I		√	√	√
MD 422	Elementary Coding and Information Theory	√		√	√
ED 405	School Internship		√	√	√

8. Evaluation plan:

There shall be minimum two Sessional Tests and two Examinations for each Theory Course, and two Examinations for a Practical Course having L-T-P structure. Details as follows:

Evaluation plan for Theory Courses:

Sessional Test/ Examination		Course Credit $\leq$ 2		Course Credit $\geq$ 3		Semester period
Nomenclature	Type	Mark s	Duration	Marks	Duration	
Sessional Test-I	Written	20	30 min	25	45 min	Within 5th week
Mid- Semester Examination	Written	30	90 min	40	2 hours min	Within 10th week
Sessional Test-II	Written/Assignment/ Semina r etc.	20	XX	25	XX	Within 14th week
End- Semester Examination	Written	50	2 hours	60	3 hours	Within 18th week

Evaluation plan for Practical Courses:

Examination		L-T-P Structure-wise		Semester period
		Marks		
		L-T-P: 0-0-z	L-T-P: x-y-z	
Nomenclature	Type	Marks	Marks	
Mid-Semester (Practical) Examination	Viva, Report	30	-	Before Mid Semester
End-Semester (Practical) Examination	Practical Examination, Viva, Report	70	50	Before End Semester

9. DETAILED SYLLABUS

PD 101: Physics - I

L2 T1 P0 CR3

Course outcomes

On completion of this course, learners will be able to -

CO1: understand the basics of vectors and matrices, introductory mechanics and properties of matter.

CO2: learn the detail of the coordinate systems: plane polarized, cylindrical and spherical; along with various vector and scalar properties.

CO3: Learn the extensive use of vectors and matrices in solving various problems in an intended learning outcome.

CO4: understand the basic mechanics in both inertial and non-inertial frames, motion under a central force and the mechanics of a system of particles.

Course content

➢ **Coordinates, Vectors and Matrices:** Coordinate systems, plane polar, cylindrical and spherical polar; line element, surface element and volume element; gradient, divergent and curl. Line, surface and volume integrals.

➢ Properties of matrices; complex conjugate matrix, transpose matrix, hermitian matrix, unit matrix, diagonal matrix, adjoint of a matrix, self-adjoint matrix, cofactor matrix, symmetric matrix, anti-symmetric matrix, unitary matrix, orthogonal matrix, trace of a matrix, inverse matrix, eigenvalue, diagonalization of matrices.

➢ **Mechanics:** Work-energy theorem, conservative forces and potential energy; energy diagram; non-conservative forces; motion in non-inertial frames; uniformly rotating frame; centrifugal and Coriolis forces.

➢ Motion under a central force. System of particles; centre of mass, equation of motion of the centre of mass; laboratory and centre of mass frame of references; elastic and inelastic collisions; linear and angular momentum and their conservation laws; fixed axis rotation; moment of inertia; theorem of parallel and perpendicular axes; compound pendulum, Kater's and bar pendulum.

➢ **Properties of Matter:** Elasticity; elastic constants; Hooke's law; torsional oscillation; bending of a beam; cantilever; surface tension; viscosity; kinematics of moving fluids.

1. **Textbook(s):**

2. Spiegel M., *Vector Analysis: Schaum's Outlines Series*, 2nd edition, McGraw Hill, 2017.
3. Potter M. C., Goldberg J., *Mathematical methods*, 2nd edition, Phi Learning Pvt. Ltd., 2008.
4. Mathur, D. S., *Mechanics*, S. Chand & Co. Ltd., 2000.
5. Kleppner, D. and Kolenkow, R., *Introduction to Mechanics*, McGraw-Hill, 1973.

Suggested Readings:

1. Harper C., *Introduction to Mathematical Physics,* 1st edition, Phi Learning Pvt. Ltd., 2008.
2. Chow, T. L., *Mathematical Methods for Physicists: A concise introduction*, 1st edition Cambridge Univ. Press, 2000.
3. Takwale R., Puranik P., *Introduction to Classical Mechanics*, McGraw Hill, 2017.
4. Young, H. D. and Freedman, R. A., *University Physics*, 12th edition, Pearson, 2009.

CD 101: Chemistry-I

L3 T0 P0 CR3

Course outcomes

After completion of this course, the students will be able to understand

CO1: Atomic theory and its evolution

CO2: Periodic propertied of elements

CO3: Basic of organic molecules, structure, bonding and organic reaction mechanisms

CO4: Synthesis of hydrocarbons

CO5: Basics of Chemical thermodynamics and thermodynamic laws

CO6: Fundamentals of solutions and colligative properties

Course content

- Structure of atom, Hund's rule, Aufbau principle, Pauli's exclusion principle.

- Periodic Properties: Periodicity of the elements, shielding, effective nuclear charge, Slater's rule, the size of the atoms, atomic, covalent and van der Waals radii, ionization energy, electron affinity, electronegativity.

- Basics of organic chemistry-1 : Bonding, structure and physical properties of organic compounds: Valence bond theory: Concept of hybridization of organic compounds and shapes of molecules; MO theory: Acyclic π orbital system and cyclic π orbital systems;

- Physical properties: Melting point, boiling point, solubility, dipole moment.

- Basics of organic chemistry-2: Electronic and steric effects: Inductive effect, resonance, hyperconjugation, steric effect, steric inhibition of resonance.

- Basics of organic chemistry-3: Thermodynamics and kinetics of organic reactions:

- Free energy and equilibrium, enthalpy and entropy factor, intermolecular & intramolecular reactions, rate constant and free energy of activation, free energy profiles for one step and multi-step reactions, catalyzed reactions, kinetic control and thermodynamic control, kinetic isotopic effect, principle of microscopic reversibility, Hammond postulate.

- Alkanes: Synthesis by: Decarboxylation, reduction of alkyl halides and tosylates, Kolbe electrolysis, Wurtz reaction, Corey–House synthesis; Reactions of alkanes: Halogenation, nitration, sulphonation, oxidation and cracking of alkanes.

- Alkenes and alkynes: Synthesis, Dehydration of alcohols, pyrolysis of esters, Cope reaction, Elimination of alkyl halides, germinal- and vicinal dihalides, Hofmann elimination; Reactions: Addition of X_2 (X = halogen), H-X, HO-X, interhalogens, water, Oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, catalytic reduction, dihydroxylation, epoxidation, polymerization, alkylation of alkynes, oxidation of alkynes to 1,2-diketones, allylic and benzylic halogenation of alkenes mediated by radicals.

- First Law of Thermodynamics: Thermodynamics terms, state and path functions, concept of heat and work, internal energy, enthalpy, first law of thermodynamics; w, q, °U and °H for expansion and compression of ideal gases, heat capacities, physical change, standard enthalpies of physical and chemical changes, Hess's law, Kirchhoff's law.

- Second Law of Thermodynamics: Spontaneous processes, Carnot cycle, entropy, criteria of spontaneity, statements of the second law of thermodynamics, entropy changes, Clausius inequality, Gibbs energy, Helmholtz energy, Third law of thermodynamics.

- Solutions: Ideal and non-ideal solutions

> Colligative properties

Textbook(s):

1. Lee, J. D., *Concise Inorganic Chemistry,* 5th Edn., Chapman & Hall, 2002.
2. Atkins, P. and Paula, J., de. *Atkins' Physical Chemistry*, 10th Edn., Oxford University Press, 2014.
3. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry,* 2nd Edn., Oxford University Press, 2012.
4. Finar, I. L., *Organic Chemistry,* Volume 1, 6th Edn., Pearson Education, 2002.

Suggested Readings:

1. Levine, I. N., *Physical Chemistry*, 6th Edn., McGraw Higher Edn., 2008.
2. Carey, F. A., Sundberg, R. J., *Advanced Organic Chemistry, Part A: Structure and Mechanisms,* 5th Edn., Springer, New York, 2007.
3. March, J., Smith, M. B., *March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure*, 6th Edn., Wiley, 2007.

CD 107: Chemistry Laboratory

L0 T0 P3 CR3

Course outcomes

After completion of this course, the students will be able to do

CO1: anlysis of inorganic mixures

CO2: estimation of compunds

CO3: measurement of some physical properties.

Course content

> Qualitative Analysis of Inorganic Mixtures (excluding interfering radicals)

> Preparation of Mohrs salt

> Estimation of Glucose

> Nitration of organic compounds

> Reduction of functional groups

> Preparation of buffer solution and measurement of pH.

> Viscosity measurement of solution

> Conductometric acid-base titration

> Measurement surface tension of liquid by stalagmometer

> Verification of Beer-Lamberts law

> Titration of a mixture of AcOH, HCl and $CuSO_4$ by conductometric method and $CuSO_4$ by conductometric method

Textbook(s):

1. Furniss, B. S., Ford, A. J. H., Smith, P. W. H., Tatchell, A. R. *Vogel's Textbook of Practical Organic Chemistry,* 5th Edn., Wiley, 1989.
2. Jadav, J. B. *Advanced Practical Physical Chemistry*, Krishna Prakashan, 2015.

Suggested Readings:

1. Mendham, J., Danney, R. C., Barnes, J. D., Thomas, M., *Vogel's Textbook of Quantitative Chemical Analysis*, 6th Edn., Prentice Hall, 2009.
2. Gurdeep, R., *Advanced Practical Inorganic Chemistry*, Krishna Prakashan, 2013.

ED 105: Basics in Computer Applications

L2 T0 P1 CR3

Course outcomes

After completion of this course, the students will be able to do

CO1: Describe a computer system and its working.
CO2: Open the windows operating system and use word processing package
CO3: Appreciate the use of the word processing package in education
CO4: Acquire the skills of trouble shooting whenever there are problems in the working of computer.

Course content

Unit -1: Computer Hardware and Organization
- Motherboard, Processor, RAM, Cache, Interface Cards, I/O Ports.
- Parts of a PC.CPU, Control Unit, ALU, Instruction Set, Registers.
- Generation of Computers, Classification of Computers

Unit–2: Types of Memory
- Memory organization, fixed & variable word length memory,
- Static and dynamic memory, RAM, ROM, cache memory, flash memory
- Secondary Memory – HD, CD, DVD, Tape, and Pen-drive

Unit-3: Software and Programming and Problem Solving Aspect
- OS, Utilities & Service programs
- Communication s/w, DBMS, Multimedia s/w, Application s/w
- Some common algorithms along with their flowcharts.

Unit-4: Concepts of Computer Network:
- Introduction, Network Classification by scale and connection methods,
- Network architecture and topology, Intranet, Extranet, Internet, TCP/IP, Basic h/w
- Components of Network.

Unit-5: Data Base and Web Page
- Introduction to Database and some concepts of DBMS
- Simple concepts of Web Page designing using HTML.

Lab Classes

- Working knowledge of Windows, MS-Word, MS-Excel, MS-PowerPoint, Simple web page designing using basic HTML tags

Textbook(s):

1. P. K. Sinha and P. Sinha, *Foundations of Computing,* BPB Publications.

Suggested Readings:

1. R. G. Dromey, *How to Solve it by Computer*, Prentice Hall of India,
2. A. S. Godbole& A. Kahate, *Web Technologies*, TATA McGraw Hill,
3. E. Navathe, *Fundamentals of Database Systems*, Pearson Education.

ED 106: Education: An Evolutionary Perspective

L2 T0 P1 CR3

Course outcomes

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

CO1: Analyse the premises, contexts that are unique to education and appreciate the nature, the purpose of education, and their practical ramifications in the school context.

CO2: Analyse the philosophical reflections and educational thoughts of great Educational thinkers

CO3: Understand the nature of knowledge in Education and its contribution to status of education as a discipline and interdisciplinary in nature

CO4: Inquire into the roles of teacher, school and the community in the changing perspectives of pedagogy

CO5: Explain the historical development of education as a system, its evolving structures and examine the concerns, issues related to education system.

Course content

Unit -1: Concept of Education
- Meaning of Education: Ancient to Present
- Concepts in Education and their changing connotations: school, curriculum, teacher, learner, teaching, learning, instruction, freedom, autonomy and control in relation to the child and teacher;
- Education as an organized, institutionalized, formal and state sponsored activity
- Shifts in process of Education: knowledge giving, didactic and constructivist interpretations, modes of Education: distance and face-to-face (tutorial, small group, large group) and oral/aural to digital; individualized and group based

Unit–2: Aims of Education
- Aims of education: Changing aims of Education in the context of globalization,
- Educational aims as derived from the Constitution of India
- Ideas of educational thinkers -Vivekananda, Gandhi, Tagore, Aurobindo, Dewey, Krishnamurthy and Paulo Friere.

Unit-3: Evolving Knowledge Base in Education
- Nature of knowledge in education: concepts, statements, educational viewpoints,
- Metaphors and theories; Emerging Knowledge base in education
- Differences between information, knowledge, belief, and opinion
- Interfaces with cognate disciplines such as physical, natural and social sciences

Unit-4: Learning Environment: The Changing Scenario
- Changing roles of Teacher, learner's participation, knowledge emphasis, learning resources.
- Shift in learning environments as well as pedagogy: Knowledge: focused to teacher, learner and learning environment.

Unit-5: Systems and structures in school education

- Education as a system and structure: meaning and nature
- Evolution of educational network over the past two centuries - 1800s to 21st century
- Role of state-central government: need for a national system of education
- Predominant concerns of the education system– coordination, quality assurance and Feasibility
- Systemic reforms in education: meaning and need.
- Demands from the secondary education system upon achieving universal elementary education

School Based Activities:

- Students will visit the schools and observe the learning environment in relation to teacher's role, learner's participation, knowledge emphasis and learning resources.
- Term paper/ seminar and discussions on some of the units

Textbook(s):

1. Gara Latchanna, *Foundation of Education*, Neel Kamal Publications Pvt.Ltd., New Delhi 2014.
2. Aggarwal, J. C., *Great Philosophers and Thinkers on Education*, New Delhi: Shipra. Publications, 2008.
3. Taneja V. R., *Socio-Philosophical Approach to Education*, Atlantic Publishers and Distributors, New Delhi, 2005.

Suggested Readings:

1. Dewey, J., *My Pedagogic Creed*, D.J. Flinders and S.J. Thorton(eds.) The Curriculum Studies Reader, Routledge: New York, 1997
2. Dewey, J., *Experience and Education*, Touchstone, New York,1997.
3. Kumar K., *Learning From Conflict*, Orient Longman, New Delhi,1996.
4. Margaret, K.T., *The open Classroom*, Orient Longman, New Delhi, 1999.
5. Ozmon, Howard A and Craver,Samuel M., *Philosophical Foundations of Education*, Prentice Hall, New York, 2007.
6. Prema, Clarke., *Teaching & Learning: The Culture of pedagogy*, Sage Publication, NewDelhi, 2001.

MD 103: Foundation of Mathematics

L 2 T1 P0 CR3

Course outcomes

CO1: It will build the fundamental concepts of mathematics in different branches mathematics to be offered in the subsequent semesters and will work as foundations.

Course content

➢ Statements, quantifiers, negation, compound statements (conjunction, disjunction, conditional and bi-conditional), contra-positive statement, proofs in Mathematics.

➢ Set, subset, superset, operations viz. union, intersection, complement etc. of sets; power set, cartesian product.

➢ Equivalence relations, equivalence classes, partition, fundamental theorem of equivalence relation.

➢ Functions, injection, surjection and bijection; image and pre-image of set under function, composition of functions, invertible function.

➢ Partial order relation, poset, chain, upper & lower bounds in poset, greatest & least elements, maximal & minimal elements, supremum & infimum, Zorn's lemma, introduction to lattice theory.

➢ Peano's axioms, principle of mathematical induction, well ordering principle, axiom of choice.

➢ Finite and infinite sets, countable and uncountable sets, Schroeder Bernstein Theorem, Continuum hypothesis.

➢ Ordinal numbers, sum and product of ordinal numbers, structure of ordinal numbers.

Textbook(s):

1. Halmos, P. R., *Naive Set Theory* Springer, 2009.
2. Kumar, A., Kumaresan, S. and Sarma, B. K., *A foundation course in Mathematics*, Narosa, 2018.

Suggested Readings:

1. Hrbacek, K. and Jech, T., *Introduction to Set Theory* , 3rd edition, CRC press, 1999.
2. Bartle, R. G. and Sherbert, D. R., *Introduction to Real Analysis,* 3rd Ed., John Wiley and Sons, 2005 (reprint, Wiley India, 2011).

MD 105: Real Analysis-I

L 2 T1 P0 CR3

Course outcomes

> CO1: Towards the end of the course students would develop an aptitude for logic and deductive arguments.
> CO2: They will be well versed with proper way of thinking/analyzing and writing.
> CO3: Apart from these, students will not only understands the topics but also able to apply them in their upcoming analysis courses.

Course content

➢ Real Numbers: algebraic and ordered properties, completeness property, supremum and infimum and applications. Absolute value and triangle inequality.

➢ Archimedean property and its applications, density theorem. Intervals, nested interval property. Binary and decimal representation, Cantor's proof of unaccountability of [0,1]. Cantor set.

➢ Sequences, bounded sequences, tails of a sequence, Cauchy sequence, convergent sequence and its limit, algebra of limits. Monotone sequences, monotone convergence theorem. Subsequences, divergence criterion. Construction of R.

➢ Infinite series, sequence of partial sums. Convergent and absolutely convergent series. Test of convergence. Alternating series. Rearrangement of infinite series.

Textbook(s):

1. Bartle, R. G. and Sherbert, D. R., *Introduction to Real Analysis,* 3rd Ed., John Wiley and Sons, 2005 (reprint, Wiley India, 2011).
2. Kumar, A. and Kumaresan, S., *A Basic Course in Real Analysis,* CRC Press, 2014.

ED 104: Communicative English

L3 T0 P0 CR3

Course outcomes

This course is designed to enhance English proficiency of students studying in the sciences. It specifically aims to achieve the following learning outcomes:

> CO1: Speak English with reasonable correctness of pronunciation and write English with reasonable clarity in different language contexts.
> CO2: Communicate in English on specific occasions such as office and business work.
> CO3: Enhance their ability for effective use of vocabulary and grammar in various language tasks such as taking and making notes, and writing letters, reports and essays.
> CO4: Make oral presentations in English as part of their need to enhance their professional skills.

Course content
A. Oral Communicative Activities

> Information transfer activities: Pair and group works involving transfer of information: describing pictures, interpreting diagrams, gleaning information from different types of written materials including articles etc. and talking about them; taking part in formal seminar presentation and group discussion.

B. *Reading*

> Reading and comprehension: global and local comprehension, drawing interferences. Materials: Stories and essays (preferably a collection of comparatively short essays on scientific, interestingly written topics, biographical/autobiographical writings, short stories- adventure and scientific fiction, and shorter poems).

> Reading silently in class followed by short comprehension questions, brief writing exercises, summaries in brief, personal responses (not typical question-answer type)- both oral and written. Reading material from Internet and talking and writing about them; reading scientific reports, literary writings, articles collected from newspapers and magazines, Internet etc. and writing notes etc on them.

C. *Writing*

> Preparing reports, project proposals. Writing applications of various types and for various purposes, curriculum vitae/resume, letters to the editors, letters to various agencies. Writing short notes on article/reports that had been read, notes on lectures (talks-radio/TV/audio, video cassettes), opinions on discussions/letters heard, notice both formal and informal/friendly, notes to inform others etc., interpreting pictures, advertisements, visuals (video, TV etc.) and writing briefly about them.

D. *Vocabulary and grammar*

> Discussion on the following before and/or after the activities mentioned in A, B and C above. Structure of simple sentences; Agreement of verb and subject; use of adverbials; Tenses, Use of passive in scientific discourse, various types of questions, direct and indirect narration, Articles, Prepositions, English modal verbs, Errors in the use of individual words.

Textbook(s)

1. Sharma, S. and Mishra B.,*Communication Skills for Engineers and Scientists.* PHI, New Delhi, 2009.
2. Wood, F. T., *A Remedial English Grammar for Foreign Students.* Macmillan, Delhi, 2010.

Suggested Readings:

1. Greenbaum, S., *Oxford English Grammar*. Oxford University Press, New Delhi, 2005.
2. Kenneth, A., Tony L, and Joan M. L., *Study Speaking.* CUP, New Delhi, 2008.
3. Lynch, T., *Study Listening*. CUP, New Delhi, 2008.
4. Thomson and Martinet, *A Practical English Grammar.* Oxford ELBS, Delhi, 2008

PD 102: Physics - II

Course outcomes

On completion of this course,

CO1: it is expected that after successfully completing the course, the student has a good idea on relativity, electricity, magnetism and electrostudent will be able to study the advanced courses like General relativity, Electrodynamics, Digital electronics etc..

Course content

➢ Special Theory of Relativity:Frames of reference, relative velocity and accelerations, Concept of ether, Michelson-Morley experiment, elements of special theory of relativity, the postulates, Galilean and Lorentz transformations, equivalence of mass and energy, time dilation, length contraction, simultaneity, Doppler effect, twin paradox.

➢ Electromagnetism: Coulomb's law (electric), electric field due to a system of charges, Gauss's law in differential and integral forms, electric dipole, its electric field and potential, capacitance of parallel plates. Coulomb's law (magnetic), Biot-Savart law, force on a current and on moving charges in a B-field.

➢ Electronics: Kirchhoff's law, network theorem, nodal analysis, mesh analysis, maximum power transfer theorem, series circuits, parallel circuits (DC analysis only), semiconductors, p-type, n-type semiconductors, p-n junction, diode, triode.

Textbook(s):

1. Beiser A., *Concepts of Modern Physics*, 6th edition, Tata McGraw Hill, 2008.
2. Rakshit, P. C. and Chattopadhaya, D., *Electricity and Magnetism*, New Central Book Agency, 2012.
3. Robbins, A. H. & Miller, W. C., *Circuit Analysis*, Delmar Cengage Learning, 2003.

Suggested Readings:

1. Resnick, R., *Introduction to Special Relativity*, 1st edition, Wiley, 2007.
2. Griffith, D. J., *Introduction to Electrodynamics*, 3rd edition, Prentice Hall of India, 1999.
3. *Edminister, J. A., Electrical Circuits- Schaum's Outline series*, 2nd edition, McGraw Hill,1983.

PD 197: Physics - Lab

Course outcomes

CO1: After completion of the course students will be able to use the different components and equipment in physics practical.
CO2: Students will also able to work effectively and safely in the laboratory environment independently and as well as in teams.

Course content

➢ Laboratory related components: Laboratory safety measures; handling of chemical; electrical and electronics items and instruments; handling of laser and laser related instruments and experiments; handling of radioactive samples and related instruments; general safety measures etc.

➢ Familiarization with equipment and components: Familiarization of different Electrical and Electronics components and hence identification & determination of values of unknown components Familiarization

of different optical and hence show different optical behavior & pattern by using different optical components and optical sources (white light, laser, sodium light etc.). Familiarization of Microsoft excel, Origin and other software for data analysis Soldering and de-soldering of components in a circuit board.

➢ Use of equipment:Multimeter and its uses, Function generator and its uses, CRO and its use to measure the wavelength, frequency, amplitude etc. of a given electrical signal.
➢ Study the variation of time period with distance between center of gravity and center of suspension for a bar pendulum, determine radius of gyration of the bar about its axis through its center of gravity and perpendicular to its length and, value of g.
➢ Determine the moment of a given magnet and horizontal component of Earth's magnetic field using magnetometers
➢ Determine g through Kater's Pendulum
➢ Find the refractive index of a given prism with the help of a spectrometer.
➢ To determine the surface tension of the given liquid (water/CC14) by capillary tube method.
➢ To measure the focal length of a given lens using (a) Bessel's method and (b)Magnification method.
➢ To study elastic and inelastic collisions using suspended spherical balls of different materials.
➢ Determination of Young's modulus of the given wire by torsional oscillation (Searl's method)

CD 102: Chemistry -II

L3 T0 P0 CR3

Course outcomes

After completion of this course, the students will be able understand

CO1: anlysis of inorganic mixures

CO2: Structure and bonding of homonuclear diatomic molecul

CO3: Polarizability of ion

CO4:   Stereochemistry of organic molecules – conformation and configuration, asymmetric molecules and nomenclature

CO5: Aromatic compound and aromaticity

CO6: Organic Intermediates, their generation and reactivity

CO7: Properties of gases and liquid

CO8: Kinetics of simple reaction

CO9: Fundamentals of electrochemistry

Course content

➢ Structure and Bonding: Valence Bond and LCAO-MO theory, bonding in homonuclear diatomic molecules (e.g.: H_2, N_2, O_2, F_2), covalent and ionic bonding, bond order, resonance, formal charge, VSEPR model, Polarizability of cations and anions, Fazan's rules.
➢ Basics organic chemistry-4: Nucleophiles, electrophiles, keto-enol tautomerism, acidity and basicity of organic compounds, Frost diagram, Hückel's rules for aromaticity, antiaromaticity, homoaromaticity.
➢ Stereochemistry-1: Representation of organic molecules in Fischer, saw horse, Newman, and flying-wedge, projection formulae and their interconversion, symmetry elements, molecular chirality, optical activity, optical purity, meso compounds, racemic mixture, resolution, enantiomers, diastereomers,

epimers, anomers, atropisomers, basic concepts of stereochemical nomenclatures: *threo*/*erythro*, *syn*/*anti*, *R*/*S*, *cis*/*trans* and *E*/*Z*).

➢ Reactive intermediates: Carbocation, carbanion, carbene, nitrene, free radical and benzyne: Generation, stability and reactions.

➢ Properties of gases and liquids: Equations of state, kinetic model of gases, collision theory, real gases, Maxwell distribution of molecular speeds, qualitative description of the structure of liquids, surface tension and viscosity.

➢ Electrochemistry: Conduction in electrolyte solutions, ionic mobility, Kohlrausch law, Ostwald's dilution law, transport number, Debye-Huckel Limiting Law, electrochemical cells, EMF, Nernst equation.

➢ Rate of reactions: Rate equations of zero, first, second, pseudo 1st order reactions, determination of order of a reaction, activation energy, activated complex theory, collision theory.

Textbook(s):

1. Atkins, P., Paula, J. de. *Atkins' Physical Chemistry*, 10th Edn., Oxford University Press, 2014.
2. Overton, T., Armstrong, F., Rourke, J., Weller, M. *Inorganic Chemistry*, 6th Edn., Oxford University Press, 2015.
3. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry*, 2nd Edn., Oxford University Press, 2012.
4. Sengupta, S. *Basic Stereochemistry of Organic Molecules*, 1st Edn., Oxford University Press, 2014.

Suggested Readings:

1. Laidler, K. J., Meiser, J. H., Sanctuary, B. C., *Physical Chemistry*, 4th Edn., Brooks Cole, 2002.
2. Carey, F. A., Sundberg, R. J. *Advanced Organic Chemistry, Part B: Reactions and Synthesis*, 5th Edn., Springer, New York, 2007.
3. March, J., Smith, M. B. *March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure*, 6th Edn., Wiley, 2007.
4. Eliel, E. L., Wilen, S. H., Doyle, M. P. *Basic Organic Stereochemistry*, 1st Edn., Wiley-Interscience, 2001.

ED 107: Education and Development

L2 T0 P1 CR3

Course outcomes

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

CO1: Explain the relationship between Education and individual, National development.

CO2: Examine the influences of political and policy decisions on Education and its aims, content and procedures.

CO3: Analyze the role of education in ensuring sustainable development.

CO4: Understand the financial supplication for education.

Course content

Unit-1: Education for Development

➢ National Development–Meaning, Scope and Different Viewpoints
➢ Education as a development indicator and related Indicators of national development,Education Commission 1964-66, NPE-1986, POA-1992.
➢ Education and development of life skills: preparation of individuals for the 21stcentury
➢ Role of education in ensuring sustainable development

Unit-2: Education and Socio-cultural Context

> Education as an instrument of social change- influence of education on society, familyand their practices
> Socio-cultural influences on the aims and organization of education
> Impingement of cultural history on education

Unit-3: Education and Economic Development

> Education for economic development- its meaning and nature
> Education as an investment, Education as development of human resource: Education for Employability, Consumer driven educational programmes, Planning Commission, World Bank

Unit-4: Education and Globalization

> Liberalization,
> Privatization,
> Internationalization and Globalization of Education

Unit -5: Emerging interface between political policies and Education

> The National and State educational policies, Implementations of educational policies
> State and centrally sponsored schemes of education
> Relationship between constitutional provisions and educational policies, Right toEducation

School Based Activities:

> Students will visit one government primary and one government secondary school to interact with teachers, students and community members to reflect on implementation of any one state/Centrally sponsored schemes/ programmes like RMSA, RTE Act 2009, Mid-Day meal, Kasturba Gandhi BalikaVidyalaya (KGBV) etc.
> Interact with school Heads to collect information about the progress of the
> schools as well as the scholarships and other inspirational motives received from various resources
> Students will visit a local community and interact with different community members and get information to develop understanding about the significance of
> education in economic,socio-cultural and globalized contexts.

Textbook(s):

1. Chandra, S.K., *Education and Development,* Discovery Publishing House, Delhi,2010.
2. Jayapalan, N., *History of Education in India,* Atlantic Publishers, New Delhi, 2008.
3. *School Education in India – Present Status and Future Needs,* NCERT, New Delhi,1986.

Suggested Readings:

1. Ministry of HRD, Department of Education, *Learning without Burden*, Report of the National Advisory Committee. Education Act. October, 2004.
2. UNDPA. *Human Development Reports* (New Delhi. Oxford, Oxford University Press) *Education for All: The Quality Imperative.* EFA Global Monitoring Report (UNESCO Paris, 2004).
3. World Bank. *Reaching the Child: An Integrated Approach to Child Development,* Oxford University Press, Delhi, 2004.

<center>

MD 104: Real Analysis-II

L 2 T1 P0 CR3
</center>

Course outcomes

CO1:
Students will understand the fundamental concepts of real analysis and apply these concepts to other fields of science.
CO2:
Students will be able to compete at the national and international level.

Course content

➢ Limits of functions, sequential criterion of limits, squeeze theorem, one sided limits, infinite limits and limits at infinity, continuity of a function, sequential criterion, algebra and composition of continuous functions.

➢ Continuous functions on intervals, maximum-minimum theorem, location of roots and Bolzano's intermediate value theorem. Uniformly continuity. Lipshitz function. Continuous extension theorem.

➢ Differentiability, Rolle's Theorem, Mean value theorems and applications, Taylor's theorem, Expansion of functions by Maclaurin's theorem.

➢ Weierstrass approximation theorem. Bernstein Approximation theorem. Monotone and inverse functions, continuous inverse theorem.

➢ Riemann Integration: definition and properties up to fundamental theorem of integral calculus.

Textbook(s):

1. Bartle, R. G. and Sherbert, D. R., *Introduction to Real Analysis,* 3rd Ed., John Wiley and Sons, 2005 (reprint, Wiley India, 2011).
2. Kumar, A. and Kumaresan, S. *A Basic Course in Real Analysis,* CRC Press, 2014.

<center>

MD 106: Group Theory

L 2 T1 P0 CR3
</center>

Course outcomes

CO1: At the end of the course the students will have a clear knowledge of basic group theory and they will be able to apply fundamental concepts of groups in solving various algebraic problems.

CO2: Students will get solid background for learning other courses on algebra to be offered in the subsequent semesters.

Course content

➢ Binary operation, semigroup, monoid, group, elementary properties of groups, subgroup, order of an element, coset, Lagrange's theorem and its applications.

➢ Conjugacy class, class equation, normal subgroups and quotient groups.

➢ Subgroup generated by a set, cyclic subgroups, properties of cyclic groups, fundamental theorem of cyclic group.

➢ Permutation, cycle notation, even and odd permutation, order of a permutation, symmetric group and alternating group. Dihedral group and presentation of group.

➢ Homomorphism and isomorphism of groups, isomorphism theorems, Cayley's theorem.

➢ Direct product of groups, properties of direct products.

Textbook(s):

1. Gallian, J. A., *Contemporary Abstract Algebra*, 4th edition, Narosa Publishing house, New Delhi, 2009.

2. Dummit, D. S. & Foote, R. M., *Abstract Algebra*, 3rd edition (John Wiley & Sons, Indian reprint, New Delhi, 2011.

Suggested Readings:

1. Fraleigh, J. B., *A First Course in Abstract Algebra*, 7th edition (Pearson Education India, New Delhi, 2008.

2. Herstein, I. N., *Topics in Algebra*, 2nd edition (John Wiley & Sons, Indian reprint, New Delhi, 2006.

NS 102: National Service Scheme

L0 T0 P2 CR2

Course outcomes

After the completion of course the student will be able to:
CO1: Define the aims and objectives of National Service Scheme.
CO2: Understand the positive aspects of community service, good health and hygiene
CO3: Develop civic and social responsibility and democratic spirit
CO4: Explain the problems and needs of the community
CO5: Demonstrate leadership quality

Course content

Unit - 01: Introduction and Basic Concepts of NSS

➢ History, philosophy, aims & objectives of NSS

- Emblem, flag, motto, song, badge
- Organizational structure, roles and responsibilities of various NSS functionaries

Unit - 02: Understanding Youth and Volunteerism

- Definition, profile of youth, categories of youth
- Issues, challenges, and opportunities for youth
- Youth as an agent of social change, Importance and role of youth leadership
- Indian Tradition of volunteerism, Needs & importance of volunteerism

Unit - 03: Community Mobilisation

- Mapping of community stakeholders
- Designing the message in the context of the problem and the culture of the community
- Identifying methods of mobilisation, Youth-adult partnership

Practicum
- Community service
- Practice of volunteerism
- Special camp and national integration camp

Textbook(s):

1. E. Panwar, JDS et. *National Service Scheme: A Youth Volunteers Programme for Under Graduate Students*, New Delhi, Daya Publishing House, 2020.
2. Rao, P. Ramachandra and Sampath Kumar, R.D. *Training of Trainers in National Service Scheme*, Visakhapatnam , Uday Publishing House, 2017.

Suggested Readings:

1. Devendra, Agochiya *Life Competencies for Growth and Success: A Trainer's Manual*, New Delhi, SAGE Publications, 2018

2. Prasad, R.R. *Community Mobilisation: Methods & Models*, New Delhi, Discovery publishing House, 2015.

3. Sanghi, Seema *The Handbook of Competency Mapping - Understanding, Designing and Implementing Competency Models in Organizations*, New Delhi, Sage Publications, 2007.

4. Silbereisen, Rainer K. and Lerner, Richard M. *Approaches to Positive Youth Development*, LA, Sage Publications, 2007.
5. Stallings, Betty B. and Ellis, Susan J. *Leading the Way to Successful Volunteer Involvement: Practical Tools for Busy Executives*, Philadelphia: Energize Books, 2010.

6. Villarruel, Francisco A. et al. *Community Youth Development: Programs, Policies, and Practices*, LA, Sage Publications, 2003.

ES 103: Environmental Studies

L4 T0 P0 CR4

Course outcomes

CO1:   Recognize the need for learning environmental studies and develop foundational knowledge on the topic.

CO2:   Appreciate the environment around us, spread awareness on environment degradation, promote environment protection and sustainable mitigation strategies.

CO3:   Develop critical thinking and analytical ability to resolve interdisciplinary issues related to the environment around us.

Course content

Unit 1: Introduction to environmental studies

➢   Multidisciplinary nature of environmental studies

➢   Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems

➢   What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources: Renewable and Non-renewable Resources

➢ Land resources and landuse change; Land degradation, soil erosion and desertification.

➢ Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

➢ Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

➢ Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation

➢ Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots.

➢ India as a mega-biodiversity nation; Endangered and endemic species of India.

➢ Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

➢ Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5: Environmental Pollution

➢ Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution.

➢ Nuclear hazards and human health risks.

➢ Solid waste management: Control measures of urban and industrial waste.

➢ Pollution case studies.

Unit 6: Environmental Policies & Practices

➢ Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.

- Resettlement and rehabilitation of project affected persons; case studies.

- Disaster management: floods, earthquake, cyclones and landslides.

- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.

- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.

- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 8: Field work

- Visit to an area to document environmental assets: river/forest/flora/fauna, etc.

- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

- Study of common plants, insects, birds and basic principles of identification.

- Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Textbook(s):

1. E. Bharucha, *Textbook of Environmental Studies,* Orient Black Swan, 2015.

Suggested Readings:

1. R. Carson, *Silent Spring*, Houghton Mifflin Harcourt, 2002.

2. M., Gadgil, & R. Guha, *This Fissured Land: An Ecological History of India*, Univ. of California Press, 1993.
3. B. Gleeson and N. Low, *Global Ethics and Environment*, London, Routledge, 1999.
4. P. H. Gleick, *Water in Crisis. Pacific Institute for Studies in Dev.*, Environment & Security. Stockholm Env. Institute, Oxford Univ. Press, 1993.
5. Martha J. Groom, Gary K. Meffe, and Carl Ronald Carroll, *Principles of Conservation Biology*, *Sunderland*, Sinauer Associates, 2006.
6. Grumbine, R. Edward and M.K. Pandit, *Threats from India's Himalaya dams*, Science, 339: 36-37, 2013.
7. P. McCully, *Rivers no more: the environmental effects of dams*, Zed Books, 1996.
8. McNeill and R. John, *Something New Under the Sun: An Environmental History of the Twentieth Century*, W. W. Norton & Company, 2000.
9. E.P. Odum, H.T. Odum and J. Andrews, *Fundamentals of Ecology*, Philadelphia: Saunders, 1971.
10. I.L. Pepper, C.P. Gerba and M.L. Brusseau, *Environmental and Pollution Science,* Academic Press, 2011.

11. M.N. Rao and A.K. Datta, *Waste Water Treatment*, Oxford and IBH Publishing Co. Pvt. Ltd.,1987.
12. P.H. Raven, D.M. Hassenzahl and L.R. Berg, *Environment*, 8th edition, John Wiley & Sons, 2012.
13. A. Rosencranz, S. Divan, and M.L. Noble, *Environmental law and policy in India*, Oxford, 1992.
14. R. Sengupta, *Ecology and economics: An approach to sustainable development*, OUP, 2003.
15. J.S. Singh, S.P. Singh, and S.R. Gupta, *Ecology, Environmental Science and Conservation*, S. Chand Publishing, New Delhi, 2014.
16. N.S., Sodhi, L. Gibson, and P.H. Raven, *Conservation Biology: Voices from the Tropics*, John Wiley & Sons, 2013.
17. V. Thapar, *Land of the Tiger: A Natural History of the Indian Subcontinent*, India Book House, 1998.
18. C. E. Warren, *Biology and Water Pollution Control*, WB Saunders, 1971.
19. E. O. Wilson, *The Creation: An appeal to save life on earth*, New York: Norton, 2006.
1. World Commission on Environment and Development, *Our Common Future*, Oxford University Press, 1987.

MD 221: Introductory Statistics & Probability

L 2 T1 P0 CR3

Course outcomes

CO1: Students learn the basic tools/concepts of collection and analysis of statistical data, without rigorous probability theory.

Course content

➢ Definitions of Statistics, population, sample, data and characteristics of data. Measures of central tendency, dispersion. Histogram, frequency curve and boxplot.

➢ Skewness and its measures. Normal and student's-t curves. Kurtosis and its measures. Effects of change of origin and scale. Definition of Probability and some properties of the probability function.

➢ Random variable, Probability distribution and distribution function. Discrete and continuous distribution. Some important discrete and continuous distributions.

➢ Random sampling and sampling fluctuation, Simple random sampling, variance of sample mean under SRS WOR, Estimation of population size (capture-release- capture method), Correlation and simple linear regression. Rank correlation.

Textbook(s):

1. Medhi, J., *Statistical Methods: An introductory Text*, (New Age International (P) Ltd, 2000).
2. Gupta, S.C. and Kapoor, V. K., *Fundamentals of Mathematical Statistics*, (S. Chand & Co., 2007).
3. Cochran, W.G., *Sampling Techniques,* third edition (John Wiley & Sons, 1977).

Suggested Readings:

1. Feller, W., *An Introduction to Probability Theory and Its Applications*, Vol. I, (Wiley, 2005).
2. Uspensky, J.V., *Introduction to Mathematical Probability*, (McGraw Hill, 2005).

MD 223: Calculus I

<div align="right">

L3 T1 P0 CR3

</div>

Course outcomes

At the end of this course student will able to

CO1: apply the tools of calculus to a variety of problem situations.
CO2: interpret the geometric meaning of differential calculus.
CO3: and this knowledge will work as a foundation for mathematical analysis courses.

Course content

➢ Indeterminate forms, L'Hospital's Rule, Successive differentiation.

➢ Convexity and point of inflexion; Tangent and Normal; Curvature of plane curves; Asymptotes; Envelopes; Singular points.

➢ Curve tracing: tracing of catenary, cissoids, asteroid, cycloid, folium of Descartes, cardioid, lemniscate.

➢ Functions of two variables: Limit, Continuity, Partial derivatives, Directional derivatives, Euler's theorem on homogeneous functions, Total Derivative and total differentials, Chain rule, Directional derivatives, Gradient vectors and equations of Tangent planes.

➢ Partial derivatives of higher order, Taylor's theorem, Criteria for Maxima/ Minima/ Saddle points, Lagrange's method of multipliers.

➢ The relation between integration and differentiation: the derivative of an indefinite integral, the first fundamental theorem of calculus, primitive functions and the second fundamental theorem of calculus, the Leibniz notation for primitives, integration by substitution, integration by parts

Textbook(s):

1. Thomas and Finney, *Calculus and Analytic Geometry*, (Pearson Education, Eleventh (Indian) Edition), 1998.
2. Bartle, R. G. and Sherbert, D. R., *Introduction to Real Analysis*, (John Wiley and Sons, Third (Indian) Edition), 2007.

Suggested readings:

1. Apostol, T. M., *Calculus*, Vol I & II, (John Wiley and Sons, Second (Indian) Edition), 2007.
2. G. A. Osborne, *Differential and Integral Calculus with examples and applications*, Forgotten Books' Classic Reprint Series, 2011.
3. B. C. Das and B. N. Mukherjee, *Differential Calculus*, U N Dhur & Sons Private Ltd, (19th Editions) 1957
4. R. Cournat, *Differntial and Integral Calculus*, John Wiley & Sons, 1970.

PD 201: Physics – III

Course outcomes

CO1: It is expected that after successfully completing the course, the student has a good idea on quantum mechanics.

Course content

➢ Particle properties of waves: Wave particle duality, Photoelectric effect, Black body radiation, Plank radiation law, Rayleigh-Jeans law, Stefan's law.

➢ Atomic physics: Rutherford model, Bohr model, hydrogen atom (quantum numbers and spectral series; qualitative), X-ray, Moseley's law, Basics of Lasers. Basics particle physics: elementary forces and particles.

➢ Limitations of classical physics: Qualitative discussions of the problem of the stability of the nuclear atom. The photo-electric effect. Franck-Hertz experiment and the existence of energy levels. Experimental evidence for wave-particle duality, X-ray diffraction and Bragg law. Compton scattering. Electron and neutron diffraction. Einstein and de Broglie's relations ($E = h\gamma$, $p = h/\lambda$).

➢ Schrodinger equation: The concept of the wave function as a probability amplitude and its probabilistic interpretation. Plane wave solutions of the one-dimensional time-dependent Schrodinger equation for a particle in free space and elementary derivation of the phase and group velocities (quantitative discussion of wave packets is not required).

➢ Uncertainty relation: The position-momentum uncertainty relation and simple consequences. Solutions of the one-dimensional Schrodinger's equation for an infinite square well potential; qualitative treatment of the finite well (derivation not required). Linear harmonic oscillator.

Textbook(s):

1. Beiser, A., *Concepts of Modern Physics*, McGraw-Hill, 2002.
2. Krane, K. S., *Modern Physics*, Wiley.

Suggested Readings:

1. Beiser, A., Perspectives *of Modern Physics*, McGraw-Hill Inc., US.
2. Thornton, S. T. and Rex, A., Modern Physics for Scientists and Engineers, Cengage Learning; 4th edition.
3. Gautreau, R. Schaum's Outline of Modern Physics, McGraw-Hill, 2nd edition.
4. Young, H.D. and Freedman, R.A., *University Physics*, 12th edition, Pearson, 2009.

CD 201: Chemistry -III

Course outcomes

After completion of this course, the students will be able understand

CO1: Concepts of acids and bases, and their strength

CO2: Fundamentals of coordination chemistry

CO3: Aromatic compounds and aromaticity

CO4: Synthesis and properties of hydrocarbons

CO5: Weak electrolyte and ionic equilibrium.

Course content

➢ Acid -Base concept: Arrhenius concept, Brønsted-Lowry acids and bases, Lewis acids and bases, Hard Soft acids - bases and HSAB principle, Acid and base strength, levelling effect.
➢ Coordination chemistry: Werner's theory, classification of ligands, coordination number, nomenclature of coordination compounds, isomerism.
➢ Aromaticity and Hückel Rule, Orientation of substituents, Directive influence of substituents, o/p ration, kinetically and thermodynamically controlled reactions.
➢ Alkynes: Preparation, properties and reactions.
➢ Alkyl halides: Preparation, properties and reactions.
➢ Ionic equilibrium: Arrhenius theory of electrolytic dissociation, Ostwald dilution law, Dissociation constant of week acids and bases, Ionization of water, pK_w and pH, Salt effect, pH expressions for various neutralization reaction, Henderson- Hasselbalch equation, solubility product, common ion effect, Buffer solutions, theory of acid base indicators, acid base titration curves (pH variation).

Textbook(s):

1. Barrow, G. M. *Physical Chemistry,* 5th Edn., McGraw Hill, 2007.
2. Finar, I. L. *Organic Chemistry,* Volume 1, 6th Edn., Pearson Education, 2002.
3. Ghosh, S. K., *Advanced General Organic Chemistry,* 3rd Edn., New Central Book Agency (P) Ltd., 2008.
4. Huheey, J. E., Keiter, E. A., Keiter, R. L. and Medhi, O. K. *Inorganic Chemistry*: Principles of *Structure and Reactivity*, 4th Edn., Pearson Education, 2006.

Suggested Readings:

1. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry*, 2nd Edn., Oxford University Press, 2012.
2. Smith, M. B., March, J. *March's Advanced Organic Chemistry, Reaction Mechanism and Structure* 6th Edn., Wiley, 2007.

ED 205: Environmental Education

L2 T0 P1 CR3

Course outcomes

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

CO1: Describe the concept, importance, scopes and aims of environmental education
CO2: Explain the environmental pollution, possible hazards and its courses and remedies
CO3: Develop a sense of responsibility towards conservation of environment, biodiversity and sustainable development
CO4: Develop reasonable understanding about the role of school and education in fostering the idea of learning to live in harmony with nature and the need to conserve the environment for sustainable development.

Course content

Unit- 1: Introduction to Environmental Education

- Meaning of environment, concept, importance, aims and scope of Environmental Education
- Differences between Environmental Education and Environmental Science
- Multidisciplinary nature of Environmental Education

Unit -2: Environmental Pollution

- Nature, causes, effects of air, water, soil, marine, noise, thermal pollution
- Measures for checking pollution
- Greenhouse effect and Ozone layer depletion and its effects

Unit -3: Bio-diversity and related issues

- Meaning of Bio-diversity, Bio Diversity of Assam,
- Wild life protection Act, Conservation of Bio Diversity,
- Need for conservation of genetic diversity for maintaining ecological balance
- Biosphere Reserve, National Park, Wild life Sanctuary,
- learning to live in harmony with nature

Unit -4: Environmental Awareness through Education

- Different programmes of Environmental Education for secondary school students
- Environmental education for developing healthy attitude towards environmental protection

Unit- 5: Role of Teachers and Students

- Environment Education tool for sustainable development
- Social and educational issues of environmental conservation
- Role of teachers and students in Environmental conservation

Practicum

- Students will visit the nearby environmental sites or local polluted areas to observe and study from environmental awareness view point and submit the report.
- Visit to national park and sanctuary for study of Bio Diversity and to submit their respective presentations.

Textbook(s):

1. Krishnamacharyulu, V. and G.S.Reddy, *Environmental Education: For B.Ed. Students of Indian Universities*, Neelkamal Publications, New Delhi, 2004.
2. Vijayan.S., *Principles of Environmental Education,* Sarup & Sons, New Delhi, 2008.
3. Kumar Aravind, *Environmental challenges of 21ˢᵗ century,* PH Publishing, Corporation. New Delhi, 2003.

Suggested Readings:

1. Robert B. Stevensyn, *International handbook of search on Environmental Education,* Rutledge publication, 2013.
2. Suresh Pauchari, *Environmental Education,* Pearson publication, 2012.
3. Robert B.Stevenson, *International handbook of research on environmental education,* Routledge, 2012.
4. Edgar Gonzalez-Gaudiano and Michael A. Peters,*Environmental education,* Sense publishers, Europe, 2008.
5. Palmer.J& Philips. N, *The handbook of Environmental Education,* Routledge. Newyork, 1990.

ED 202: Learner and Learning

L2 T0 P1 CR3

Course outcomes

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

CO1: Describe the basic concepts of nature of learner and develop an understanding about the influence of a psycho-social cultural context in shaping human development.

CO2: Acquainted with the nature, extent and causes of individual differences among learners and caters for the educational needs to various types of children.

CO3: Critically analyse the different theoretical perspectives on learning and get conversant with psychological principles and techniques to facilitate learning.

CO4: Identifies the various factors of learning and discuss the role of the teacher and school in addressing various factors influencing learning.

CO5: Comprehend teaching as a process of communication and be aware of paradigm shift in teaching learning.

Course content

Unit- 1: Nature of the Learner: Child and Adolescent
➤ Learner as a developing individual; a psycho-social entity; stages of development
➤ Developmental characteristics of a child and an adolescent: Physical, Cognitive, social, Emotional, moral and language; their interrelationships
➤ Factors influencing development such as heredity, nutrition, child-rearing practices, siblings and peers

Unit -2: Understanding Differences between Learners
➤ Differences between individual learners: Multiple Intelligence, Learning Style, Self-Concept, Self-Esteem, Attitude, Aptitude, Skills and Competencies, Interest, Values, Locus of Control and Personality.
➤ Understanding -differently - abled learners, slow learners, gifted and exceptional learners
➤ Methods of assessing individual differences: tests, observation, rating scales, self-reports
➤ Catering to individual differences: grouping, individualizing instruction, guidance and
➤ Counseling, bridge courses, enrichment activities and clubs

Unit -3: Understanding Learning
➤ Nature of learning: learning as a process and learning as an outcome

- Types of learning: factual, associations, conceptual, procedural, generalizations, principles and rules, attitudes, values and skills
- A critical analysis of the relevance and applicability of various learning theories for different kinds of learning situations
- Pedagogic principles for organizing learning: behavioristic, cognitivist, and humanistic

Unit -4: Factors Influencing Learning
- Biological and hereditary factors influencing learning
- Factors related to the subject matter content and learning material
- Factors related to the method of learning
- Factors influencing remembering and forgetting
- Conceptual organization and Reorganization, scaffolding
- Attention, motivation and readiness as factors influencing scholastic learning
- Role of the teacher and school in addressing various factors influencing learning

Unit -5: Learning Communication and Experience
- Concept, components and types of communication,
- Classroom communication – an analysis of its facilitative and Inhibitive nature
- Role of media in communication process, teaching as interpersonal communication,
- Reflection on the factors of communication affecting learning and learner
- The issue of media influences on learning – role of parents and teachers
- Paradigms for organizing learning: teacher centric, subject centric and learner centric

School Based Activities

Students will visit school and interact with class teacher for the following tasks:

- Critical analysis of classroom instruction in the light of the understandings developed in Units 2 & 3
- Any one experiment on learning – division of attention, memory, transfers of learning.
- Analysis of common behavioral problems observed in classroom, suggesting the ways to address them.
- Administration of group intelligence test and reporting the result.
- Analysis of classroom problems of high and low achievers and the strategies to address these problems

Textbook(s):

1. Aggarwal, J.C. (2009). Psychology of Learning & Development, Shipra Publication, Delhi
2. Mangal, S.K. (2007).Essentials of Educational Psychology, Prentice Hall of India, New Delhi
3. Chauhan, S. S.(2005) Advance Educational Psychology, Vikas Publishing House, New Delhi.

Suggested Readings:

1. Anita, Woolfolk. (2013). Educational Psychology: Active Learning Edition
2. Woolfolk, A.E. (2009) Educational Psychology (11th Edition, My Education Lab Series, (Prentice Hall, New York.

3. Matheson, David. (2004). An Introduction to the study of education (2nd edition). David Fulton Publish.
4. Dandipani, S.(2000).A Textbook of Advanced Educational Psychology. New Delhi: Anmol.

DM 301: Fundamentals of Disaster Management

L3 T0 P0 CR3

Course outcomes

On completion of this course, learners will be able to -

CO1: identify the potential threats and vulnerability factors of any system which may lead to significant damage and disruption.

CO2: contribute in CBDRM process through public awareness and capacity building of vulnerable communities.

Course content

Unit 01: Understanding disaster phenomena and parameters of disaster risk

- Definitions of hazard, vulnerability, risk and disaster.
- Approaches to understand disaster phenomena, disaster risk and its associated parameters.
- Selected models and approaches to study disaster risk.
- Classification, characteristics, causes, and damage potentials of different natural hazards.
- Factors relevant to civil unrest (community conflict, religious conflict, political conflict, terrorism, war, national scarcity).
- Health hazards (biological, radiation and physical).
- Dimensions of vulnerability and examples of hazard specific vulnerability factors (structural and non-structural).

Unit 02: Global disaster scenario and disaster risk mitigation mechanisms

- Disaster trends (Global, national and regional).
- Methods of hazard, vulnerability and capacity assessment (HVCA).
- Scopes of and criteria for disaster risk mitigation measures (prevention, mitigation and preparedness).
- Capacity building for disaster risk mitigation (structural and non-structural measures).
- Alternative adjustment processes for damage mitigation.
- Community based disaster risk reduction mechanism.
- Counter disaster resources and their roles.

Unit 03: Safety norms and practices for damage mitigation

- Importance of safety measures in risky systems for damage mitigation.
- Industrial hazards, vulnerability and safety norms.
- Concept of fire, elements of fire (Fire triangle) and products of fire.
- Types of heat sources and fuels that may ignite fire.
- Different types of fire extinguishers and their applications.
- Fire detection and suppression facilities (isolated or integrated).
- Common fire protection tools and devices.
- Electrical safety norms for prevention of fire.

Unit 04: Environment and disasters

- Environment, ecosystem and disasters.
- Climate change – issues and concerns.
- Air, water and soil pollution.
- Post disaster impact on environment.
- Impact of developmental projects on disaster risk.
- Aspects of environmental management for disaster risk reduction.
- Environmental Impact Assessment *(EIA)*.
- Role of NGT on environmental management.

Unit 05: Disaster management mechanism, policies and legislations

- Community-hazard profiles in India.
- Different phases of Disaster Management.
- Relief mechanism.
- Objectives, provisions and recommendations of DM Act 2005 and NPDM 2009.

Unit 06: Field work / Case studies (Group assignment)

- Risk assessment, hazard and vulnerability mapping of vulnerable systems or areas.
- Case studies on past disaster events.

Textbook(s):

1. Etkin, D. *Disaster Theory: An Interdisciplinary Approach to Concepts and Causes,* Elsevier Science & Technology, 2015.
2. Chakrabarty, U. K. *Industrial Disaster Management and Emergency Response,* Asian Books Pvt. Ltd., New Delhi 2007.

Suggested Readings:

1. Raju, N. V. S. *Disaster Management: Hazard and Risk Awareness - A Comprehensive Approach*, B. S. Publications, BSP Books Pvt. Ltd., Hyderabad, 2019.
2. Alexander, D. *Natural Disasters,* ULC press Ltd, London, 1993.
3. Carter, W. N. *Disaster Management: A Disaster Management Handbook,* Asian Development Bank, Bangkok, 1991.

MD 218: Introductory ODE & PDE

L 3 T1 P0 CR4

Course outcomes

CO1: Students are expected to be proficient in solving basic ordinary and partial differential equations using analytical techniques.

CO2: They should be able to model some physical problems and apply knowledge thus earned in other areas of mathematics.

Course content

- First order linear and nonlinear ODE: Exact differential equations and integrating factors, separable equations and equations reducible to this form, Bernoulli equation, integrating factors and transformations, Clairaut form, singular solution. Orthogonal and oblique trajectories, rate problems.

- Explicit methods of solving higher order linear differential equations: Basic theory of linear differential equations, homogeneous linear differential equations with constant coefficients, method of undetermined coefficients, variation of parameters, Cauchy-euler equation, Wronskian. Statements and proofs of theorems on second order homogeneous linear equations.

- Laplace Transforms: Laplace Transforms of some elementary functions, Linearity property, First and second translational or shifting theorem. Change of scale property, Laplace transforms of derivatives, multiplication by powers of t, and related problems. Laplace transform of periodic functions. Inverse Laplace transforms, Convolution theorem. Solution of ordinary differential equations by Laplace transform.

- Series Solutions for ODE, Types of singularity, Solution at an Ordinary Point, Solution at a Singular Point. Method of Frobenius. General solution of Bessel and Legendre equation.

- Introduction, Origins of First order PDE, Cauchy Problem for First order equations, Linear equations of first order, Lagrange equation, Integral Surface passing through a given curve, surface orthogonal to a given system of surfaces.

- Nonlinear PDE of first order, Compatible systems of first order equation, Charpit's Method, special types of first order equations, solution satisfying given conditions

Textbook(s):

1. Ross, S.L., *Differential equations,* 3rd edition, (Wiley, 2016).
2. Sneddon, I., *Elements of Partial Differential Equations,* (Dover, 2006).

Suggested Readings:

1. Fraleigh, J. B., *A First Course in Abstract Algebra,* 7th edition (Pearson Education India, New Delhi, 2008.

MD 220: Linear Algebra-I

L 3 T1 P0 CR4

Course outcomes

CO1: It is expected that at the end of the course the student will be able to apply the techniques of Linear Algebra to other branch of mathematics and practical problems.

Course content

- Matrices and System of linear equations, Reduced Row-Echelon form and its relevance to Linear systems, Elementary operation, Gaussian reduction.

- Vector spaces and Subspaces, Direct sum of subspaces, Quotient space.

- Linear combination and Span, Linear Independence, Exchange lemma, Basis of a vector space and Dimension Theory.

- Linear transformation, Linear transformations and Linearly Independent Sets, Matrix representation of linear transformations, Transition matrix and similar matrices, Rank of a linear Transformation and Rank of a matrix.

- Determinants, Multilinear Transformations, Determinant of a Family of Vectors, of a Matrix, and of a Linear Transformation.
- Eigenvalues and eigenvectors, Characteristic polynomial, Cayley-Hamilton Theorem, Diagonalizable Matrices and Linear Transformations .

Textbook(s):

1. Stephen H. F., Arnold J. I. and Lawrence E. S., *Linear Algebra*, 4th edition, Prentice Hall, 2003
2. Hoffman, K. and Kunze, R., *Linear Algebra*, Prentice Hall, 1984.

Suggested Readings:

1. Halmos, P. R., Finite dimensional vector spaces, Springer Verlag, New York, 1987.
2. Poole, David, Linear Algebra: A modern introduction, 3rd edition, Brroks/Cole Cengage learning, 2011.

MD 222: Co-ordinate Geometry

L 3 T1 P0 CR4

Course outcomes

CO1:   At the end of the course the student will have a concrete understanding of conic sections both in 2D and 3D, and would be able to apply the concepts and solve problems.

Course content

- Transformation of co-ordinate axes. Pair of straight lines. General equation of second degree and the conditions for representing a pair of straight lines, a parabola, an ellipse, a hyperbola and a circle.

- Reduction to standard forms: The centre of a conic, Reduction of the equation of a central conic, Equation of the axes and length of the axes, Reduction of the equation of a non-central conic. The equation of tangent, Condition of tangency of line, Equation of normal, Pair of tangents and director circle, Chord of contact, Pole and polar, Chord in terms of middle points, Diameter and conjugate diameters, Asymptotes.

- Polar equation of a conic, tangent and normal, properties. Circle and its parametric form, Orthogonal circle, condition of orthogonality of circles.

- Change of axes: shift of origin, rotation of axes. Sphere, Cone and Cylinder.

- Central Conicoids: Ellipsoid, Hyperboloid of one and two sheets. Intersection of a conicoid and a line: Tangent line, tangent plane, condition of tangency, Director sphere. Normal: Equation of the normal, number of normals from a given point, cubic curve through the feet of the normal, cone through six normal. Polar plane and polar lines, Enveloping cone, Enveloping cylinder, Diameters and diametral planes, conjugate diameters and diametral planes.

- The paraboloid. Reduction of second degree equations.

Textbook(s):

1. Jain, P.K. and Ahmad, K., *Text Book of Analytical Geometry of two & three Dimensions*, New Age Publications, 2014.
2. Das, B., *Analytical Geometry and Vector Analysis*, (Orient Book Company, 1995).

Suggested Readings:

1. Khan, R.M., *Analytical Geometry & Vector Analysis*, (New Central Book Agency Pvt. Ltd., 2004).
2. Askwith, E. H., *A Course of Pure Geometry*, Michigan Historical Reprint Series (University of Michigan Library, 2005).
3. Askwith, E. H. and Askwith, E., *A Course of Pure Geometry* (Hard Press, 2007).
4. Spain, B., *Analytical Conics* (Dover, 2007).
5. McCrea, W. H., *Analytical Geometry of Three Dimensions* (Dover, 2006).

MD 224: Numerical Methods and Boolean Algebra

L3 T1 P0 CR4

Course outcomes

After completion of this course student will learn

CO1: basic concepts in group theory, cyclic groups, permutation groups, subgroups, normal subgroups and group homomorphisms

Course content

➢ Finite Difference operators and their operations on functions of a single variable. Existence and uniqueness of interpolating polynomial, Lagrange interpolation, Newton divided difference, forward and backward interpolation, central difference interpolation and associated error terms. Extrapolation and inverse interpolation. Properties of divided differences.

➢ Roots of algebraic and transcendental equations: Bisection method, Secant method, Regula- Falsi method, Newton-Raphson method, their geometrical interpretation and derivation.

➢ Numerical differentiation, Richardson's extrapolation.

➢ Numerical integration: Newton –Cotes quadrature formula, Trapezoidal rule, Simpson's 1/3rd and 3/8th rule of integration. Use, interpretation and derivation. Composite Trapezoidal and Simpson's rules. Double integration.

➢ Solution of system of linear algebraic equations: Direct methods- Gauss elimination, pivoting and Gauss-Jordan methods. LU-factorization.

➢ Boolean ring and Boolean algebra, principle of duality, fields of sets, elementary relations.

Textbook(s):

1. Atkinson, K.E., *An introduction to Numerical Analysis,* 2nd edition (John Wiley and Sons. 2004).
2. Burden, R.L., and Faires, J.D., *Numerical analysis theory and applications* (Cengage Learning, 2005).

Suggested readings:

1. Jain, M.K., Iyengar, S.R.K. and Jain R.K., *Numerical methods for Scientific and Engineering Computation,* 5th edition (New Age International (P) Ltd., New Delhi, 2006).
2. Sastry, S.S., *Introductory methods of Numerical Analysis* (Prentice Hall of India, New Delhi, 1997).

ED 203: Contemporary Issues in Education

L2 T0 P1 CH4 CR3

Course outcomes

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

CO1: contextualise education in promotion of constitutional values and utilize information about human rights to formulate policies in education.

CO2: recognise the intersection between gender and other socio-cultural identities and develop inclusive classroom environment.

CO3: understand the concept and importance of yoga education and demonstrate basic asanas and pranayams for holistic development.

CO4: identify factors that give rise to conflict and war and suggest strategies to promote peace through education.

Course content

Unit-1: Indian constitution and Human Rights

➢ Human Rights- Definition, Historical Background
➢ United Nations and Universal Declaration of Human Rights
➢ Right to Child Protection, Constitutional provisions
➢ National Human Rights Commission, State Human Rights Commission
➢ Role of Voluntary organizations and Educational Institutions
➢ Constitutional provisions for Universalization of Elementary Education
➢ Right to education and its implications for Universalization of Secondary Education (USE)

Unit-2: Gender Issues in Education

➢ Gender Culture and Institution: Intersection of class, caste and religion,
➢ Construction of Gender in Curriculum Framework since Independence: An Analysis, Gender and the hidden curriculum, Gender in Text and Context (textbooks inter-sectionality with other disciplines, classroom processes including pedagogy),
➢ Meaning of Equality of Educational Opportunities, provision and outcomes; constitutional provisions for ensuring equity
➢ Nature and forms of inequality including dominant and minor groups, gender
➢ Inequality in schooling: public-private schools; Rural-urban-tribal schools, and differential school systems – schools for education of the challenged, idea of Common School System

Unit-3: Inclusive Education

➢ Definition, concept and importance of inclusive education
➢ Historical perspectives on education of children with diverse needs
➢ Difference between special education, integrated education and inclusive education
➢ Advantages of inclusive education for education for all children
➢ International& National Initiatives
➢ Current Laws and Policy Perspectives supporting IE for children with diverse needs

Unit-4: Yoga Education

➢ Origin of Yoga & its brief development,
➢ Yoga as a Science or Art (Yoga Philosophy and essential).
➢ Meaning of Yoga, Objectives, Types, importance of yoga and yogic Asanas
➢ Meditation – Objectives, types, effect on body, mind and soul,
➢ Yogic therapies and modern concept of Yoga

Unit-5: Peace Education

➢ Peace as a dynamic Social Reality
➢ Relevance of Peace: regional, national and international contexts
➢ Dangers to Social Security: terrorism, war, natural calamities and impact on quality of life
➢ Peace context: conditions for promotion of peace, UNESCO's concerns on Peace and
➢ Understanding, National Integration, International Understanding
➢ Role of education in promotion of peace: implications for pedagogy
➢ Teacher role in promoting peace

School Based Activities

➢ Analysis of school textbooks from gender equality perspective.
➢ Survey of students on awareness of gender equality concerns.
➢ Students will visit the schools and identify the children with special needs and find out the extent to which they are benefited by the current laws and policy perspectives
➢ Students will learn basic aasanas and pranayama during practical period and visit a school and give Yoga training to the students
➢ Survey of students on awareness of human rights

Textbook(s):
1. Gupta, S., *Education in Emerging India*, Shipra Publications, Delhi, 2008.
2. Rao, V. K. and Nayak, A.K., *Secondary Education,* A.P.H. Publishing Corporation, New Delhi, 2002.

Suggested Readings:
1. Kumar, Arvind, *Environmental challenges of the 21st century,* APH Publishing Corporation, New Delhi, 2003.
2. *Govt. of IndiaNational Policy on Education,* Min. of HRD, New Delhi, 1986.

3. *Govt. of India.Programme of Action (NPE),* Min of HRD, New Delhi, 1992.
4. *UNESCO.Education for All: The Quality Imperative,* EFA Global Monitoring Report., UNESCO, Paris, 2004.

ED 204: Assessment and Evaluation

L2 T0 P1 CR3

Course outcomes

After the completion of this course, the student teacher:

CO1:   critically analyses the recent trends and scope of assessment and evaluation.

CO2:   examines the contextual roles of different forms of assessment in schools.

CO3:   explores the different dimensions, procedures, tools and techniques related to assessment

CO4:   examines the issues and concerns of assessment and evaluation practices in schools.

CO5:   apply the statistical tools for analysis and interpretation in educational assessment process.

Course content

Unit 1: Perspectives on Assessment and Evaluation
➢ Conceptual overview of assessment and Evaluation
➢ Meaning, Principles and Purposes of Assessment and Evaluation
➢ Forms of assessment: based on
- purpose : prognostic, formative, diagnostic and summative,
- nature of information gathered : qualitative, quantitative
- nature of interpretation : norm referenced, criterion referenced

Unit -2: Tools and Techniques for Assessment and Evaluation
➢ Different Types of Tests
- Paper pencil tests, Oral tests, and Performance tests
- Construction of an Achievement Test and Diagnostic test
➢ Different Types of Tests
- Rating scale, Check list, Anecdotal records , Socio-metric technique,Interview, Questionnaire and Inventory
- Use of Projects, Assignments, Work sheets, Practical work, Seminars and Reports as assessment devices

- Self-assessment and peer-assessment practices
- Developing and maintaining a comprehensive learner profile

Unit-3: Reforms in Evaluation
- Recent trends and practices prevailing in assessment and evaluation: online assessment, open book exam, participatory assessment, performance based assessment
- Rubrics & Portfolios: Meaning and significance in evaluation
- Continuous and comprehensive evaluation
- Credit system and Grading - direct and indirect

Unit- 4: Issues, Concerns and Trends in Assessment and Evaluation
- Issues and Problems: Marking Vs Grading, No detention policy, Objectivity Vs Subjectivity
- Policy perspectives on examinations and evaluation: Recommendations in National Policies of Education and curriculum frameworks.
- Impact of entrance test and public examination on teaching and learning

Unit-5: Elementary Statistics in Educational Evaluation
- Need and importance of statistics in education
- Classification and tabulation of data
- Graphical representations of data
- Measures of central tendency, Measures of variability, Measure of Relative Position: Percentiles and Percentile Ranks
- Normal distribution - normal probability curve and its characteristics

Engagement with the Field/Practicum/Activity: The Students may undertake any one of the following activities:

- Design a Questionnaire or Interview Schedule in a selected topic
- Design different types of questions items and identify the reliability of the test.
- Present the report of student: using a portfolio or rubrics

Suggested Readings and References:

Textbook(s):
1. Sidhu, K.S., *New Approaches to Measurement and Evaluation,* Sterling Publishers, New Delhi, 2009.
2. Lal, J.P., *Educational Measurement and Evaluation*. New Delhi: Anmol Publications, 2006.
3. George, D., *Modern Trends in Examination System,* New Delhi: Commonwealth Publication, 2005.

Suggested Readings:
1. Reid, Howard M., *Introduction to Statistics-Fundamental Concepts and Procedures of Data Analysis*. New Delhi: SAGE Publications Pvt Ltd., 2013.
2. Gardner, John, *Assessment and Learning* -2nd edition, New Delhi: SAGE Publications India Pvt. Ltd., 2012.

3. *Pearson Series in Education Essentials of Educational Technology and Management*, New Delhi, Pearson Education, 2012.
4. Quinlan, Audrey M. A., *Complete Guide to Rubrics: Assessment Made Easy for Teachers*, K. D. College, USA: Rowman Littlefield Education, 2012.

Online/Web Resources/eBooks (Links)

1. Hickey, D. & Itow, R. C. (2012). Participatory assessment for participatory teaching and learning in school contexts**.** *Designing with Teachers: Participatory Approaches to Professional   Development   and   Education*,78-88.   https://dmlhub.net/wp-content/uploads/2012/08/designing-with-teachers.pdf
2. Northern Illinois University Center for Innovative Teaching and Learning. (2012). Rubrics for assessment. *Instructional guide for university faculty and teaching assistants.* https://www.niu.edu/citl/resources/guides/instructional-guide

3. Davis, M. H., & Ponnamperuma, G. G. (2005). Portfolio assessment. *Journal of Veterinary Medical Education, 32*(3), 279–284. https://doi.org/10.3138/jvme.32.3.279

4. Brualdi A. (2000). Implementing Performance Assessment in the Classroom. *Classroom Leadership, 3*(5) http://www.ascd.org/publications/classroom leadership/feb2000/Implementing-Performance-Assessment-in-the-Classroom.aspx

MD 311: Calculus II

L3 T1 P0 CR4

Course outcomes

After the completion of this course, the student teacher will be able to:
CO1: Evaluate integrals involving reduction techniques.
CO2: Identify and evaluate Improper integrals and use beta gamma functions.

CO3: Use techniques of vector calculus in physical problems.
CO4:   Evaluate double and triple integrals and use them to calculate area, length, volume and surface area of solids of revolution.
CO5: To learn and identify where and how to apply Green, Gauss and Stokes theorem.

Course content

➢ Reduction formulae for integration. Improper Integral, Beta and Gamma functions.

➢ Line integral, Double integral, triple integral, Jacobian, Surface integral and their applications. Volume, Area, length, volume and surface area of solids of revolution.

➢ Vector Calculus, vector point function, continuity and differentiation of vector point function, partial derivative of vectors, Curl, Gradient, Divergence. Vector Integration.

➢ Green, Gauss and Stokes Theorems and their applications.

Textbook(s):

1. Apostol, T. M., *Calculus*, Vol I & II, (John Wiley and Sons, Second (Indian) Edition), 2007.

Suggested readings:

1. Spiegel, M. R. *Vector Analysis,* Schaum's outline series, (Publishing House India), 2009.
2. Thomas and Finney, *Calculus and Analytic Geometry,* (Pearson Education, Eleventh (Indian) Edition), 1998.
3. B. C. Das and B. N. Mukherjee, *Integral Calculus*, U N Dhur & Sons Private Ltd, (19th Editions) 1977.
4. R. Cournat, *Differntial and Integral Calculus*, John Wiley & Sons, 1970.
5. G. A. Osborne, *Differential and Integral Calculus with examples and applications*, Forgotten Books' Classic Reprint Series, 2011.

MD313: Programming, Algorithm and Mathematical Software

L2 T0 P2 CR4

Course outcomes

CO1: Towards the end of the course the student would be able to use Mathematica/MATLAB for solving various problems of mathematics.

Course content

➢ Algorithms and flowcharts. Divide and conquer strategy.

➢ Fundamentals of C: Data types in C, variables in C, input output statements, constant declaration, arithmetic operators in C, arithmetic expressions, assignment statements, arithmetic assignment operators, increment and decrement operators, type conversions, operator precedence.

➢ Basic techniques: sum of numbers, swapping contents of variables, computing area, simple interest etc. Decision making: if statement, if…else statement, the break statement, the continue statement, the go-to statement.

➢ Looping techniques: for loop, while loop, do…while loop.

➢ Basic operations through Matlab, Input through keyboard and its illustration, Flow Control statements.

➢ Iterative Method for Solving Non-linear Equation, Numerical Integration, Numerical Solution of 1st order IVP.

➢ Numerical Differentiation and BVP.

➢ Introduction to Mathematica, Symbolic Computation.

Textbook(s):

1. Rajaraman, V., *Fundamentals of Computers*, (PHI, 2002).
2. Venkateshmurthy,M.G., *Programming Techniques through C-A Beginner's Companion*, (Pearson Education, 2002).

Suggested readings:

1. Hunt, B. R., Lipsman, R. L., Osborn, John E. & Rosenberg, J., *Differential Equations with Matlab*, (Wiley, 2005).
2. Wolfram, S., *The Mathematica Book* (Wolfram Media, 2008).
3. Gray, T. W. & Glynn, G., *The Beginners Guide to Mathematica*, Version 4, Addision-(Wesley, 2008).

MD 315: Statics and Dynamics

L3 T1 P0 CR4

Course outcomes

>   CO1:   It is expected that at the end of the course the student will be able to apply
>
>   knowledge of Statics and Dynamics wherever needed further.

Course content

> ➢ Centre of Mass, Radius of gyration, Centre of gravity of a plane area, arc and sector of a curve. Centre of gravity of solids and surface of revolution.

> ➢ Friction, laws of friction, limiting friction, equilibrium of a particle in rough inclined plane.

> ➢ Buoyancy, Hydrostatic equilibrium, Archimedes' Principle, Capillary rise, Surface Tension.

> ➢ Principle of virtual work in two dimensions, Neutral, Stable and Unstable equilibrium.

> ➢ Velocities and acceleration, Newton's laws of motion, velocity and acceleration in curvilinear coordinates, tangential and normal components of velocity, acceleration, momentum, force etc.

> ➢ One dimensional motion in resisting medium; motion of particles of variable mass, Rocket motion. Two dimensional motion, motion of a projectile.

> ➢ Central force reduced mass, angular momentum; motion under central force, inverse square law of motion, polar equation of orbit, Keplar's laws of motion.

> ➢ Periodic motion; Simple harmonic motion, Differential equation of simple harmonic motion and solution, Kinetic and Potential energies of Simple harmonic motion, Compound pendulum.

> ➢ Kinematics of rigid bodies, Euler's theorem, moments and products of inertia.

> ➢ Parallel axes theorem, theorem of six constants. Principal axes.

Textbook(s):

> 1.   Whittaker, E.T. and McCrea, W., *A Treatise on the Analytical Dynamics of Particles and Rigid Bodies: with an Introduction to the Problem of Three Bodies* (Cambridge University Press, 1988).
> 2.   Loney, S. L., *Elements of Statics & Dynamics*, Part I (Maxford Books, 2003).

Suggested readings:

> 1.   Spiegel, M. R., *Schaum's Outline of Theory and Problems of Theoretical Mechanics: with an Introduction to Lagrange's Equations and Hamiltonian Theory* (McGraw-Hill, 2007).

2. Ramsey, A. T., *Dynamics*, 2nd Edition (The University Press, 2007).
3. Chorlton, *F. Textbook of Dynamics*, 2nd edition (Horwood, 1983).
4. Loney, S. L., *An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies*, (AITBS Publishers, 2016).

MD 317: Elementary Complex Analysis

L3 T1 P0 CR4

Course outcomes

Towards the end of the course students are expected to:

CO1: Learn the concept of analytic functions

CO2: Complex integration over curves, and contours

CO3: Connection between analytic functions and their integration over closed contour

Course content

➢ Complex numbers as ordered pairs, Geometric representation of complex numbers, Riemann sphere and Stereographic Projection.

➢ Continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations, harmonic functions.

➢ Elementary analytic functions (exponential function, trigonometric functions and logarithm function) and their mapping properties.

➢ Complex integration, Cauchy-Goursat theorem, Cauchy's integral formula.

➢ Cauchy's Integral formula for derivatives, Cauchy's inequality and Liouville's theorem, the fundamental theorem of algebra, Maximum-modulus theorem, Morera's theorem.

Textbook(s):

1. Churchill R. V. and Brown, J. W., *Complex variables and applications*, McGraw-Hill International edition, 2006.
2. Mathews, J. H. and Howell, R. W., Complex Analysis for Mathematics and Engineering, 3rd Edition, Narosa, 1998.

Suggested readings:

1. Saff, E. B. and Snider, A. D., *Fundamentals of Complex Analysis with applications to Engineering and Science,* 3rd Edition, Pearson, 2003 (ISBN 978-81-317-2019-6)

ED 301: Teaching Approaches and Strategies

L2 T0 P1 CR3

Course outcomes

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

CO1: Demonstrate his/her understanding of the role of a teacher at different phases of Instruction.

CO2: Demonstrate his/her understanding of different skills and their roles in effective teaching.

CO3: Critically reflect on the suitability of learning resources planned in teaching-learning and design ICT integrated learning resources.

CO4: Understand and Apply Learning Resources for Different Pedagogies.

CO5: Understand Changing roles and develop competencies of a teacher in technology enhanced learning

Course content

Unit -1: Understanding Teaching

➢ Teaching as a planned activity – elements of planning
➢ An analysis of teacher roles and functions:
  i) pre-active phase: visualizing; decision-making on outcomes, preparing and organization;
  ii) interactive phase facilitating and managing learning;
  iii) post-active phase – assessment of learning outcomes,
➢ Professionalism in teaching, professional ethics, concepts of teaching- skills, competencies and commitments.

Unit- 2: Teaching Approaches and Models of Teaching

➢ Instructional Skills: Structuring, Soliciting and Reacting, Verbal and Non-verbal, Feedback and Reinforcement, Discourse, Demonstration and Modeling
➢ Advance Organizer Model, Inquiry Strategy as approach to teaching thinking skills and construction of knowledge, Concept Attainment/ Concept Formation, Inductive Thinking, Problem Based Learning/Project Based Learning
➢ Approaches to Organizing Learning - Approaches to Individualized Instruction: Computer Managed Instruction, Programmed Instruction, and Learning Activity:
➢ Packages; Approaches to Small Group and Whole Group Instruction: Cooperative and Collaborative approaches to learning, Brain storming, Role Play and Dramatization, Group Discussion, Simulation and Games, Debate, Quiz and Seminar

Unit -3: Learning Resources for Classroom Teaching

➢ Meaning, purpose, steps in development, guidelines for use, and criteria of judging quality of the following resources
➢ Print Resources: resources for communicating verbal experiences - text book, work book,Case study and self-instructional material
➢ Audio Resources: resources for communicating audio experiences - educational radio
➢ Broadcast and audio programmes – an analysis of their formats, strengths and limitations
➢ Visual Resources: Resources for communicating visual experiences
➢ Non-projected visual Resources: graph, map chart, poster, models and material – nature of experiences provided by them, their making and possibilities of using them as learning resources
➢ Projected Visual Resources: still visuals – slide, transparency and film-strip, moving visuals –film, video and animation

Unit-4: Learning Resources for Different Pedagogies

➢ Media selection, utilization and integration into teaching and learning – learning resources for different pedagogies: a classification of learning resources based on teaching objectives.
➢ Principles of self-learning
➢ Ways and means of promoting self-learning: organization, merits and demerits of
➢ Computer Assisted Instruction, personalized system of instruction, self-paced activity,

- Learning activity packages, learning centers, mini courses, modular instruction, and Programmed instruction
- Learning to learn skills – An analysis and teacher's role in promoting them.

Unit-5: Technology-Enhanced Learning Resources
- ICT and Multimedia as technology-enhanced communication devices in teaching-learning: a comparative review of various learning resources, Flip Class
- Interactive white board – its features and advantages
- Computer as a learning resource for presentation, documentation, word processing, evaluation. Animation and other visual presentation options on a computer; Internet as an Information Resource; evaluating information resources on the Internet
- Emerging Internet trends and technologies for facilitating learning
- Designing and Developing Technology-enhanced Learning Material
- Changing roles and competencies of a teacher in technology enhanced learning

School Based Activities:
Students will visit the school and observe the learning resources available in the school.

- Preparation of at least three teaching-learning resources from those mentioned in Unit 2
- Planning and preparation of an ICT integrated presentation for secondary level
- Identification and use of an internet resource for learning at the secondary level
- Critical analysis of an existing learning resource
- Observe the teachers of various classes and identify the skills they adopt in their interaction with pupils.
- Observe a teacher in action in the classroom and list down his / her various behaviors.
- Observe the transactional mode of teachers who adopt different teaching methods.
- Write down the name of a few methods that teachers generally employ for the purpose of teaching and classify them under teacher centered, pupil centered or group centered.
- Writing instructional objectives for different content categories
- Identifying skills incorporated in a lesson plan and judging their appropriateness and Adequacy
- Practice of skills in a simulated situation.

Textbook(s):

1. Kochar, S.K. Methods and Techniques of Teaching (Sterling Publishers, New Delhi, 2009).
2. Rao, V.K. and Reddy, R.S (ed.) Teaching and Learning. Commonwealth Publishers, New Delhi, 2007.
3. Sampath K. et al Introduction to Educational Technology(Sterling Publishers, New Delhi, 2009)

Suggested Readings:

1. Bloom, B. S., Englehart M D, Furst E. J., Hill W. H. and Khrath wohl, D. R., *Taxonomy of Educational Objective Handbook 1 -Cognitive Domain,,* Longman, London,1964.
2. Bloom, B. S., Englehart M D, Furst E. J., Hill W. H. and Khrath wohl, D. R., *Taxonomy of Educational Objective Handbook II -Affective Domain* Longman, London,1964 .
3. Jangira N K and Ajit Singh, *Core Teaching Skills: The Microteaching Approach*, NCERT, New Delhi, 1982.

4. Kumar, K. L., *Educational Technology*. New Age International (P) Ltd Publishers, NewDelhi, 1996.

ED 302: Classroom Organizations and Management

Course outcomes

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

CO1: Analyse the purpose of classroom management for effective teaching-learning process.

CO2: Describe various physical facilities required for smooth functioning of school activities.

CO3: Explain the role of teachers and the principal in ensuring a vibrant school climate

CO4: Discuss various ways of preventing problems in managing a classroom.

CO5: Explain various mechanisms for coordinating the functions of school.

Course content

Unit -1: Classroom Organization

➢ Classroom organization– Meaning and purposes. Seating arrangements and its purposes.

➢ Concept of a smart classroom. Display area and chalk board – other facilities such as OHP and Multimedia in a classroom.

➢ Characteristics of School climate – conducive, learner friendly, inclusive, vibrant, Relation between school policy and school climate

Unit -2: Physical Facilities in a School

➢ Physical resources in a school - physical space (building) with adequate classroom space, adequate furniture, learning resources such as labs, library, sports field, and staffrooms, rest rooms, etc.

➢ Management of physical resources - Cleanliness, appropriate use of each with an intent or Schedule; Streamlining ways of using the facilities: coordination, sharing

Unit-3: School Environment- Teachers' Role

➢ School as an institution with an environment of its own leadership style of the headmaster and its influence on teacher role performance

➢ Visualize the requirements- procure, maintain and replenish with support of authorities,

➢ Teacher self-assessment and accountability – importance of feedback,

➢ Factors affecting school environment - goodwill, acceptance, belongingness, openness, orderliness, and access, both among teaches and between teachers and students, promoting self-esteem among students; Team work and transparency in functioning among teachers

Unit- 4: Classroom Management

➢ Classroom management – concept, need and approaches

➢ Roles of students in a classroom – leader, follower and non-participant

➢ Role of a teacher in classroom management – relationship between leadership styles of a teacher and classroom discipline

➢ Managing behavior problems in a classroom– Preventative, Supportive and Corrective.

➢ Common - mistakes in classroom behavior management. Establishment of routines, rules and procedures

➢ Punishment and its legal implications – the rights of a child

> Time management in a classroom – allocated time versus engaged time

Unit – 5: Mechanisms for Coordinated Functioning in School

> Planning: annual and long term; annual school calendar
> Day to day schedules- time table, notifications, announcements, Monitoring for coordinated functioning: allotment, autonomy and accountability (internal and external)
> Staff Meetings: forum for sharing, review and further planning,Regular, documentation of events and activities
> Approaches to professional development of teachers in a school
> Mechanisms that promote and hinder school-community and teacher-parent relationship

School Based Activities:

Students will visit the school and:

> Observe the school environment and identify the problems of the students and interact with head and teachers regarding the solutions. Conduct an action research project on secondary school classroom problem.
> Survey of resources available (human and material) in a school and the manner of their utilization.
> Draw out a plan of the school building in the area and write a critical report.
> In consultation with the principal and teachers of a school, prepare an institutional plan.
> Observe the various activities run in the school to understand the mechanism of school. Assess the existing monitoring mechanism at secondary school and give suggestion for improvement.

Textbook(s):

1. Krishnamacharyulu. V., *School Management and system of Education,* Neelkamal publications PVT. Ltd., 2008.
2. Siddhu, S.K., *School Organization and Administration,* New Delhi, Sterling Publishers, 1987.
3. Gupta, S. K. and Gupta S., *Educational Administration and Management* ManoramaPrakashan, Indore, 1991.

Suggested Readings:

1. Wayne Hoy & Cecil Mskel, *Educational Administration: Theory, Research and Practice,* Mcgraw Hill Humanities, 9th edition, 2012.
2. Fred.C.Lunenburg & Allan C.Ornstein, *Educational Administration: Concepts And Practices,Cengage Learning,* 6th Edition, 2012.
3. Marsh, C., *Handbook for Beginning Teachers,* Second Edition, Pearson Education, Australia, 2000.
4. Vashist, Savita(ed.), *Encyclopedia of School Education and Management,* Kamal Publishing House, New Delhi, 1998.
5. Chau, Ta-Ngoc., *Demographic Aspects of Educational Planning*, International Institute for Educational Planning,Paris, 2003.

MD 318: Introductory Topology

Course outcomes

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

CO1: Demonstrate an understanding of the concepts of metric spaces and topological spaces, and their role in mathematics

CO2: Demonstrate an understanding of the basic of convergence of sequences, continuity of functions in metric

CO3: Spaces and topological spaces.

CO4: Apply the theory in the course to solve a variety of problems at an appropriate level of difficulty.

Course content

➤ Definition and examples of metric spaces, Neighborhoods, Limit points, Interior and boundary points, Open and closed sets, Closure and interior of a set, Equivalent metrics.

➤ Subspaces, Cauchy sequences, Completeness, Cantor's intersection theorem, Baire's category theorem.

➤ Continuous functions, Uniform continuity, Isometry.

➤ Topological spaces, examples, basis and sub-basis, subspaces, closure, interior, exterior and boundary.

➤ Continuity, open functions, homeomorphisms, embeddings, strong and weak topologies.

Textbook(s):

1. O'Searcoid, M., *Metric Spaces*, Springer, 2006.
2. Shirali, S. and Vasudeva, H. L., *Metric Spaces*, Springer, 2007.

Suggested Readings:

1. Kumersan, S., *Topology of Metric Spaces*, Narosa, 2011.
2. Simmons, G. F., *Topology and Modern Analysis*, McGraw Hill Education, 2017.

MD 314: Elementary Number Theory

L3 T1 P0 CR4

Course outcomes

At the end of the course the student will be able to go for higher courses in number theory.

CO1: They will be more logical and careful in finding proofs of mathematical results.

CO2: They will be able to answer the questions related to number theory in NET/GATE examinations.

Course content

➤ Divisibility, greatest common divisor, least common multiple, Euclidean Algorithm.

➤ Prime numbers, factorization in prime numbers, fundamental theorem of arithmetic.

- Divisor functions, perfect numbers, Mersenne numbers, Fermat numbers.

- Greatest integer function (Gauss function), Mobius function, Euler function.

- Concept of congruences and its elementary properties, congruences in one unknown, complete residue system, reduced residue system.

- Diophantine equations, linear Diophantine equations, Pythagoras equation, sum of two squares.

- Quadratic residues and congruences of second degree in one unknown, Legendre symbol, Jacobi symbol, congruences of second degree with prime modulus and with composite modulus.

- Primitive roots and indices, order, necessary and sufficient condition for the existence of primitive roots, construction of reduced residue system.

- Continued fractions, simple continued fractions, approximation of irrational numbers by continued fractions, solution of Pell's equation.

Textbook(s):

1. Burton, D. M., *Elementary Number Theory*, 6th Edition (Tata McGraw-Hill, New Delhi, 2007).
2. Niven, I. and Zuckerman, H., *An Introduction to the Theory of Numbers*, 5th Edition (Wiley Eastern, New Delhi, 2000).

Suggested readings:

1. Hardy, G.H. and Wright, E. M., *An Introduction to the Theory of Numbers*, 4th edition (Oxford University Press, 1960).
2. Andrews, G.E., *Number Theory* (Hindustan Publishing Corporation, New Delhi, 1992).
3. Telang, S. G., *Number Theory* (Tata McGraw-Hill, New Delhi, 1996).
4. Hsiung, Y., *Elementary Theory of Numbers* (World Scientific, 1992; First Indian Reprint, Allied Publishers Limited, 1995).

MD 316: Introduction to Optimization

L3 T1 P0 CR4

Course outcomes

CO1: After completion of the course we expect that the student will be able to formulate fairly complex optimization problems and will be able to solve.

Course content

- General linear programming problems, Standard form of L.P.P., Graphical method for L.P.P.

- Geometry of linear programming: Polyhedra and Convex sets, Extreme point, vertices and basic solutions, basic feasible solutions,, Convex function, Convex hull of a set, Convex polyhedrons, Existence of extreme points, optimality of extreme points.

- Supporting hyperplanes and extreme points, Development of Simplex method, Applications of Simplex Technique, Column geometry and the simplex method, Solution of Simultaneous Equations, Inverse of a Matrix By Simplex Method, Problem of Degeneracy.

- The dual Problem, duality theorem, comparison of solutions of primal and its dual. Standard form problems and the dual simplex method along with its limitations, Farkas' lemma and linear inequalities, Separating hyperplane and duality General linear programming duality.

- Formulation of LP problem in revised simplex form. Computational procedure (algorithms). Advantage of revised simplex over simplex.

Textbook(s):

1. Hadley, G., *Linear Programming,* (Narosa Publishing House, New Delhi, 1987).
2. Kanti Swaroop, P.K. Jain and Man Mohan, *Operation Research: An Introduction,* (S. Chand & Company, New Delhi, 1996).

Suggested readings:

1. Taha, H.A., *Operation Research: An Itroduction,* (Macmilllan, New York., 1992)
2. Kambo, N.S., *Mathematical Programming Techniques,* (Affiated East West Press, New Delhi., 1990).

MD 322: Seminar

L0 T0 P3 CR3

Course outcomes

CO1: After the completion of this course, the student will develop preperation of presentation materials and presentation skil.

ED 308: Pedagogy A: Physical Science-I

L2 T0 P1 CR3

Course outcomes

After the completion of this course, the student

CO1: describes the meaning, nature, scope and historical development of physical science and discuss strategies to promote scientific attitude, scientific temper among learners following the steps of scientific method.

CO2: formulates the aims and objectives of teaching and learning physical science.

CO3: design the framework of lesson plan using different teaching methods, approaches and strategies for teaching-learning of physical science.

CO4: develops and use various resources for teaching-learning physical science.

CO5: compares the perspective of science curriculum in the NCFs with prescribed school science syllabus and textbooks.

Course content

Unit -1: Nature and Scope of Physical Science

➢ Nature and Scope of Physical Science, Historical and Developmental Perspectives of Science
➢ Role of Science in Removing Ignorance and Superstition, Bringing Socio-Economic Changes Concern to Environment
➢ Steps in Scientific Method. Developing Scientific Attitude and Scientific Temper
➢ Science process skills

Unit–2: Aims & Objectives of Teaching and Learning Physical Science

➢ Aims & Objectives of Teaching Physical Science at Secondary School Level.
➢ Formation of General and Specific Objectives w.r.t the Taxonomy of Educational Objectives(Bloom's Taxonomy with Anderson & Krathwohl's Revision)
➢ Nurturing Curiosity, Creativity and Aesthetic Sense in Physical Science
➢ Development of Problem Solving Skills in Physical Science

Unit-3: Pedagogy of Physical Science

➢ Criteria of selecting Appropriate Method, Approach and Strategy of Teaching-Learning Physical Science
➢ Methods of Teaching-Learning Physical Science: Teacher Centred and Students Centred
➢ Approaches and Strategies of teaching-Learning Physical Science: Constructivist Approach, Collaborative Learning Approach, Problem Solving Approach, Concept Mapping, Cognitive conflict, Experiential Learning Approach, Inquiry Approach, Analogy Strategy etc.
➢ ICT in Science Education

Unit-4: Resources for Teaching-Learning in Physical Science

➢ Identification of Learning Resources from Immediate Environment, Community resources in Teaching Learning Physical Science, Handling Hurdles in Utilisation of Resources
➢ Exploring Alternatives Resources, Collection of Locally Available materials and Improvisation of Apparatus, Science Kits
➢ Laboratory as a Learning resource, Planning and organization of Physical science laboratory
➢ Technology: Use of Various Web Resources (ICT resources) in Physical Science Teaching

Unit-5: Physical Science Curriculum and Text Book
- ➤ Place of Physical Science in School Curriculum
- ➤ Issues and Concerns of Physical Science Curriculum
- ➤ National Curriculum Frameworks of NCERT with Special Reference to Science Education, Emphasis of NCF-2005 on Transaction of Curriculum
- ➤ Analysis of Text Books, School Syllabus and Other Printed Materials in Physical Science (State, NCERT etc.), Characteristics of a Good Text book.

Engagement with the Field/Practicum/Activity: The Students may undertake any one of the following activities:
- ➤ Visit a school and organize a group activity to develop scientific attitude like quiz, role-play, panel discussion etc.
- ➤ Visit a school and organize a science exhibition and poster presentation of scientific concepts.
- ➤ Students will visit the school and identify various components in science laboratory and other related activities.
- ➤ Preparation of low cost and no cost learning teaching aids on any topic.
- ➤ Content analysis of any topics of sciences.
- ➤ Design & develop at least two learning resources for physical science (one out of them has to be an ICT based learning resource).
- ➤ Design a learning situation in Physical Science by selecting an appropriate strategy.
- ➤ Comparing the science textbooks at Secondary Stage on the basis of different validities of Science Curriculum stipulated in NCF-2005.

Suggested Readings and References

Textbook(s):
1. Vaidya,N., *Science Teaching for 21st Century*. Deep & Deep Publications, 1999.
2. Mohan, R., *Innovative Science Teaching for Physical Science Teachers*. Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
3. Das, R.C., *Science Teaching in Schools,* Sterling, New Delhi, 2009.
4. Gupta, S. K., *Teaching of Physical Science in Secondary Schools,* New Delhi, 1985.
5. NCERT., *Pedagogy of Science, Textbook of B.Ed.,* Part I&II, National Council for Educational Research and Training, New Delhi, 2013.

Suggested Readings:
1. NCERT., *National Curriculum Framework for School Education,* National Council of Educational Research and Training (NCERT), New Delhi, 2005.
2. NCERT., *Position Paper of National Focus Group on Teaching of Science,* New Delhi: NCERT, 2006.
3. Tobin, K., *The Practice of Constructivism in Science Education,* Lawrence Erlbaum Associates, 1993.
4. Tony L., Matt C., Bernie K. and Judith T., *Teaching Science,* New Delhi, Sage Publication India Pvt .Ltd., 2010.

Online/Web Resources/Websites/eBooks (Links):

1. International Bureau of Education The Chinese National Commission For Unesco (2000). *Science Education For Contemporary Society :Problems, Issues and Dilemmas.* Final Report Of The International Workshop On The Reform In The Teaching Of Science And Technology At Primary And Secondary Level In Asia:Comparative References To Europe. http://www.ibe.unesco.org/sites/default/files/China_FinalReport.pdf

2. National Academy of Sciences and . 2008. *Science, Evolution, and Creationism.* Washington, DC: The National Academies Press. https://doi.org/10.17226/11876.

3. McFarlane A. & Sakellariou S. (2002). The Role of ICT in Science Education, Cambridge Journal of Education, 32:2, 219-232, DOI: 10.1080/03057640220147568

4. Rocha Fernandes G.W., Rodrigues A.M., Rosa Ferreira C.A. (2019) ICT-Based Science Education: Main Digital Resources and Characterisation. In: Using ICT in Inquiry-Based Science Education. SpringerBriefs in Education. Springer, Cham. https://doi.org/10.1007/978-3-030-17895-6_1

ED307: Pedagogy B:Mathematics- I

L 2 T0 P1 CR 3

Course outcomes

On the completion of this course, the student teacher would be able to:

CO1: acquaint with the meaning and nature of discipline mathematics

CO2: internalize the aims and objectives of teaching mathematics and endow with the significance of taxonomy of instructional objectives of teaching mathematics

CO3: inquire into the contribution of eminent mathematicians

CO4: gain perspective on the principles, approaches and the recent trends in mathematics curriculum structuring and the mode of transaction

CO5: apprehend the pedagogy of teaching mathematics and tune themselves as a innovative practitioner

Course content

Unit I: Nature and Scope of Mathematics and Objectives of teaching it
- ➤ The concept, meaning and Nature of Mathematics
- ➤ Place and value of Mathematics in the Modern World
- ➤ Need and importance of Mathematics in school curriculum

Unit 2: Aims and Objectives of Teaching Mathematics
- ➤ Aims and Objectives of teaching Mathematics at different stages
- ➤ Taxonomy of Educational objectives –Cognitive, Affective, Psychomotor

- Need and importance of stating instructional objectives and identifying learning outcomes in behavioural terms
  .

Unit 3: History of Mathematics with special reference Indian Mathematics
- Contribution of Indian and Western Mathematicians
- Contribution of Arabs and Greeks to the development of mathematics
- Correlation of mathematics with other subjects

Unit 4: Construction and Organisation Mathematics Curriculum
- Principles governing the construction and organisation of curriculum
- Approaches in curriculum construction- Psychological, Logical, Topical and Spiral
- Modern Trends in curriculum construction and analysis of secondary level mathematics curriculum

Unit 5: Planning of Instruction in Mathematics
- Lesson plan - Selecting the content for instruction (facts, concepts, generalisation, process, Sequencing of content categories), identifying the teacher points, organisation of content.
- Choosing the appropriate methodology and teaching aids (Heuristic Method, Analytic-synthetic method, Inductive-deductive method and laboratory method)
- Construction of different types of tests and use of appropriate evaluation tools

School Based Activities:

- Preparation of biographic sketches of Indian Mathematicians.

- Observe the mathematics teacher and list down the various strategies, methods, techniques and audio visual materials practiced by them to stimulate the students understanding of concepts.

- Preparation of four lessons plans on any topics from prescribed mathematics school texts using 5E/or ICON models.

- Preparation of an achievement test on any topic by developing blue print on prescribed text and development of test items in conformity with blue print.

- Analyze the achievement test and identify the learning difficulties of students.

Textbook(s):

1. Chambers, Paul., *Teaching Mathematics*, New Delhi: Sage South Asia Publishers, 2010.

2. Sidhu, K.S., *The Teaching of Mathematics*, New Delhi: Sterling Publishers Pvt ltd., 2006.

3. Malhotra,V., *Methods of Teaching Mathematics*, New Delhi: Crescent Publishing Corporation, 2006.

4. Sudhir Kumar, *Teaching of Mathematics*, New Delhi: Anmol Publications, 2000.

Suggested Readings:

1. Clare Lee, S.,Johnston-Wilder, Robert Ward-Penny, *A Practical Guide to Teaching Mathematics in the Secondary School*, Routledge Publishers, London, 2012.
2. Deepka,E., *Designing assessment for mathematics*, 2nd Ed., Thousand Oaks, CA:Corwin Press, 2007.
3. Anderson, L., & Krawth Wohl, D.E., *A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives (Abridged)*, NewYork: Addison Wesley Longman, Inc., 2001.

ED 303: School Education in North East India

L2 T0 P0 CR2

Course outcomes

After the completion of this course, the student teacher will be able to:
CO1: Describe the Education scenario of the North East.
CO2: Explain the historical developments in school education in the region
CO3: Identify the common problems in the school education in different states of the region
CO4: Develop strategies for handling some of the problems by the teachers

Course content

Unit -1: North-East India – A Historical Perspective on Education
➢ North-east India-diversity, common features, phases of education
➢ Contribution of Missionaries towards Educational Development in the region
➢ Brief overview of educational development
➢ Imbalances of education, nature of disparity – caste/gender/urban/rural
➢ Right to Education Act 2010

Unit -2: School Education of the North-East
➢ Organization of Education - pre-primary, primary, secondary and higher secondary levels.
➢ Enrolment, dropout, concept of universalization of education
➢ Role of SSA, curriculum and teacher training;
➢ Implementation of SSA, RMSA, MDM, ICT etc

Unit- 3: Planning School Education
➢ Planning and administration of education at different levels -viz; state boards, central boards and NIOS.
➢ Problems, innovations and changes in school education.

Unit -4: Training and Educating School Teachers
➢ Brief historical development of Teacher Education in the North East India

- ➤ Role of SCERTs in teacher education in the North East India

- ➤ Functions of IASE, CTE, DIET etc in the North East India

- ➤ Role of NCTE in regulating teacher education in the North East India

Unit -5: Inclusive Policy in School Education

- ➤ Meaning, historical background of social exclusion

- ➤ Accessibility of school education to SC, ST, Tea garden communities, minority and other marginalized sections of the society

- ➤ Measures for ensuring inclusion in education including school education

- ➤ School Based Activities: seminars and group discussions

Text Book

1. Biloris Lynden and Utpal Kumar De, *Education in North East India: Experience & Challenge*, Concept Publishing Company, New Delhi, 2004.

Reference Book

1. L.K. Barua, *Education and Culture in North East India*, Indian Institute of Advanced Study, Shimla, 2011.

MD 425: Combinatorics

L3 T1 P0 CR4

Course outcomes

After completing the course student will

CO1: learn different combinatorial techniques and will be able to apply these techniques in solving problems in other branches of Mathematics.

CO2: be with increased the mathematical skill and mathematically matured.

Course content

- ➤ Basic counting rules, Permutations: Allocation Problem, Circular and Ring Permutations, Generalized Permutations, Combinations: Allocation Problem, Pascal's formula, Generalized combinations, The Multinomial Theorem, Properties of Binomial Coefficients.

- ➤ Partitioning of a set, The pigeonhole Principle: simple form, strong form, The inclusion-Exclusion principle, Calculating in two ways: Fubini's Principle, Derangements.

- ➤ Generating Functions: Ordinary generating Functions, Exponential generating Function.

- Recurrence Relations: Homogeneous Recurrence Relations, Inhomogeneous Recurrence Relation.

Textbook(s):

1. V. K. Balakrishnan, *Introductory Discrete Mathematics*, Dover Publications, New York, 1996.
2. Richard A. Brualdi, *Introductory Combinatorics*, 5th Edition, Pearson, 2010.

Suggested readings:

1. K. H. Rosen, *Discrete Mathematics & its Applications*, 6th Edition., Tata McGraw-Hill, 2007.

2. S. Lipschutz, M. Lipson, *Theory and Problems of Discrete Mathematics*, 3rd Edition, Schaum's Outline Series, McGraw-Hill.

MD 414: Computer Programming

L3 T1 P0 CR4

Course outcomes

It is expected that at the end of the course

CO1: the student will be able to apply knowledge and skill developed in this course to solve mathematical problems using C-programming.

CO2: students should be able to write their own codes based on various mathematical methods and implement the same.

Course content

- Revision of fundamentals of C: Data types in C, variables in C, input output statements, constant declaration, arithmetic operators in C, arithmetic expressions, assignment statements, arithmetic assignment operators, increment and decrement operators, type conversions, operator precedence. for loop, while loop, do…while loop, if statement, if…else statement, switch statement, conditional operators. The break statement, the continue statement, the go-to statement.

- Arrays: Arrays, declaration of one dimensional arrays, two dimensional arrays.

- Structures and Unions: User defined data types, structures, array of structures, unions, enumerated data type.

- Searching and Sorting: Bubble sort, selection sort, insertion sort, linear search and binary search.

- Function in C: Simple functions, passing arguments to functions with return value, call by value, call by reference, overloaded functions, inline functions, default arguments.

- Pointers: Introduction; accessing address of a variable; pointer declaration, initialization, accessing variable through pointer, chain of pointers; pointer expressions, increment and scale factor. Pointers and Arrays. Array of pointers. Pointers as function arguments.

- Files in C: Defining and opening a file, closing a file. Input/Output operations on files.

- ➢ Dynamic Memory Allocation and Linked list: Dynamic memory allocation, Malloc, Calloc, Free, Realloc. Concepts of linked list, advantages of linked list, types of linked list. Creating a linked list.

Textbook(s):

1. Rajaraman, V., *Fundamentals of Computers* Prentice Hall of India, New Delhi, 2002.
2. Balaguruswamy, E., *Programming in ANSI C,* Tata McGraw-Hill, 2004.

Suggested readings:

1. Kanetkar, Y. P., *Let us C,* BPB Publication, 2001.
2. Venkateshmurthy, M. G., *Programming Techniques through C,* Pearson Education, 2002.

MD 421: Computer Laboratory

L0 T0 P2 CR2

Course outcomes

It is expected that at the end of the course

CO1: the student will be able to develop their skill to write and execute C- programme to solve mathematical problems.

Course content

Practical unit for the course MI 414 Computer Programming

Textbook(s):

1. Rajaraman, V., *Fundamentals of Computers* Prentice Hall of India, New Delhi, 2002.
2. Balaguruswamy, E., *Programming in ANSI C,* Tata McGraw-Hill, 2004.

Suggested readings:

1. Kanetkar, Y. P., *Let us C,* BPB Publication, 2001.
2. Venkateshmurthy, M. G., *Programming Techniques through C,* Pearson Education, 2002.

ED 408: Pedagogy A: Physical Science-II

L2 T0 P1 CR3

Course outcomes

After the completion of this course, the student will learn

CO1: designs unit plan, lesson plans in physical science based on behaviourist and constructivist approaches and prepares teaching-learning aids in science.

CO2: identify the erroneous concepts in scientific knowledge and design dialogue strategies for communication.

CO3: plan & organises physical science co-curricular activities.

CO4: explains the need of different types of assessment strategies and discuss different tools and techniques of assessment in Physical Science.

CO5: describes the need & importance of professional development for physical science teachers.

Course content

Unit -1: Planning the Process of Teaching-Learning in Physical Science
➢ Need of Planning Teaching-learning Experiences in Physical Science
➢ Designing of Unit Plan and Lesson Plan in Physical Science & Its Significance, Lesson Planning based on Behaviourist & Constructivist Approaches
➢ Preparation of Various Types of Teaching–Learning Aids/Instructional Aids in Science Teaching, Principles for Selection of Proper Teaching-Learning Aids & their use.
➢ Skills of Teaching and Its significance
➢ Simulated Teaching as key component of Teaching Practice Programme, Use of Simulated Teaching to develop Skills of Teaching in teacher trainees

Unit-2: Exploring Learners and Learning Process
➢ Exploring Learners - generating discussion, involving learner in teaching –learning process Encouraging learner to raise questions, appreciating dialogue amongst peer group
➢ Science as a Discourse of Interdisciplinary learning;
➢ Communication in Science Learning
➢ Erroneous Concepts of Scientific Knowledge and Remedies: learner's preconception, sources of misconception, language and misconception, effective remedies.

Unit-3: Planning & Organising Physical Science Co-Curricular Activities
➢ Importance of Science Activities
➢ Planning & Organization of Field Visit/Study Tours, Project Work, Science quiz, Excursion, Science Exhibition: Nurturing Creative Talent at Local Level and Exploring Linkage with District/State/ Central Agencies
➢ Debate, Discussion, Drama, Poster making Visit to Various Places, Science club, Celebration of specific days, Science Fair etc.

Unit-4: Tools & Techniques of Assessment for Learning Physical Science
➢ Concept of Test, Examination, Measurement, Assessment and Evaluation
➢ Planning Assessment Framework in Physical Science, Learning Indicators in Physical Science

- ➢ Assessment of Process Skills/Experimental Skills in Science Teaching.
- ➢ Practicing Continuous and Comprehensive Evaluation/Assessment to test Regular Progress
- ➢ Tools & Techniques of Assessment in Physical Science- Assessment of Written & Oral Work, Project Work, Laboratory Work, Filed Trips, Journal Writing, Concept mapping, Portfolio, Rubrics etc

Unit-5: Continuing Professional Development of Physical Science Teachers
- ➢ Need for Professional Development of Physical Science Teachers
- ➢ Role of Reflective Practices in Professional Development
- ➢ Participation in Professional Learning Community and Collaboration with Research Institutes
- ➢ Need for Pre-service & In-service Professional Development Programmes

Engagement with the Field/Practicum/Activity: The Students may undertake any one of the following activities:
- ➢ Preparation of a unit plan in Physical Science.
- ➢ Preparation of at least two lesson plans for a particular concept in Physical Science- one based on behaviourist and another on constructivist approach.
- ➢ Develop a simulated lesson plans.
- ➢ Construction of various type of test items/tools for assessment.
- ➢ Debate on any one topics like- Physical Science and Sustainable development; Social and ethical issues related to Physical Science; Role of Language in Physical Science; Gender and Physical Science etc
- ➢ Visit to any of the professional organization and prepare a report on the in-service professional development programmes that they undertake for Science teachers.
- ➢ Visit a nearby school to interact with a few senior teachers of physical science. Seek their opinion on what major area you should focus upon during your pre-service training programme.
- ➢ Identify the institutions and organisations that regularly organise seminars and conferences on various aspects of science and science education. Collect the information about the themes of the seminars and conferences that were organised during last five years.
- ➢ Ask your fellow trainees to observe the practice lessons taken by you and provide their feedback. Refine your presentation in the light of their feedback.
- ➢ Observe some practice lessons taken by your fellow students and try to give them critical feedback about their teaching-learning proceedings.

Textbook(s):
1. Sharma, R. C., *Modern Science Teaching,* Dhanpatrai publishing company (P) Ltd., New Delhi, 2006.
2. Vaidya, N., *Science Teaching for the 21st Century,* Deep and Deep Publications, New Delhi, 2003.
3. NCERT., *Pedagogy of Science, Textbook of B.Ed.*, Part I&II, National Council for Educational Research and Training, New Delhi, 2013.
4. Mohan, R., *Innovative Science Teaching for Physical Science Teachers*. Prentice Hall of India Pvt. Ltd., New Delhi, 2002.

Suggested Readings:

1. Prasad, J., *Practical aspects in Teaching of Science*. New Delhi: Kanishka Publication, 1999.
2. NCERT., *National Curriculum Framework for School Education*, National Council of Educational Research and Training (NCERT), New Delhi, 2005.
3. NCERT., *Position Paper of National Focus Group on Teaching of Science*, NCERT, New Delhi, 2006.
4. *Science & Children*, A Peer Reviewed Journal Published by National Science Teachers Association (NSTA).
5. *The Science Teacher*, A Peer Reviewed Journal Published by National Science Teachers Association (NSTA).
6. NCERT., *Position Paper of National Focus Group on Examination Reforms*,NCERT, New Delhi, 2000.
7. NCERT, *Source Book on Assessment for Classes VI-VIII Science*, National Council of Educational Research and Training (NCERT), New Delhi,2012.
8. CBSE., *Revised Formative Assessment Manual for Teachers Class-IX Science*, 2016.

Online/Web Resources/Websites/eBooks (Links):

1. National Academies of Sciences, Engineering, and Medicine. 2015. *Science Teachers' Learning: Enhancing Opportunities, Creating Supportive Contexts*. Washington, DC: The National Academies Press. https://doi.org/10.17226/21836.
2. National Research Council. 1999. *The Assessment of Science Meets the Science of Assessment: Summary of a Workshop*. Washington, DC: The National Academies Press. https://doi.org/10.17226/9588.
3. National Research Council. 1997. *Science Teaching Reconsidered: A Handbook*. Washington, DC: The National Academies Press. https://doi.org/10.17226/5287.
4. Jensen EA and Gerber A (2020) Evidence-Based Science Communication. *Front. Commun.* 4:78. https://doi.org/10.3389/fcomm.2019.00078

ED 407: Pedagogy B: Mathematics II

L2 T0 P1 CR3

Course outcomes

On the completion of the course the student teacher would be able to

CO1: acquainted with meaningful pedagogical analysis of various topics in secondary school mathematics

CO2: appreciate the conception and significance of arithmetic and modern mathematics in daily life

CO3: acquire innovative strategies and techniques for successful in teaching and learning modern mathematics.

CO4: explore the diverse backgrounds and interests children bring to the classroom from their environment and experience to promote positive attitude towards modern mathematics concepts

CO5: familiarize the nature and functions of various instructional resources

Contents

Unit 1: Teaching of Arithmetic with special reference to the following topics:
- Number system, complex number, rational and irrational numbers, number line
- Decimal fractions, ratio, proportion, percentage, loss and profit,
- Partnership business, discount, interest, shares, stocks and dividends, bank account and other forms of deposits.

Unit 2 : Teaching of Algebra with special reference to the following topics :
- Exponents, algebraic expressions, square and cube formulae,
- Factorisation, HCF, LCM, polynomials, linear equations, linear simultaneous equations, quadratic equation, graphs, logarithms,
- Surd permutation and combination, A.P. and G.P. series.

Unit 3: Teaching of Geometry with special reference to the following topics:
- Triangles, types of triangles theorems on angles of a triangle and on right angled triangles, congruency and similarity of triangles
- Circles and related theorems, theorems on concurrency locus, construction and mensuration
- Trigonometric ratios of identities, values of trigonometric ratios of some particular angles, heights distances.

Unit 4 : Teaching of Statistics with special reference to the following topics :
- Collection, classification tabulation and graphical representation of data and their interpretation
- Measures of central tendency, Measures of variability
- Flow chart and algorithm for solving computational problems.

Unit 5 : Learning Resources in Mathematics
- Types and functions of different learning resources for Mathematics instructional support
- Preparation and use of learning resources: Text books, Models, Calculators and Computers.
- Use of the Mathematics Laboratory for enhancing learning.

School Based Activities

- Visit the school library and list the available resources for enriching mathematics teaching.

- Observe the mathematics laboratory and list the resources available and give suggestions to facilitate the establishment of a mathematics laboratory.
- Prepare a lesson plan using ICT or prepare a programmed instruction material on any topic.
- Preparation of low cost and no cost learning teaching aids on any topic.
- Critical Evaluation of Mathematics Textbook (VI to X)

- ➢ Analysis of unit / chapter in a mathematics text book and identify the concepts, principles, process in the underling mathematical structure.
- ➢ Construct a diagnostic test in mathematics and diagnosing pupils learning difficulties and suggesting remedial measures.

Textbook(s):

1. Tiwari.D., *Encyclopaedia of Modern methods of Teaching*, Crescent Publishing Corporation, New Delhi, 2007.
2. James, Anice, *Teaching of Mathematics,* Neelkamal Publication Pvt. Ltd., Hydrabad, 2005.
3. Sharma, H.S. & Mangal, U.C., *Teaching of Mathematics,* Radha Prakashan Mandir, Agra, 2005.
4. Aggarwal, S.M., *A Course in Teaching of Modern Mathematics*, Dhanpat Rai, New Delhi, 2002.

Suggested Readings:

1. Kincheloe, J., Critical Pedagogy, (2nd Edn), Peter Lang, New York, 2008.
2. Sumner, W.L., *The Teaching of Arithmetic & Elementary Mathematics*, Blackwell, Oxford, Basil, 1938. https://archive.org/details/dli.ernet.455/page/n5/mode/2up
3. Bender, W.N.,*Differentiating Math instruction strategies that work for K-8 classrooms*. Thousand Oaks, Corwin press, CA, 2005.
4. Butler and Wren, *The teaching of Secondary Mathematics*, MC Graw Hill Book Company, 2000.

ED 404: Initial School Experience/ School Internship-I

L0 T0 P4 CR4

Course outcomes

After the completion of this course the student will:

CO1: Identify and critically examine the different components, functions and processes of school system.

CO2: Evaluate the existing facilities and resources of the school system.

CO3: Analyse the school curriculum, annual school calendar, syllabus and textbook.

CO4: Develop lesson plan based on innovative methods and approaches.

CO5: Examine the role and significance of community as learning resource.

Course content/ Framework

The internship will be organized for a continuous period of four weeks in selected schools of the area. The student-teachers will be oriented on the following components of school activities.

a. Understanding and examining the school process and existing facilities.

- ➢ Collect the information from school authority and record the observations on physical facilities and social organization of the school.
- ➢ Prepare a map of school complex.

b. Examination of school morning assembly

- ➢ Evaluation of classroom environment and learning activities. Attend the school assembly and record the observations on the various activities conducted in school assembly and students involvement in it.
- ➢ Make a reflection on significance of school assembly by highlighting the values gained through the different activities.

c. Evaluation of classroom environment and learning activities.

- ➢ Examine the classroom physical environment and prepare a layout of seating arrangement of the students.
- ➢ Describe the classroom management approaches adopted in the school.
- ➢ Describe the social organisation of classroom i.e the manner in which students interact with each other and the teacher, opportunities for students to learn formally and informally in the classroom, in the school etc.

d. Evaluation of school co- curricular activities.

- ➢ Develop an understanding on the importance of co-curricular activities in child personality development.
- ➢ Describe the various co-curricular activities conducted and organised in the school by highlighting its significance.

e. Analysis of existing school library and learning resources.

- ➢ Examine the school library and make an analysis of its organizational structure and management.
- ➢ List out the learning resources available in school and its usage.

f. Examining school laboratory organization and facilities.

- ➢ Examine the school laboratory organizational structure and management.
- ➢ List out the equipment and instruments available in school laboratory.
- ➢ Prepare a layout of school laboratory.

g. Analysis of Existing School academic calendar and Time Table.

- ➢ Examine the school annual calendar and time table of any elementary class
- ➢ Make a reflection on school annual calendar and time table with respect to the principles of its construction.

h. Analysis of school curriculum

- ➢ Make an analysis of existing school curriculum by describing the innovative activities that the school undertakes for child academic progress and personality development.

i. Maintaining student profile

> Record the observation of child information related to age, gender, learning abilities, interests/hobbies, apparent learning styles, apparent cultural/ethnic/racial/backgrounds, apparent socio-economic class, etc.

j. Analysis of school syllabus and textbooks.

> Analyse the syllabus of any elementary school subject and reflect on its organization.
> Review any elementary school textbook of any based on external and internal features.

k. Preparation of Lesson Plans and Unit Plans.

> Understanding the different structure and components of lesson plan.
> Learn to develop lesson plan based on innovative methods and approaches.
> Learn to prepare unit plans on topics from elementary school subjects.

l. Observation of classroom teaching.

> Understand the classroom teaching process and different activities conducted during instruction delivery.
> Record the observation of classroom teaching of regular teachers

m. Examining the community as resource

> Developing an insight into the role and significance of community as learning resource.
> Examine the local community and analyse its beneficial use as a learning resource for school.

Evaluation

> Evaluation will be internal, done by the Department teachers. Evaluation will be done on different components of pre-internship. Student teachers will submit report on each pre-internship activity.

References and Resources (Textbooks Links)

Textbook(s):

1. NCTE., *School Internship: Framework and Guidelines,* National Council for Teacher Education (NCTE), New Delhi, 2016.
2. NCFTE., *National Curriculum Framework for Teacher Education,* National Council for Teacher Education (NCTE), New Delhi, 2010.

Suggested Readings:

1. *Teacher Education*, Second Edition, PHI Learning Pvt. Ltd., 2019.
2. Kochhar, S. K., *School Administration and Management*, Sterling Publishers Pvt. Limited, India, 2011.

3. Savage, J., *Lesson Planning: Key Concepts and Skills for Teachers,* Taylor & Francis, United Kingdom, 2014.

Online/Web Resources/eBooks (Links)

1. Greenberg, E. (1978). The Community as a Learning Resource. *Journal of Experiential Education*, *1*(2), 22–25. https://doi.org/10.1177/105382597800100205
2. Stadler-Altmann, Ulrike. (2015). Learning Environment: The Influence of School and Classroom Space on Education. The Routledge International Handbook of Social Psychology of the Classroom,252-262
3. https://www.researchgate.net/publication/282348767_Learning_Environment_The_Influence_of_School_and_Classroom_Space_on_Education

MD 422: Elementary Coding and Information Theory

L3 T1 P0 CR4

Course outcomes

On completion of this course the students will be able to understand:
- CO1: basic idea about encoding and decoding of data.
- CO2: the ideas of entropy and information content.
- CO3: the idea of data compression and channel coding.
- CO4: how different coding techniques will perform in different situations.

Course content
- Coding and Decoding: Coding, Unique Decoding, Block Codes and Instantaneous Codes, Some Important Block Codes, Construction of Instantaneous Codes, Kraft's Inequality, McMillan's Theorem.
- Huffman Codes : Information Source, Huffman Codes, Construction of Binary Huffman Codes, Construction of General Huffman Codes.
- Data Compression and Entropy: An Example of Data Compression, The Idea of Entropy, The Definition of Entropy. Maximum and Minimum Entropy, Extensions of a Source, Entropy and Average Length, Shannon's Noiseless Coding Theorem.
- Reliable Communication Through Unreliable Channels: Binary Symmetric Channels, Information Rate, Hamming Distance, Detection of Errors, Correction of Errors, Channel Capacity, Shannon's Fundamental Theorem.
- Error-Correcting Codes: Binary Addition and Multiplication, Codes Described by Equations, Binary Linear Codes, Parity Check Matrix, The Probability of Undetected Errors.

Textbook(s):
1. Jiří Adámek, *Foundations of Coding: Theory and Applications of Error-Correcting Codes with an Introduction to Cryptography and Information Theory*, John Wiley & Sons, INC, 1991.
2. Richard W. Hamming, *Coding and Information Theory* (2nd Ed.), Prentice-Hall, Inc., Upper Saddle River, NJ, USA, 1986.

Suggested readings:
1. Steven Roman, *Coding and Information Theory*, Springer-Verlag New York, 1992.
2. Raymond Hill, *A First Course in Coding Theory*, Oxford University Press, 1990.

<h1 align="center">ED 405: School Internship</h1>

<p align="right">L0 T0 P16 CR16</p>

Course outcomes

After the completion of this course the student will:

CO1: Organise different school related events and co-curricular activities.

CO2: Develop subject specific lesson plan and teaching learning resources based on innovative methods and approaches.

CO3: Develop tests to measure the learning achievement and diagnose the learning difficulties in a particular subject area.

CO4: Carry out research work specific to child development and school functioning.

CO5: Explain the significance and usage of maintaining reflective journal.

Course content / Framework

The internship will be organized for a continuous period of Sixteen weeks in selected schools of the area. One week orientation programme will be organized on the following components of school activities.

a. Practicing microteaching skills
- Developing microlesson plan on each microteaching skill and practicing demonstration classes with respective pedagogy teachers.

b. Organization of school related activities.
- organizing morning assembly meeting during the internship period
- participate and organizing different co-curricular activities like –Yoga camp, Exhibitions, Group Discussion, Quiz, Awareness raising program and Debate etc.

c. Preparation of Lesson Plans
- Develop subject specific lesson plan for each pedagogy based on innovative methods and approaches
- Teaching one lesson every day from any method/subject.

d. Undertake case study on a child.
- Identify a child as case and conduct a case study on intellectual, mental, physical, social and emotional development of the child under the supervision of teacher educator.

e. Conducting achievement test
- Assessment of the performance of the students preparing blue prints and question paper of achievement test.
- Analysing the results of the achievement test.

f. Preparation of a diagnostic tests and organisation of remedial teaching.
- Design and administer diagnostic test for identification of subject -specific learning difficulties
- Oragnisation of remedial classes to overcome the learning difficulties,

> Conduct of post test to assess the effectiveness of the remedial teaching

g. Development of teaching-learning resources.
> Develop subject-specific teaching learning materials and describe its significance and usage.

h. Teaching as a substitute teacher.
> Taking arrangement classes as assigned by the school coordinator.

i. Undertake action research project on at least one problem area of schooling
> Identify one problem in school and carry out action research under the supervision of teacher educator.

j. Maintenance of a reflective diary or journal to record
> recording reflections on day-to-day school activities and own teaching.
> maintaining reports related to curricular and co-curricular activities

Evaluation
> Evaluation of performance during School internship will be done on the basis of assessment by the supervisors of the Department. The distribution of marks/weightage will be determined by the Departmental Advisory Committee. The evaluation of the teaching component will be done by both internal (continuous) and external experts, the ratio of weightage of internal-external being 60:40. The grading will be done according to the principles of evaluation and grading policies adopted by the University.

References and Resources (Textbook Links)

Textbook(s):

1. NCTE., *School Internship:Framework and Guidelines,* National Council for Teacher Education (NCTE),New Delhi, 2016.
2. NCFTE., *National Curriculum Framework for Teacher Education,* New Delhi, 2010.

Suggested Readings:

1. *Teacher Education,* Second Edition, PHI Learning Pvt. Ltd., 2019.
2. Kochhar, S. K., *School Administration and Management,* Sterling Publishers Pvt. Limited, India, 2011.
3. Savage, J., *Lesson Planning: Key Concepts and Skills for Teachers,* Taylor & Francis, United Kingdom, 2014.
4. Sagor, R., *Guiding School Improvement with Action Research,* ASCD. 2000.
5. *Measurement, Evaluation and Assessment in Education,* Prentice Hall India Pvt., Limited, India, 2016.

Online/Web Resources/eBooks (Links)

1. Xygkou, A. (2009). Child Case Study-Assessment And Intervention. 10.13140/2.1.1011.0086.
2. Göker S. D. (2016). Use of Reflective Journals in Development of Teachers' Leadership and Teaching Skills. Universal Journal of Educational Research, 4(12A), 63 - 70. DOI:10.13189/ujer.2016.041309