

## ICE 459: INDUSTRIAL SAFETY, ENVIRONMENTAL AND ELECTROCHEMICAL SCIENCES

### Course objectives:

- To learn general safety aspects in industry, chemical warfare convention.
- To know about QA and QC, environment problems such as air and water pollution.
- To understand causes for Corrosion and protecting methods for it

### Unit:

10 hr

**Safety:** Flammable material handling and fire fighting equipments, control measures for toxic chemicals, industrial hygiene, safety in laboratories & plant, safety in the transportation & storage of chemicals. OHSAS 18000.

**Chemical Warfare Convention:** Definitions and schedules. Toxic chemicals, remote control systems, tear gas, chemical weapons, ocean dumping of chemical weapons.

### Unit II:

12 hr

**Quality Control and Assurance:** Role, Government standards like ISI, MINAS, Agmark, I.P ASTM. Concepts of quality and quality control, the nature of variabilities. Specification and tolerances, sampling inspection, cost reduction and quality improvement experiments. Optimization. Basic concepts of quality assurance, quality acceptance, sampling, reliability, cost aspects of quality decisions. Quality control in raw materials, production (in process) and finished product. Current trends in quality control, ISO 9000 and ISO 14000 series. Laws related to quality control. ISO 17025.

### Unit III:

10 hr

**Air Pollution:** Qualitative study of environmental segments, air pollutants, prevention & control, Green house gases & acid rain. Ozone hole & CFC's. Photochemical smog, PAN and Bhopal Gas tragedy.

**Water, Waste Water Treatment and Analysis:** Hydrologic cycle, sources, criteria & standards of water quality- safe drinking water. Public health significance & measurement of colour, turbidity, total solids, acidity, fluoride, alkalinity, hardness, chloride, residual chlorine, sulphate, fluoride and phosphate in natural & polluted water. Significance of DO, BOD & COD. Water purification for drinking & industrial purposes, disinfection techniques, demineralization, desalination processes & reverse osmosis.

**Energy systems:** Chemical energy sources and limitations. Electrochemical energy sources. Principle and importance of primary(dry cell), secondary (Lead-acid battery) and fuel cells ( H<sub>2</sub>-O<sub>2</sub>). Basics of solar energy system. Safety implications. Energy from wind, ocean, geothermal and biomass.

### Unit IV:

10hr

**Corrosion:** Fundamentals of corrosion. Corrosion related damage, Types of corrosion. Methods of prevention & control (organic & inorganic coating, inhibitors, cathodic & anodic protection, material selection & design improvement). Corrosion problems in practice, passivity.

**Metal Finishing & Processing:** Metal finishing & technological importance, fundamentals of electrodeposition, electroplating process (copper and Nickel). Principles & applications of electroless plating.

**Paints:** Classification of paints, types, Constituents of paints. Requirements of a good paint. Emulsion paints. Paint removers.

**Electrochemistry of Environment:** Global warming, role of electrochemistry in the transport system, fixing of CO<sub>2</sub>, sewage disposal and treatment of waste

### Course Outcomes:

- It is an open elective course student learns safety aspects in industry, chemical warfare convention.
- QA and QC, environment problems such as air and water pollution.
- Corrosion causes and inhibition

### References

1. Environmental Chemistry, A. K. Dey, 7<sup>th</sup> ed, New Age international Publishers, 2012.
2. Environmental Chemistry, S. K. Banerji, Prentice Hall India, 1993.
3. Environmental Chemistry, B. K. Sharma. 4th edition, GOEL Publishing House, New Delhi, 1998.
4. Chemistry of Water Treatment, S.D. Faust and O.M. Aly, Butterworths, 1983.
5. Environmental chemistry, Ahluwalia V. K., Anne Books India, 2008.
6. Chemistry for Environmental Engineering, Sawyer and McCarty, McGraw Hill, 1978.
7. Environmental Chemistry, I. Williams, John Wiley, 2001
8. Statistical Quality Control, 2<sup>nd</sup> Edn., Manohar Mahajan Dampat Rai and Sons, 1995.
9. Quality management: a process improvement approach, Fryman Mark A, Cengage learning, 2002.
10. Quality Control, Paranthaman D, Tata, McGraw Hill, 1987.
11. Gupta R. N. Chemical warfare and casualty management 2011
12. Vyas M. N. Safety and hazards management in chemical industries 2013. Atlantic publication.
13. Dikshith T. S. S Safety evaluation of environmental chemicals. New Age International, 1996.
14. Chemical Safety Matters-IUPAC-IPCS, Cambridge Univ. Press, 1992.
15. Engineering chemistry, Gadag R V, I K international, 2010.
16. Chemical and Electrochemical Energy Systems, Narayan R & B Viswanathan, University Press, 1998.