Name of Faculty: Science	**Department:** Biotechnology
Program: M.Sc. Medical Biotechnology	**Type:** Theory + Practical
Subject: DSC-1 Animal Cell Culture	**Semester:**1
Credit: 04 + 02	**Total Learning Hours:** 60
Course Description: This course will provide basic knowledge & understanding about Animal tissue culture. It will prepare a student for further tissue culture work, teach principles & protocols about different tissue culture methods & types.	
Student Learning Outcome: On completion of the course student will: 1) be aware about the fundamental concepts of animal tissue culture. 2) know skills needed for a tissue culture laboratory. 3) be well informed about cell lines.	

Unit – 1 Introduction (06 Hours)
1.1. Historical background
1.2 Applications
1.3 Advantages
1.4 Limitations
1.5 Biology of Cultured Cells

Unit 2 Lab Design, Equipment & Materials (07 Hours)
2.1 Layout & Design
2.2 Essential, supplementary & specialized equipment
2.3 Culture Vessels & Substrates
2.4 Defined media & supplements
2.5 Serum free Media

Unit 3 Aseptic Techniques, Preparation & Sterilization (07 Hours)
3.1 Elements for Aseptic Techniques & Sterile Handling
3.2 Preparation of Media & Reagents
3.3 Sterilization of media, apparatus & liquids
3.4 Sources of Contamination
3.5 Monitoring & Eradication for contamination

Unit 4 Types Of Tissue Culture (08 Hours)
4.1 Primary Culture & Subculture Culture
4.2 Organ Culture
4.3 Histotypic Culture
4.4 Organotypic Culture
4.5 Tissue Engineering

Unit 5 Primary Culture & Subculture (08 Hours)
5.1 Initiation of primary cell culture & isolation of tissues
5.2 Types of primary Culture
5.3 Criteria of subculture

5.4 Subculture of monolayer cells
5.5 Subculture of Suspension Cells

Unit 6 Cell Lines (08 Hours)
6.1 Cell Clone, Cell strain & Types of Cell lines
6.2 Need & Parameters of Characterization of cell lines
6.3 Transformation & Immortalization
6.4 Selective Culture of Tumor Cells
6.5 Development of cell lines from tumours

Unit 7 Cell Separation (08 Hours)
7.1 Cell Density & Isopyknic Sedimentation
7.2 Cell size & Sedimentation velocity
7.3 Antibody based techniques
7.4 Fluorescence – activated cell sorting
7.5 Other techniques like Electrophoresis, chromatography

Unit 8 Quantitation & Cryopreservation (08 Hours)
8.1 Cell Counting Methods
8.2 Cell Viability Assays
8.3 Plating Efficiency & Labeling Index
8.4 Principles of Cryopreservation
8.5 Vitrification

REFERENCES:

- Culture of Animal Cells by R. Ian Freshney, Wiley Blackwell pub.
- Animal Cell Culture by John R W Masters, Oxford University Press
- In vitro Cultivation of animal Cells by Currel B C, Butterworth-Heinemann
- Animal Cell Culture & Technology by M. Butler, BIOS Scientific Pub.
- Basic Cell Culture by J M Davis, Oxford University Press
- Culture of Cells for Tissue Engineering
- Principles of Animal Cell Culture by Basant Kumar Sinha & Rinesh Kumar, International Book Distributing Co.

PRACTICALS:
1) Isolation of splenocytes/hepatocytes/fibroblasts from spleen/liver/chick embryo
2) Culture peripheral blood mononuclear cells (PBMC) & cell counting by Hemocytometer
3) Observation & viability test of Cultured Cells & feeding a monolayer culture

Name of faculty: Science	**Department:** Biotechnology
Program: M.Sc. Genetics/Medical Biotechnology	**Type:** Theory + Practical
Subject: DSC-2 rDNA Technology	**Semester:** 1
Credit: 04 + 02	**Total learning hours:** 60

Course description:

The rDNA technology also known as genetic engineering is a major means to change; manipulate and modify the genes as per need hence a way to create desired variations in available biological products or produce novel commercial products as well as to study biological processes and phenomena. The objective of studying this course is to learn the techniques and methods for generating genetically modified organisms or cells so as to use them for commercial applications. Students will obtain knowledge about the model organism representative of each major group of organisms, tools and molecular techniques needed for rDNA development and experimental studies.

Student learning outcome:

On completion of course students will be able to:

- Understand and apply fundamentals of gene transfer in biological systems.
- Explain molecular techniques for developing recombinant genes and organisms.
- Identify and explain successful recombinant organisms.
- Understand screening methods for successful recombinant genes and their transfer.

Unit-1 Introduction and Modes of Gene Transfer: (7 h)

1.1 Introduction: History
1.2 Modes of Gene Transfer- Transformation, Transduction, Conjugation and Transfection
1.3 Gene Transfer to Animal Cells
1.4 Gene Transfer to Plants

Unit-2 Enzymes in rDNA: (8 h)

2.1 Range of DNA Manipulative Enzymes (Nucleases, Ligases, Polymerases, DNA Modifying Enzymes)
2.2 Cutting DNA Molecules: (Restriction-Modification System, Variations in Cutting DNA Molecule, Estimation of Sizes of DNA Molecules)
2.3 Special Gel Electrophoresis Methods for Separating Larger Molecules
2.4 Elimination of Restriction in Host *E.coli*
2.5 Ligating DNA Molecules: (DNA Ligase, Topoisomerase, Sticky Ends and Blunt Ends)

Unit-3 Vectors: (8 h)

3.1 Types of Vectors
3.2 Plasmid and Phage Vectors
3.3 Cosmids, Phasmids and Other Advanced Vectors

3.4 Cloning Vectors for Prokaryotes
3.5 Cloning Vectors for Eukaryotes

Unit-4 Gene Expression Systems: (8 h)
4.1 Selecting Suitable Expression System
4.2 Prokaryotic Expression Systems:(Expression System Based on Bacteriophage- T7 RNAP, Expression System Employing *trc* Promoter)
4.3 Gram Positive Model: *Bacillus* Expression
4.4 araB Expression System in *E.coli*
4.5 Eukaryotic Expression Systems: (Recombinant Protein Expression in *Pichia,* Inducible Mammalian Expression Systems, Drosophila S2 System for Heterologous Gene Expression)

Unit-5: Cloning Strategies: (7 h)
5.1 Basic Principles of Gene Cloning (Gene Cloning: Definition and Explanation, Importance of Gene Cloning)
5.2 Creating a Genomic Library
5.3 cDNA Library

Unit-6: Screening Strategies for DNA Libraries: (8 h)
6.1 Sequence Dependent Screening
6.2 Screening Expression Libraries
6.3 Functional Cloning

Unit-7: Advances in Transgenic Technology: (7 h)
7.1. Transgenic Mice Methodology
7.2. Transgenic Livestock
7.3. Promoters for Transgenesis in Plants (Constitutive Promoters,Tissue Specific Promoters, Inducible Promoters)
7.4. Insect Resistant Plants

Unit-8: Applications and Regulations: (8 h)
8.1. Commercial Products by Recombinant Microorganisms
8.2. Applications of Transgenic Animals (Transgenic Mice, Transgenic Fish, Transgenic Poultry)
8.3. Recombinant Antibodies
8.4. Bioremediation (Genetic Engineering in Biodegradative Pathways)
8.5. Regulating rDNA Technology

References:

- Old, R. W., Primrose, S. B., & Twyman, R. M. (2009). *Principles of Gene Manipulation: An Introduction to Genetic Engineering*. Oxford: Blackwell Scientific Publications. ISBN-13: 978-1-4051-3544-3
- Glick, B. R., Pasternak, J. J., & Patten, C. L. (2010). *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. Washington, DC: ASM Press. ISBN: 978-1-55581-498-4
- T. A. Brown, (2001) *Gene Cloning and DNA Analysis: an Introduction*, Blackwell Science. ISBN-978-1-119-07256-0

- Russell P.,*iGenetics: A Molecular Approach (2010)* (3rd revised edition), Pearson. ISBN: 978-0-321-61022-5
- Fernandez J. And Hoeffler J., Gene Expression Systems Using Nature for the Art of Expression, Elsevier ISBN:0-12-253840-4

Practicals:

1. To isolate plasmid DNA and characterize the isolated plasmid.
2. To perform transformation of plasmid pUC 18 in *E.coli*.
3. To study transfection in Animal Cell Culture.
4. To perform Restriction digestion of given DNA and characterize the restricted fragments of DNA.

Name of faculty: Science	**Department:** Biotechnology
Program: M.Sc. Biotechnology	**Type:** Theory + Practical
Subject:SEC-1 Molecular Biology Techniques (Elective)	**Semester:** 1
Credit: 04 + 02	**Total learning hours:** 60

Course description:
Insights into basic and advanced concepts of molecular techniques and methods which will exemplify different types of Polymerase chain reactions and their diverse applications. This course may help to understand methodology and principle of advanced high throughput sequencing techniques. In addition, this course may recognize the difference between various molecular techniques as well as their strength and limitations

Student learning outcome: After the completion of this course, students will be able to:

- Familiarize with concepts pertaining to basic and advance molecular biology principles and techniques for understanding various contemporary areas of research and their applications mainly gene isolation and characterization
- Understand and analyse the experimental data for advanced molecular biology related applications
- Evaluate selectivity and specificity of vectors for cloning genes and their expressions
- Learning basic and advanced techniques for assigning gene function, protein extraction, purification and will familiarize with advanced protein characterization techniques.
- Compare and contrast different methodologies used in molecular biology in order to solve biological problems

UNIT-1 Principle and methods for isolation of nucleic acid and proteins (6 hours)
1.1 Composition and structure of DNA and RNA
1.2 Isolation and separation of nucleic acids (DNA & RNA)
1.3 Quantification procedures: Spectrophotometer, Pulse-field gel electrophoresis and bioanalyzer
1.4 Elution and recovery of nucleic acid from gel

Unit-2 Manipulation of Nucleic acids (7 hours)
2.1 Types and characteristics of restriction modification (R-M) system
2.2 Optimization of transformation efficiency: Dam and Dcm methylases of *E. coli*
2.3 Joining DNA molecules: (DNA ligase, Adaptors & Linkers, Homopolymer tailing, Joining DNA molecules without DNA ligase)
2.4 Role and Applications: DNA and RNA Polymerases, Terminal transferase, Reverse transcriptase, Alkaline phosphatase, T4 Polynucleotide kinase, S1 Nucleases, DNase-I, RNase-I Topoisomerase I & II (Genetic Engineering, Rastogi and pathak, Oxford Publication)

Unit-3 PCR types and nucleic acid hybridization (8 hours)
3.1 PCR: Principle and methods
3.2 Variants of traditional PCR
3.3 Advanced PCR techniques: Real-time PCR , End-point PCR, Digital PCR
3.4 Hybridization and blotting techniques: Southern & Northern

UNIT-4 Gene cloning strategies (8 hours)
4.1 TOPO TA and seamless cloning, Limitations of conventional cloning, Gateway cloning, Golden Gate Cloning
4.2 Preparation of Genomic DNA libraries using different vectors
4.3 PCR as an alternative to genomic DNA cloning
4.4 Properties and preparation of cDNA libraries
4.5 Rapid amplification of cDNA ends (RACE)

UNIT-5 DNA sequencing techniques (8 hours)
6.1 DNA sequencing techniques: Maxam-Gilbert and Sanger methods
6.2 Next generation sequencing: 454, Illumina, Nanopore, Ion Torrent, Pyrosequencing
6.3 RNA-sequencing, ChIP sequencing, Methyl sequencing/ Bi-sulfite sequencing

Unit 6 Proteomic Techniques for Analysis (8 hours)
5.1 Extraction and purification of proteins from cells & tissues
5.2 PAGE, SDS-PAGE, isoelectric focussing, 2D electrophoresis, N-terminal sequencing
5.3 Peptide fingerprinting, Mass Spectroscopy and types
5.4 Protein microarrays
5.5 Phage display libraries

Unit 7 Functional genomics and proteomics (8 hours)
7.1 EMSA and DNA-footprinting, chromosome walking, chromosome jumping
7.2 Suppression Subtractive Hybridization (SSH), DNA Microarrays, SAGE
7.3 Methods for studying protein interactions
7.4 Protein structure determination, prediction and threading, Bioinformatics for protein interaction studies

UNIT-8 Biotechnology applications for human welfare (7 hours)
8.1 Riboswitches, Aptamers and their Applications
8.2 Telomerase Structure, Function and applications
8.3 Fundamentals of RNAi and siRNA, Virus induced gene silencing and its applications.
8.4 Site directed mutagenesis, Transposon mutagenesis, Genome editing: ZFN and TALENS, CRISPR/ CAS system and their applications.

References and Textbooks:

1. Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th ed, Blackwell, 2006 6. ISBN 978-1405135443
2. Peter J. Russell, Reed College, iGenetics: A Molecular Approach, 3rd Edition,Pearson Publishers, ISBN 9780321569769

3. T. A. Brown, Gene Cloning and DNA Analysis: An Introduction 7th edition, Wiley Blackwell, 978-1119072560
4. Andreas Hofmann, Samuel Clokie, Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, 978-1316614761
5. Jolls. O and Jornvali H (eds) 2000: Proteomics in functional genomics, Birkhauser veriog, Basel, Switzerland. ISBN 978-3034884587
6. Smita Rastogi and Neelam Pathak, Genetic Engineering, Oxford Higher Education, ISBN 978-0195696578
7. Pennington, S. and Dunn M. Proteomics from protein sequence to function. New Delhi: Viva Books Private Limited; 2002. ISBN 978-8176492904

PRACTICALS

i. Extraction of DNA and gel electrophoresis
ii. Restriction digestion of DNA/Plasmid
iii. To perform Polymerase chain reaction.

References and Textbooks for Practical's:

1. Philippa D. Darbre, Introduction to Practical Molecular Biology, Wiley–Blackwell, ISBN- 978-0471919650
2. T.A Brown, Essential Molecular Biology: A Practical Approach VolumeII, Oxford University Press; 2nd edition, ISBN-978-0199636440

Name of Faculty: Science	**Department:** Biotechnology
Program: M.Sc.	**Type:** Theory
Subject: Bioethics & Biosafety	**Semester-**7
Credit: 04 + 02	**Total Learning Hours:** 60
Course Description: This course introduces students to basic concepts of Bioethics & Biosafety. It will also inculcate the importance, need & applications of these areas in the students of any applied science branch. It will provide information about rules, regulations, laws, acts & protocols regarding bioethics & biosafety to be followed in different fields of science.	
Student Learning Outcome: After completion of the course, students will be: 1)Student will be able to appreciate the importance of Bioethics & Biosafety 2)Student will be able to implement necessary bioethics rules & regulations wherever needed in practice 3) Student will be able to identify the need of safety & will to execute it in practical life.	

Unit 1 Introduction (07 Hours)
1.1 History & Definitions of Ethics & bioethics
1.2 History & Definitions of Safety & Biosafety
1.3 Applications of Bioethics
1.4 Applications of Biosafety
1.5 Environment Ethics

Unit 2 Ethical, Legal, Social Issues – I (09 Hours)
2.1 Prenatal Diagnosis & Genetic manipulation
2.2 Biotechnology
2.3 Genetically modified Organism: Foods & Crops
2.4 Stem Cell Research
2.5 Organ transplantation & Xenotransplantation

Unit 3 Ethical, Legal, Social Issues – Ii (09 Hours)
3.1 Biodiversity & Resource management
3.2 Human & animal Cloning
3.3 Animal Testing & Animals in Research
3.4 Testing of Drugs on Human Volunteers
3.5 Assisted Reproductive Technologies (ART)

Unit 4 Hazardous Materials – Handling & Disposal (07 Hours)
4.1 Hazards & Biohazards (biological agents) with their types/ categories
4.2 Disposal of chemical wastes & hazardous wastes
4.3 Material Safety Data Sheet (MSDs)
4.4 Controlling the exposure to hazardous substances
4.5 Duties, immunization & first aid of employees

Unit 5 Risk Assessment & Containment (07 Hours)
5.1 Risk Assessment

5.2 Containment Levels
5.3 Containment in Animal lab
5.4 Containment in Plant tissue culture Lab
5.5 Containment in Microbiological lab

Unit 6 Biosafety (07 Hours)
6.1 Risk Assessment of Planned introduction & Biotechnology products
6.2 Planned introduction & Field trials of GM plants
6.3 Planned introduction of GE organisms
6.4 Biosafety during industrial production
6.5 Risk & Safety management in ART & stem cell research

Unit 7 Regulations & Guidelines – I (07 Hours)
7.1 NIH guidelines
7.2 ICH International Community Harmonization guidelines
7.3 Regulatory Framework for GE Plants in India
7.4 Indian Biosafety guidelines
7.5 Laboratory Biosafety Manual of WHO

Unit 8 Regulations & Guidelines – II (07 Hours)
8.1 Cartagena Protocol
8.2 ART regulation Bill
8.3 National Regulatory Bodies for Biosafety in India
8.4 Ethical Guidelines for Biomedical research involving human subjects
8.5 National Guidelines for Stem Cell Research

Reference Books
- Bioethics & Biosafety by M K Sateesh ,I K International Pub. Ltd
- Biotechnology Expanding Horizons by B D Singh, Kalyani Pub.

Web Resources
- Biosafety resource book by FAO http://www.fao.org/3/i1905e/i1905e00.htm
- Biosafety Manual by WHO https://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf
- ICMR Bioethics Unit https://ethics.ncdirindia.org/

Practicals
1) Case study on Bioethics
2) Project on Analysis of Biosafety measures / First aid of any Institute/lab/ Industrial unit
3) Visit to an industry to study safety measures

Name of faculty: Science	**Department:**Environmental Science
Program: M.Sc.	**Type:** Theory + Practical
Subject: DSE-1Energy and Environment	**Semester:** 3
Credit: 04 + 02	**Total learning hours:** 60

Course description:

The students are expected to understand the importance of energy conservation and become capable to identify the technologies for effective utilization of renewable energy sources.

Student learning outcome:

After learning the subject, students will be able to understand,

- Importance of renewable energy sources.
- Application of different renewable energy sources.
- Impact of energy on ecology, society and environment.
- Energy Policy of India and our energy future.
- The need, importance and scope of non-conventional and alternative energy.

Unit-1: Introduction:

Energy, Units of energy, Law of conservation of energy, Scenario of renewable and non-renewable energy sources, Needs of renewable energy, advantages and limitations of renewable energy, present energy scenario of conventional and RE sources.

Unit-2: Solar Energy:

Sun as source of energy: solar energy potential in India, National solar mission, solar radiation and its spectral characteristics, solar radiation outside the Earth's atmosphere and at the Earth's surface, flat plate and concentrating collectors, solar thermal power generation, fundamentals of solar photo voltaic conversion.

Unit-3: Wind Energy:

Wind power and its sources, modern wind energy-modern wind turbines, wind energy estimation, types of wind energy systems, site selection, details of wind turbine generator.

Unit-4: Bio Energy:

Types of biogas plants, biogas generation, factors affecting biogas generation, advantages and disadvantages of biomass energy, biomass gasification, types of gasification.

Unit-5: Ocean thermal energy:

Ocean thermal energy conversion principal, energy from tides, tidal power plants, single and double basin plants, site requirements, advantages and limitations.

Unit-6: Energy, environment and society:

Impact of energy use on the environment, fossil fuel burning and related issues of air pollution, global warming, greenhouse effect, nuclear energy and related issues of radioactive waste, social inequalities related to energy production, distribution and use.

Unit-7: Energy, ecology and environment:
Energy -production, transformation and utilization, associated environmental impacts: Nuclear accidents, pollution, construction of dams, over consumption of energy and its impact on the environment, economy and global change.

Unit-8: Energy policy and our energy future:
Energy statistics in India and world, importance of energy conservation, India's Energy Strategy(National Energy Policy), energy audit definition, energy management system, types of energy audit, Fuel and energy substitution in future.

References:

- Solar Energy: Principles of Thermal collection and storage, S.P.Sukhatme and J.K.Nayak, McGraw-Hill Education.
- Elliott, D. 1997. Sustainable Technology, Energy, Society and Environment. New York, Routledge Press.
- Sathyajith Mathew.2006.Wind energy: fundamental, resources analysis and economics. Springer Berlin Heidelberg, The Netherland ISBN: 139783540309055.
- M.V.R. Koteswara. Rao, "Energy Resources: Conventional & Non-conventional" BSP Publications,2006.
- Craig. J.R.,Vaughan, D.J.,Skinner.B.J.1996. Resources of the Earth: Origin, use and environmental impact.(2nd edition). Prentice hall, New Jersey.
- Godfrey Boyle, "Renewable Energy Power for A Sustainable Future," Oxford University Press.

Practicals:

1. Determination of calorific value by Bomb Calorimeter.
2. Solar radiation measurement methods using Pyrheliometer and Pyranometer.
3. characteristics of solar PV system
4. characteristics of Thermister.

Name of faculty: Science	**Department:** Environmental Science
Program: M.Sc.	**Type:** Theory + Practical
Subject: DSE-1 **(**Laboratory) safety and Management	**Semester:** 1
Credit: 04 + 02	**Total learning hours:** 60

Student learning outcome:

At the end of the course students will be able to...understand about

- Be aware of the factors that can lead to an accident.
- Discuss toxicology, industrial hygiene, source models, dispersion models, , fires and fire prevention, explosions and explosion prevention, electrostatics, pressure relief systems, runaway reactions, and risk analysis as they apply to chemical process safety, and be able to solve corresponding problems.
- Discuss the nature of the accident process and methods used in accident investigation, inherently safer design strategies, and the various strategies and governmental regulations relevant to process safety management.

Unit-1: Introduction of Industrial Hygiene: (7 Lecture)

1.1 Definition, scope and applications

1.2 Occupational Environmental Stress: Physical & Chemical

1.3 Airborne chemicals: Dust or aerosols (respirable and non respirable, inhalable and total dust), gases, fumes, vapours, mist and smoke.

1.4 Concept of threshold limiting values

UNIT-2: Biosafety: (7 Lecture)

2.1 Introduction; Historical Background

2.2 Introduction to Biological Safety Cabinets and types

2.3 Primary Containment for Biohazards and Biosafety Levels of Specific Microorganisms

2.4 Recommended Biosafety Levels for Infectious Agents and Infected Animals

UNIT-3: Safety Precautions: (7 Lecture)

3.1 Precautions: Process and operations involving explosives, flammables, toxic substances, dusts, vapors, cloud formation & combating.

3.2 Safety precautions for transportation for hazardous chemicals; Handling and storage of hazardous chemicals.

3.3 Respiratory personal protective equipment (RPPE) & non respiratory personal protective equipment (NRPPE): head protection , ear protection , face and eye protection , hand protection, foot protection and body protection.

UNIT-4: Fire and Explosion (7 Lecture)

4.1 Fire phenomena, classification of fire and extinguishers.

4.2 Statutory and other standards.

4.3 Fire prevention & protection system.

4.4 Explosion phenomena, explosion control devices, fire awareness.

UNIT-5: Electrical Safety: (7 Lecture)
5.1 Electricity and Hazardous, Indian standards.
5.2 Effects of electrical parameters on the human body.
5.3 Safety measures for electric works.

UNIT-6: Noise and Vibration: (7 Lecture)
6.1 Noise: generation, types and permissible limit
6.2 measurement and evaluation of noise
6.3 control methods: control of source, isolation, sound proofing and practicing aspects of control of noise
6.4 vibration: generation, types and control

Unit-7: Hazards & Risk identification, Assessment and control techniques: (7 Lecture)
7.1 Hazards, Risks & detection techniques, Preliminary hazard analysis(PHA) & hazard analysis(HAZAN)
7.2 Failure mode effect analysis(FMEA), Hazard and operability(HAZOP) study.
7.3 Hazard ranking (DOW & MOND index), Fault tree analysis, Event tree analysis(ETA)
7.4 Major accident hazard control, onsite and off-site emergency plans.

Unit-8: Storage hazards: (7 lecture)
8.1 safety measures for storage of flammable liquids/solvents, acid and alkali, chlorine and ammonia
8.2 safety of storing gas cylinders, color coding, marking and ensuring safe connection of cylinder
8.3 design of storage shed or go-down, retention basin, catch pot or dump vessel. Safe placement of containers.

References and Textbooks:

- Industrial Hygiene & Chemical Safety - M.H.Fulekar: I. K.International Publishing House, New Delhi.
- Industrial Hygiene Reference And Study Guide- Allan K. Fleeger, Dean Lillquist, AIHA, 01-May-2006
- Personal Protective Equipment -Guide to Ports/Dock Workers - M.H.Fulekar : Government of India's Publication
- Fundamentals of Industrial Hygiene-Barbara A. Plog, Patricia J. Quinlan, National Safety Council Press, 2002
- Occupational safety management and engineering, Willie Hammer, Dennis Price, Prentice Hall, 2001
- Industrial Safety and Health Management, C. Ray Asfahl, David W. Rieske, Prentice Hall, 31-Jul-2009
- Fundamentals of Occupational Safety and Health, Mark A. Friend, James P. Kohn, Government Institutes, 16-Aug-2010
- Handbook of occupational safety and health, Louis J. DiBerardinis, John Wiley, 1999

- Occupational Hygiene. Blackwell Science, Harrington, J.M. & K. Gardiner. 1995, Oxford.
- Industrial Hygiene Evaluation Methods. Micheal S. Bisesi. CRC Press, 28-Aug-2003

Practicals:

1. Preparation of Material Safety Data Sheet for some common chemicals.
2. To neutralize the given sample using NaOH / HCL/ $CaCO_3$
3. Determination of CO_2 from the atmosphere by volumetric method in a workplace Environment.
4. Estimate Noise Levels at different locations.