

**M.E. (Industrial Safety Engineering)**  
**2015 Regulations, Curriculum & Syllabi**



**BANNARI AMMAN INSTITUTE OF TECHNOLOGY**  
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### **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

- I. Possess a mastery of Health safety and environment knowledge and safety management skills, to reach higher levels in their profession.
- II. Competent safety Engineer rendering professional expertise to the industrial and societal needs at national and global level subject to legal requirements.
- III. Effectively communicate information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities.

### **PROGRAMME OUTCOMES (POs)**

- a. Apply knowledge of Mathematics, Science, Engineering fundamentals and an engineering specialization for hazard identification, risk assessment and control of occupational hazards.
- b. Design, Establish, Implement maintain and continually improve an occupation health and management system to improve safety.
- c. Conduct investigations on unwanted incidents using root cause analysis and generate corrective and preventive action to prevent recurrence and occurrence of such incidents.
- d. Design complex man machine systems using human factors engineering tools so as to achieve comfort, worker satisfaction, efficiency, error free and safe workplace environment.
- e. Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings so as to provide practical solutions to safety problems.
- f. Communicate effectively on health and safety matters among the employees and with society at large.
- g. Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to occupation health and safety practices.
- h. Understand and commit to comply with legal and contractual requirements, professional ethics and responsibilities and general norms of engineering practice.
- i. Understand the impact of Health safety and environment solutions on productivity, quality and society at large.
- j. Demonstrate the use of state of the art occupational health and safety practices in controlling risks of complex engineering activities and understand their limitations.

**MAPPING OF PEOs AND POs**

PEO(s)	Programme Outcome (s)									
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
I	x		x							
II		x		x	x		x			x
III						x		x	x	

**M.E. Industrial Safety and Engineering (Full Time)**  
**Minimum credits to be earned: 78**

<b>First Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15IS11	Applied Probability and Statistics*	I	(a),(c)	3	2	0	4
15IS12	Safety Management	II	(b),(d),(e)	3	0	0	3
15IS13	Occupational Health and Hygiene	II,III	(f),(h) (i)	3	0	0	3
15IS14	Safety in Engineering Industry	II,III	(f),(h),(i)	4	0	0	4
15IS15	Industrial Safety Health and Environmental Acts	II	(g),(j)	4	0	0	4
	Elective I			3	-	-	3
15IS17	Industrial safety Laboratory -I	II	(g),(j)	0	0	4	2
15IS18	Technical Seminar	III	(h)	0	0	2	1
15GE19	Business English - I <sup>α</sup>			1	0	2	2
<b>Total</b>				<b>21</b>	<b>2</b>	<b>8</b>	<b>26</b>
<b>Second Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15IS21	Research Methodology			3	0	0	3
15IS22	Risk Analysis	I	(a),(c)	3	2	0	4
15IS23	Electrical safety	II	(b),(d),(e)	3	0	0	3
15IS24	Fire Engineering and Explosion control	II	(b),(d),(e)	4	0	0	4
	Elective II			3	-	-	3
	Elective III			3	-	-	3
15IS27	Industrial safety Laboratory -II	II	(g),(j)	0	0	4	2
15IS28	Internship training	I,III	(c),(h),(i)	0	0	4	2
15GE29	Business English - II <sup>α</sup>			1	0	0	1
<b>Total</b>				<b>20</b>	<b>2</b>	<b>8</b>	<b>25</b>
<b>Third Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
	Elective IV			3	0	0	3
	Elective V			3	0	0	3
	Elective VI			3	0	0	3
15IS34	Project Work - Phase I	II,III	(e),(f),(g)				6
<b>Total</b>				<b>9</b>	<b>0</b>	<b>0</b>	<b>15</b>
<b>Fourth Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15IS41	Project Work - Phase II	II,III	(e),(f),(g)				12
<b>Total</b>							<b>12</b>

\* Common to Industrial Safety Engineering and Biotechnology

<sup>α</sup> Common to all M.E. / M.Tech. Programmes

**M.E. Industrial Safety and Engineering (Part Time)**

<b>First Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15IS11	Applied Probability and Statistics <sup>†</sup>	I	(a),(c)	3	2	0	4
15IS12	Safety Management	II	(b),(d),(e)	3	0	0	3
15IS13	Occupational Health and Hygiene	II,III	(f),(h) (i)	3	0	0	3
15IS17	Industrial safety Laboratory -I	II	(g),(j)	0	0	4	2
15GE19	Business English - I <sup>α</sup>			1	0	2	2
<b>Total</b>				<b>10</b>	<b>2</b>	<b>6</b>	<b>14</b>
<b>Second Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15IS21	Research Methodology			3	0	0	3
15IS22	Risk Analysis	I	(a),(c)	3	2	0	4
15IS23	Electrical safety	II	(b),(d),(e)	3	0	0	3
15IS27	Industrial safety Laboratory -II	II	(g),(j)	0	0	4	2
15GE29	Business English - II <sup>α</sup>			1	0	0	1
<b>Total</b>				<b>10</b>	<b>2</b>	<b>4</b>	<b>13</b>
<b>Third Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15IS14	Safety in Engineering Industry	II,III	(f),(h),(i)	4	0	0	4
15IS15	Industrial Safety Health and Environmental Acts	II	(g),(j)	4	0	0	4
15IS24	Fire Engineering and Explosion control	II	(b),(d),(e)	4	0	0	4
15IS18	Technical Seminar	III	(h)	0	0	2	1
<b>Total</b>				<b>12</b>	<b>0</b>	<b>2</b>	<b>13</b>
<b>Fourth Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
	Elective I			3	0	0	3
	Elective II			3	0	0	3
	Elective III			3	0	0	3
15IS28	Internship training	I,III	(c),(h),(i)	0	0	4	2
<b>Total</b>				<b>9</b>	<b>0</b>	<b>4</b>	<b>11</b>
<b>Fifth Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
	Elective IV			3	0	0	3
	Elective V			3	0	0	3
	Elective VI			3	0	0	3
15IS34	Project Work - Phase I	II,III	(e),(f),(g)		-	-	6
<b>Total</b>				<b>9</b>	<b>0</b>	<b>0</b>	<b>15</b>
<b>Sixth Semester</b>							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15IS41	Project Work - Phase II	II,III	(e),(f),(g)				12

<sup>†</sup> Common to Industrial Safety and Engineering and Biotechnology

<sup>α</sup> Common to all M.E. / M.Tech. Programmes

<b>List of Core Electives</b>							
<b>Code No.</b>	<b>Course</b>	<b>Objectives &amp; Outcomes</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>PEOs</b>	<b>POs</b>				
15IS51	Environmental Pollution Control	I,III	(f), (h), (j)	3	0	0	3
15IS52	Safety in Construction	I,III	(f), (h), (j)	3	0	0	3
15IS53	Safety in Powder Handling	I,II	(b),(c),(d)	3	0	0	3
15IS54	Industrial Noise and Vibration Control	I	(a) (c)	3	0	0	3
15IS55	Safety in Chemical Industry	III	(f), (h), (i)	3	0	0	3
15IS56	Fireworks safety	III	(f), (h), (i)	3	0	0	3
15IS57	Nuclear Engineering and Safety	I	(a),(c)	3	0	0	3
15IS58	Plant Layout and Material Handling	I,II	(a),(b) (e)	3	0	0	3
15IS59	Safety in Petrochemical Industries	I,II	(b),(c),(d)	3	0	0	3
15IS60	Maintainability Engineering	II	(b),(j)	3	0	0	3
15IS61	Safety in Textile Industry	II,III	(e),(h),(i)	3	0	0	3
15IS62	Physical and Chemical Treatment of Water and Wastewater	II	(b), (d) ,(e)	3	0	0	3
15IS63	Environmental Impact Assessment	II	(g),(j)	3	0	0	3
15IS64	Disaster Management	I,II	(a),(b) (e)	3	0	0	3
15IS65	Safety in on shore and off shore drilling	II	(b),(d),(e)	3	0	0	3
15IS66	OHSAS 18000,ISO 14000 and ISO 9000	II	(g),(j)	3	0	0	3
15IS67	Reliability Engineering	I	(a),(c)	3	0	0	3
15IS68	Safety in Mines	II,III	(d),(f),(j)	3	0	0	3
15IS69	Transport Safety	I,II	(a),(b) (e)	3	0	0	3
15IS70	Work Study and Ergonomics	I	(a),(c)	3	0	0	3
15IS71	Wastewater Management	II	(b),(d),(e)	3	0	0	3
15IS72	Environmental Impact Management	II	(g),(j)	3	0	0	3
15IS73	Disaster Mitigation Management	I,II	(a),(b) (e)	3	0	0	3
<b>One Credit Courses</b>							
<b>Code no.</b>	<b>Course</b>	<b>Objectives &amp; Outcomes</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>PEOs</b>	<b>POs</b>				
15ISXA	Behavioral Based Safety	I,II	(a),(b) (e)	1	0	0	1
15ISXB	Hazard and operability studies	I,II	(a),(b) (e)	1	0	0	1
15ISXC	Layer of protection analysis	I,II	(a),(b) (e)	1	0	0	1



**15IS11/I5BT11 APPLIED PROBABILITY AND STATISTICS**  
**(Common to Industrial Safety and Engineering & Bio Technology)**

**3 2 0 4**

**Course Objectives (COs)**

- To design biological and industrial experiments, especially in medicine and agriculture; the collection, summarization, and analysis of data from those experiments and the interpretation of results.
- To provide knowledge on correlation and sampling techniques to solve problems in an efficient way.

**Course Outcomes (COs)**

The students will be able to

1. Apply the concept of probability and probability distributions in their field. To acquire the concept of estimation theory
2. Do testing of hypothesis which will be useful in solving engineering problems.
3. Design and analyze the statistical experiments.

**Unit I**

**Probability**

Axioms of probability - Addition and multiplication theorems on probability - Conditional probability - Baye's theorem (problems only) - Random variable: Continuous and discrete random variables - Distribution function - Expectation with properties - Moments, mean, Variance and standard deviation of a random variable.

**9Hours**

**Unit II**

**Standard distributions**

Discrete distributions: Binomial, Poisson and Geometric - Continuous distributions: Normal, Exponential and Gamma - Simple problems and properties.

**9Hours**

**Unit III**

**Two Dimensional random variables**

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and Regression: properties and problems - Rank correlation - Multiple and Partial Correlations.

**9 Hours**

**Unit IV**

**Testing of hypothesis**

Concepts of sampling - Methods of sampling - Sampling distributions and classifications - Standard Error - Tests of hypothesis: Tests of hypothesis about proportion, mean and their differences - Chi-square distributions: Test of goodness of fit and test of independence of attributes.

**9 Hours**

**Unit V**

**Design of experiments**

Basic principles of experimental designs - Analysis of variance : one-way, Two-way classifications - Latin square design - 2 Factorial Design.

**9 Hours**

**Unit VI<sup>§</sup>**

**Self Study**

Data collection with two samples for a particular variable in an industry- Setting of hypothesis – Verification of hypothesis – Presentation of the data with results.

**Total: 45 + 30 Hours**

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<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

### Reference(s)

1. Johnson R.A., *Miller & Freund's: Probability and Statistics for Engineers*, Pearson Education, 8<sup>th</sup> Edition, 2013 .
2. Walpole R.E , Myers R.H, Myers R.S.L and Ye K, *Probability and Statistics for Engineers and Scientists*, Pearsons Education, Delhi , 2002.
3. Lipschutz S and Schiller J, Schaum's outline Series: *Introduction to Probability and Statistics*, McGraw Hill Publications, New Delhi, 1998.
4. Gupta S.C and Kapur J. N, *Fundamentals of Mathematical Statistics*, Sultan Chand, NewDelhi 1996.
5. Ross. S , *A first Course in Probability*, 8<sup>th</sup> Edition, Pearson Education , New Jersey, 2010.

## 15IS12 SAFETY MANAGEMENT

3 0 0 3

### Course Objectives

- To provide and make students learn about various functions and activities of safety department.
- To prepare students to conduct safety audit and write audit reports effectively in auditing situations.
- To impart knowledge about sources of information for safety promotion and training.

### Course Outcomes (COs)

Students will be able to

1. Understand the functions and activities of safety engineering department.
2. Carry out a safety audit and prepare a report for the audit.
3. Prepare an accident investigation report.

### Unit I

#### Concepts

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety.

9 Hours

### Unit II

#### Techniques

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

9 Hours

### Unit III

#### Accident Investigation and Reporting

Concept of an accident, reportable and non reportable accidents, unsafe act and condition – principles of accident prevention – heinrich theory, Supervisory role- Role of safety committee - Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports-Class exercise with case study.

9 Hours

### Unit IV

#### Safety Performance Monitoring

Permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety t score, safety activity rate – problems.

9 Hours

## Unit V

### Safety Education and Training

Importance of training-identification of training needs-Training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Home safety training - 5S concepts.

**9 Hours**

## Unit VI<sup>§</sup>

Tool Box talk and its importance- implementing safety management system in small and micro scale industries.

**Total: 45 Hours**

### Reference(s)

1. V., Subramanian. *The Factories Act 1948 with Tamilnadu factories rules 1950*, Madras Book Agency, 21st ed., Chennai, 2000.
2. C.Ray Asfahl , *Industrial Safety and Health management*, Pearson Prentice Hall,2003.
3. National Safety Council, *Accident Prevention Manual for Industrial Operations*, N. S. C. Chicago, 1988.
4. H.W Heinrich,. *Prevention Industrial Accident* McGraw-Hill Company, New York, 1991.
5. N.V Krishnan. *Safety Management in Industry* Jaico Publishing House, Bombay, 1997.
6. John Ridley, *Safety at Work*, Butterworth & Co., London, 1983.
7. <http://www.labour.gov.hk/>

## 15IS13 OCCUPATIONAL HEALTH AND HYGIENE

**3 0 0 3**

### Course Objectives

- To understand the basic knowledge on anatomy of human organs and its basic functions.
- To enable students to compare the hazards with the permissible levels.
- To enable the students know about types of hazards arising out of physical, chemical and biological agents.

### Course Outcomes (COs)

Students will be able to

1. Understand the functions and activities of occupational health services.
2. Identify various types of hazards arising out of Physical, Chemical and Biological agents in a process.
3. Recognize notifiable occupational diseases arising out of occupation and suggest methods for the prevention of such diseases.

## Unit I

### Physical Hazards

Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, hearing conservation programs-vibration, types, effects, instruments, surveying procedure, permissible exposure limit.

Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard-non-ionizing radiations, effects, types, radar hazards, microwaves and radio- waves, lasers, TLV-cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control

**10 Hours**

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<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

## **Unit II**

### **Chemical Hazards**

Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling.

Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education.

**10 Hours**

## **Unit III**

### **Biological and Ergonomical Hazards**

Classification of Biohazardous agents –bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design.

Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck- back injuries.

**9 Hours**

## **Unit IV**

### **Occupational Health and Toxicology**

Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as Silicosis, Asbestosis, Pneumoconiosis, Siderosis, Anthracosis, Aluminosis and Anthrax, Lead-nickel, Chromium and Manganese toxicity, Gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests - Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems

**9 Hours**

## **Unit V**

### **Occupational Physiology**

Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene.

**7 Hours**

## **Unit VI<sup>§</sup>**

### **Control of Workplace Hazards**

Problems due to poor lamination- Dermal Exposure-Ventilation- Symptoms of various Occupational diseases.

**Total: 45 Hours**

### **Reference(s)**

1. Louis J. Di Berardinis, *Handbook of occupational safety and health*, Wiley, 1999.
2. Danuta Koradecka, *Handbook of Occupational Health and Safety*, CRC, 2010.
3. Lawrence Slote, *Handbook of occupational safety and health*, Wiley, 2001.
4. E.J. McCornick, and M.S Sanders, *Human Factors in Engineering and Design*, Tata McGraw-Hill, 1992.
5. Benjamin O.Alli, *Fundamental Principles of Occupational Health and Safety* ILO 2008.
6. <https://www.osha.gov/>

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<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

7. John W. Cherrie, *Reducing occupational exposure to chemical carcinogens*, Oxford journal of occupational medicine (2009), 96-100

## 15IS14 SAFETY IN ENGINEERING INDUSTRY

4 0 0 4

### Course Objectives

- To provide in depth knowledge in Principles of Environmental safety and its applications in various fields.
- To provide the knowledge of air and water pollution and their control.
- To expose the students to the basics in hazardous waste management.

### Course Outcomes (COs)

Students will be able to

1. Illustrate and familiarize the basic concepts and scope of engineering safety.
2. Understand the standards of professional conduct that are published by professional safety organizations and certification bodies.
3. Illustrate the importance of safety of employees while working with machineries

### Unit I

#### Safety in Metal Working Machinery and Wood Working Machines

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planing machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards. Inspection of material handling equipments.

12 Hours

### Unit II

#### Principles of Machine Guarding

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening. Selection and suitability - lathe-drilling-boring-milling-grinding-shaping-sawing-shearing-presses-forge hammer-flywheels-shafts-couplings- gears-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

12 Hours

### Unit III

#### Safety in Welding and Gas Cutting

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.

12 Hours

### Unit IV

#### Safety in Cold Forming and Hot Working of Metals

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes - Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures - Safety in Gas Furnace Operation, Cupola, Crucibles, Ovens, Foundry Health Hazards, Work Environment, Material Handling in Foundries, Foundry Production Cleaning And Finishing Foundry Processes.

12 Hours

## Unit V

### Safety in Finishing, Inspection and Testing

Heat treatment operations, Electro Plating, Paint Shops, Sand And Shot Blasting, Safety In Inspection And Testing, Dynamic Balancing, Hydro Testing, Valves, Boiler Drums And Headers, Pressure Vessels, Air Leak Test, Steam Testing, Safety In Radiography, Personal Monitoring Devices, Radiation Hazards, Engineering And Administrative Controls, Indian Boilers Regulation.

**12 Hours**

## Unit VI<sup>§</sup>

Advances in Industrial Ergonomics and safety, Work and protective clothing, Theory and practice of Industrial safety, Industrial Noise and Vibration, Machine Guarding and Industrial machine safety, Manual material handling, Modeling for safety and health.

**Total: 60 Hours**

### Reference(s)

1. Philip E. Hagan, John Franklin Montgomery, James T. O'Reilly, *Accident Prevention Manual* – NSC, Chicago, 2009.
2. Charles D. Reese, *Occupational Health and Safety Management*, CRC Press, 2003.
3. John V. Grimaldi and Rollin H. Simonds *Safety Management by All India Travelers Book seller*, New Delhi, 1989.
4. John Davies, Alastair Ross, Brendan Wallace, *Safety Management: A Qualitative Systems Approach*, CRC Press, 2003.
5. *Health and Safety in welding and Allied processes*, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.
6. Anil Mital *Advances in Industrial Ergonomics and Safety* Taylor and Francis Ltd, London, 1989
7. Dr. Vincent Matthew Ciriello (*Prediction of the maximum acceptable weight of lift from the frequency of lift*, journal of industrial ergonomics,( 2014), pg .225–237

## 15IS15 INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENT (SHE) ACTS

**4 0 0 4**

### Course Objectives

- To provide exposure to the students about safety and health provisions related to hazardous processes as laid out in Factories act 1948.
- To help students to learn about Environment act 1948 and rules framed under the act.
- To provide wide exposure to the students about various legislations applicable to an industrial unit.

### Course Outcomes (COs)

Students will be able to

1. Understand the important legislations related to Health, Safety and Environment.
2. Implement the health and welfare provisions given in factories act.
3. Comply with the statutory requirements for an Industry on registration, license and its renewal.

## Unit I

### Factories Act – 1948

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare – special provisions – penalties and procedures- Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948 – Tamilnadu safety officer rules 2005.

**12 Hours**

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<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

## **Unit II**

### **Environment Act – 1986**

General Powers of the central government, prevention, control and abatement of environmental Pollution - Biomedical waste (Management and handling Rules), 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001-No Objection certificate from statutory authorities like pollution control board. Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.

**12 Hours**

## **Unit III**

### **Manufacture, Storage & Import of Hazardous Chemical Rules 1989**

Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets .

**12Hours**

## **Unit IV**

### **Other Acts and Rules**

Indian Boiler (Amendments) Act 2007, Static and mobile pressure vessel rules (SMPV), Motor vehicle rules, The Mines and Minerals (Development & Regulation) Act, 2010, Workman compensation act, rules – Electricity act and rules – Hazardous wastes (management and handling) rules, 1989, with amendments in 2000 - The building and other construction workers act 1996., Petroleum rules, Gas cylinder rules-Explosives Act 1983-Pesticides Act – Tamilnadu lifts act 1997 .Boiler operating Engineers’ rules -2011

**12 Hours**

## **Unit V**

### **International Acts and Standards**

Occupational Safety and Health act of USA (The William - Steiger’s Act of 1970) – Health and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000- Benefits and Elements.

**12 Hours**

## **Unit VI<sup>§</sup>**

Current amendments in safety legislations and ISO 9000

**Total: 60 Hours**

### **Reference(s)**

1. *The Factories Act 1948 with Tamilnadu factories rules 1950*, Madras Book Agency, 21<sup>st</sup> ed., Chennai, 2000.
2. *The Environment Act (Protection) 1986 with allied rules*, Law Publishers (India) Pvt. Ltd., Allahabad.
3. *Water (Prevention and control of pollution) act 1974*, Law publishers (India) Pvt. Ltd., Allahabad.
4. *Air (Prevention and control of pollution) act 1981*, Law Publishers (India) Pvt. Ltd., Allahabad.
5. *The Indian boilers act 1923 with amendments*, Law Publishers (India) Pvt. Ltd., Allahabad.
6. *The Indian Electricity act 2003 with rules*, Law publishers (India) Pvt. Ltd., New Delhi.
7. Indian School of Labour education, *Industrial safety and Laws*, Chennai, 1982.

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<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

### 15IS17 INDUSTRIAL SAFETY LABORATORY-I

0 0 4 2

#### Course objectives

- To provide basic knowledge on the various methods of analysis of water and wastewater
- To emphasize the students to know how to carryout different experiments related to safety.

#### Course Outcomes (COs)

The student will be able to

1. Demonstrate the various characteristics of water and wastewater sample
2. Analyze a water sample

#### LIST OF EXPERIMENTS

1. Estimation of Hardness
2. Determination of pH
3. Estimation of Alkalinity in Waste water
4. Determination of chlorides
5. Determination of total solids, suspended solids and dissolved solids
6. Estimation of Sulphates in the given sample
7. Determination of Iron
8. Estimation of Dissolved oxygen
9. Determination of bio chemical oxygen demand in the given sample (titration method)
10. Indian standards of drinking water- A Study
11. Analysis of exhausts gases by using Orsat apparatus
12. Personal exposure measurement to dust and fumes using personal air sampler

Total: 60 Hours

### 15IS18 TECHNICAL SEMINAR

0 0 2 1

#### Course Objectives

- To develop journal paper reading and understanding skill.
- To improve communication and presentation skill of students

#### Course Outcomes (COs)

The students will be able to

1. Select the method, analysis and optimize the given problem for the given field applications

#### Guidelines

- The students are expected to make a presentation on the state of research on a particular topic based on current journal publications in that topic.
- A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
- Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.



## 15GE19 BUSINESS ENGLISH I

1 0 2 2

### Course Objectives

- To acquire skills for using English in workplace effectively.
- To communicate for essential business needs.
- To prepare students for taking BEC Vantage level examination which is an International Benchmark for English language proficiency of Cambridge English Language Assessment (CELA).

### Course Outcomes (COs)

1. To enable students to get International recognition for work and study.
2. To use English confidently in the International business environments.
3. To be able to take part in business discussion, read company literature, write formal and informal business correspondences and listen and understand business conversations.

### Unit I

#### GRAMMAR AND VOCABULARY

Comparison of adjectives – forming questions – asking complex questions – expressing purpose and function – tenses – conditionals – time statements – modal verbs – active and passive voice – articles – direct and indirect speech – cause and effect – relative pronouns – expressions followed by – *ing* forms – countable / uncountable – acronyms – marketing terms / vocabulary – financial terms – collocations – discourse markers.

**10 Hours**

### Unit II

#### LISTENING

Purposes of listening – features of listening texts – potential barriers to listening – specific listening skills – strategies to use when listening – distinguishing relevant from irrelevant information – gap filling exercise – multiple-choice options – note completion – matching and multiple choice questions – listening for specific information, gist, topic, context and function.

**7 Hours**

### Unit III

#### SPEAKING

Word and sentence stress – clear individual sounds – turn taking – initiating and responding – intonation patterns – pronunciation – mother tongue intrusion – conversation practice – turn-taking and sustaining the interaction by initiating and responding appropriately.

**10 Hours**

### Unit IV

#### READING

Purposes of reading – potential barriers to reading – paraphrasing – identifying facts and ideas – skimming and scanning for information – matching statements with texts – spotting reference words – understanding text structure – understanding the ideas in a text – distinguishing between the correct answer and the distractor – understanding cohesion in a text – deciphering contextual meaning of words and phrases – cloze – proof reading – transcoding.

**8 Hours**

### Unit V

#### WRITING

Paragraphing a text – using appropriate connectives – editing practice – Longer Documents: writing a proposal.

**10 Hours**

**Total: 45 Hours**

### Reference Books:

1. Guy Brook-Hart, “BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student’s Book”, 1<sup>st</sup> Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, “Cambridge BEC VANTAGE – Self-study Edition”, Cambridge University Press, UK, 2005.

## 15IS21 RESEARCH METHODOLOGY

3 0 0 3

### Course Objectives

- To understand some basic concepts of engineering research and its methodologies.
- To identify various sources of information for literature review and data collection.
- To familiarise the various procedures to formulate appropriate research problem and design of experiments.

### Course Outcomes (COs)

The students will be able to

1. Demonstrate the concepts of engineering research and its methodologies.
2. Understand the various methods used to collect the data to research.
3. Formulate appropriate research problem and conduct the experiments using systematic methods.

### Unit I

#### Introduction

Definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps - Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

9 Hours

### Unit II

#### Sampling Methods

Scales – measurement, Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling.

9 Hours

### Unit III

#### Hypotheses Testing

Testing of hypotheses concerning means -one mean and difference between two means -one tailed and two tailed tests, concerning variance – one tailed Chi-square test.

9 Hours

### Unit IV

#### Design of Experiments

Introduction, Types - Full and Fractional factorial Design- Orthogonal Array Design - Taguchi techniques - Regression Models - Response Surface Methods.

9 Hours

### Unit V

#### Optimization and Report Writing

Optimization – classification- methods- genetic, particle swarm and artificial bee colony algorithms. Report writing- Types of report, guidelines to review report and typing instructions - oral presentation.

9 Hours

### Unit VI<sup>\$</sup>

Case Study: apply Research Methodology principles into design and manufacturing field.

**Total: 45 Hours**

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<sup>\$</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

### Reference(s)

1. Kothari, C.R., *Research Methodology –Methods and techniques*, New Age Publications, New Delhi, 2009.
2. Panneerselvam, R., *Research Methodology*, Prentice-Hall of India, New Delhi, 2004.

## 15IS22 RISK ANALYSIS

3 2 0 4

### Course Objectives

- To provide knowledge on risk, hazard and their assessment techniques in Industry
- To understand the principles of operation of various equipment for safety application .
- To conduct a risk assessment technique in Industries.

### Course Outcomes (COs)

Students will be able to

1. Familiarize the basic concepts of risk and hazard
2. find solution for risk assessment studies through the use of software.
3. Implement hazard analysis techniques in Industry and helpful to prevent the accidents in Industry.

### Unit I

#### Hazard, Risk Issues and Hazard Assessment

Introduction, hazard monitoring-risk issue - Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis (PHA), hazard operability studies (HAZOP)

10 Hours

### Unit II

#### Instrumentation

Applications of Advanced Equipment's and Instruments, Thermocalorimetry, Differential Scanning Calorimeter (DSC), Thermo Gravimetric Analyzer (TGA), Accelerated Rate Calorimeter (ARC), Principles of operations, Controlling parameters, Applications, advantages. Explosive Testing, Deflagration Test, Detonation Test, Ignition Test, Minimum ignition energy Test, Sensitive Test, Impact Sensitive Test (BAM) and Friction Sensitive Test (BAM), Shock Sensitive Test, Card Gap Test.

13 Hours

### Unit III

#### Risk Analysis Quantification and Softwares

Fault Tree Analysis & Event Tree Analysis, Logic Symbols, Methodology, minimal cut set ranking - fire explosion and toxicity index(FETI), various indices - Hazard analysis(HAZAN)- Failure Mode and Effect Analysis(FMEA)- Basic concepts of Software on Risk analysis, CISCON, FETI, ALOHA

12 Hours

### Unit IV

#### Consequences Analysis

Logics of consequences analysis- Estimation- Hazard Identification based on the properties of chemicals- Chemical inventory analysis- identification of hazardous processes- Estimation of source term, Gas or vapour release, liquid release, two phase release- Heat radiation effects, BLEVE, Pool fires and Jet fire- Gas/vapour dispersion- Explosion, UVCE and Flash fire, Explosion effects and confined explosion- Toxic effects- Plotting the damage distances on plot plant/layout.

13 Hours

### Unit V

#### Credibility of Risk Assessment Techniques

Past accident analysis as information sources for Hazard analysis and consequences analysis of chemical accident, Mexico disaster, Flixborough, Bhopal, Seveso, Pasadena, Feyzin

disaster(1966), Port Hudson disaster- convey report, hazard assessment of nonnuclear installation- Rijnmond report, risk analysis of size potentially Hazardous Industrial objects- Rasmussen masses report, Reactor safety study of Nuclear power Plant.

**12 Hours**

#### **Unit VI<sup>§</sup>**

Layer of protection analysis (LOPA)- Safety integrity level(SIL)- Introduction about PHAST software.

**Total: 60 Hours**

#### **Reference(s)**

1. P. Frank. Less Butterworth-Hein, *Loss Prevention in Process Industries* (Vol.I, II and III), Butterworth-Hein UK 1990.
2. F.I. Khan, S.A. Abbasi, *Advanced Risk Assessment In Chemical Process Industries*, Discovery Publishing House, 2000..
3. Center for Chemical Process Safety (CCPS ), *Quantitative Risk assessment in Chemical Industries, Institute of Chemical Industries, Centre for Chemical process safety*. second Edition, 2000.
4. *Guidelines for Hazard Evaluation Procedures*, Centre for Chemical Process safety, AICHE 2008.
5. <https://www.easa.europa.eu/essi/>
6. <http://www.hse.gov.uk/research/hsl>
7. <https://www.jlab.org/accel/ssg/safety/>

### **15IS23 ELECTRICAL SAFETY**

**3 0 0 3**

#### **Course Objectives**

- To provide knowledge on basics of electrical fire and statutory requirements for electrical safety.
- To know the causes of accidents and various protection systems in Industries from electrical hazards.
- To understand the various hazardous zones and applicable fire proof electrical devices.

#### **Course Outcomes (COs)**

Students will be able to

1. Recognize different hazardous zones in Industries.
2. Understand the operation of various protection systems from electrical hazards.
3. Select the suitable electrical equipment in different hazardous zone.

#### **Unit I**

##### **Concepts and Statutory Requirements**

Introduction – electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid-cardio pulmonary resuscitation(CPR).

**9 Hours**

#### **Unit II**

##### **Electrical Hazards**

Primary and secondary hazards - shocks, burns, scalds, falls - human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage classifications excess energy-current surges-Safety in handling of war equipment-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity – definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc-ignition energy-national electrical safety codes - IS codes - Lightning

<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

hazards, lightning arrestor, installation – specifications, earth resistance, earth pit maintenance.

**9 Hours**

### **Unit III**

#### **Protection Systems**

Fuse, circuit breakers and overload relays – protection against over voltage and under voltage – safe limits of amperage – voltage – safe distance from lines-capacity and protection of conductor-Joints and connections, overload and short circuit protection - no load protection - earth fault protection. FRLS insulation-insulation and continuity test-system grounding - equipment grounding earth leakage circuit breaker (ELCB) - cable wires-maintenance of ground - ground fault circuit interrupter - use of low voltage - electrical guards - Personal protective equipment – safety in handling hand held electrical appliances tools and medical equipment.

**9 Hours**

### **Unit IV**

#### **Selection, Installation, Operation and Maintenance**

Role of environment in selection-safety aspects in application - protection and interlock self diagnostic features and fail safe concept-lock out and work permit system discharge rod and earthing devices-safety in the use of portable tools-cabling and cable joints-preventive maintenance.

**9 Hours**

### **Unit V**

#### **Hazardous Zones**

Classification of hazardous zones - intrinsically safe and explosion proof electrical apparatus - increase safe equipment - their selection for different zones-temperature classification - grouping of gases-use of barriers and isolators-equipment certifying agencies.

**9 hours**

### **Unit VI<sup>§</sup>**

#### **Application of electrical safety laws**

Electrical safety codes of practice and regulation- compliance, enforcement and engagement-electrical safety audits- electrical safety engagement programs. NFPA 70E, ANSI codes

**Total: 45 Hours**

#### **Reference(s)**

1. John Cadick, *Electrical safety Handbook*, Third Edition, Mc Graw Hill, 2006
2. W. Fordham Cooper, *Electrical Safety Engineering*, Butterworth and -Heinemann Ltd London, Third edition, 1998.
3. Dr .Massim A.G .Mitolo, *Electrical safety of Low voltage systems*, Mc Graw Hill, 2009
4. *Accident prevention manual for industrial operations*, N.S.C. Chicago, 1982.
5. *Accident Prevention Manual for Business & Industry: Engineering & Technology*, 13th Edition, N.S.C. Chicago, 2009.
6. *Indian Electricity Act and Rules* Government of India, 2003.
7. [www.nfpa.org/safety-information/for-consumers/causes/electrical](http://www.nfpa.org/safety-information/for-consumers/causes/electrical)
8. Tsung chi Wu, Safety leadership and safety performance in petrochemical industries: The mediating role of safety climate, *Journal of loss prevention in process industries*, volume 24, issue 6, November 2011, pages 716-721

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<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

## 15IS24 FIRE ENGINEERING AND EXPLOSION CONTROL

4 0 0 4

### Course Objectives

- To know the various fire prevention systems and protective equipment.
- To understand the science of explosion and its prevention techniques.
- To understand the various fire prevention techniques to be followed in a building.

### Course Outcomes (COs)

Students will be able to

1. Know the basic concepts of fire and explosion science and difference source of ignition
2. Understand the operation of various types of fire-fighting equipment and prevention of explosion
3. Employ explosion protection techniques and their significances to suit the industrial requirement.

### Unit I

#### Physics and Chemistry of Fire

Fire properties of solid, liquid and gases - fire spread - toxicity of products of combustion - theory of combustion and explosion – vapour clouds – flash fire – jet fires – pool fires – unconfined vapour cloud explosion, shock waves - auto-ignition – boiling liquid expanding vapour explosion – case studies – Flixborough, Mexico disaster, Pasedena Texas, Piper Alpha, Bombay Victoria dock ship explosions, Mahul refinery explosion, Nagothane vapour cloud explosion and Vizag refinery disaster.

12 Hours

### Unit II

#### Fire Prevention and Protection

Sources of ignition – fire triangle-IS 2190 – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – Fire extinguishing agents- Water, Foam, Dry chemical powder, Carbon-dioxide- Halon alternatives Halocarbon compounds - Inert gases , dry powders – types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – fire watchers – layout of stand pipes – fire station-fire alarms and sirens – maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills – notice-first aid for burns.

12 Hours

### Unit III

#### Industrial Fire Protection Systems

Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards – alarm and detection systems. Other suppression systems – CO<sub>2</sub> system, foam system, Dry chemical powder (DCP) system, halon system – need for halon replacement – smoke venting. Portable extinguishers – flammable liquids – tank farms – indices of inflammability-fire fighting systems.IS-15105 (guidelines for installation of sprinklers)

12 Hours

### Unit IV

#### Building Fire Safety

Objectives of fire safe building design, Fire load, fire resistant material and fire testing – structural fire protection – structural integrity –concept of egress design - exit – width calculations - fire certificates – fire safety requirements for high rise buildings –Snookers-Tamilnadu fire and rescue services act-1985

12 Hours

### Unit V

#### Explosion Protecting Systems

Principles of explosion-detonation and blast waves-explosion parameters – Explosion Protection, Containment, Flame Arrestors, isolation, suppression, venting, explosion relief of large enclosure-explosion venting-inert gases, plant for generation of inert gas rupture disc in process vessels and

lines explosion, suppression system based on carbon dioxide (CO<sub>2</sub>) and halons-hazards in LPG, ammonia (NH<sub>3</sub>), sulphur dioxide (SO<sub>2</sub>), chlorine (Cl) etc-Installation of fire protection system.

**12 Hours**

### **Unit VI<sup>§</sup>**

#### **Case studies**

Fire, Arson and Explosion Investigation - applied Fire/safety analysis, Analysis of Fire and explosion scenes, Fire and explosion Case Preparation, Inspection and testing of fire protection systems (IS standards)

**Total: 60 Hours**

#### **Reference(s)**

1. R.S.Gupta., *Hand Book of Fire Technology*, Orient Blackswan, 2010
2. Arthur E Cote *Fire protection Handbook* NFPA 2008.
3. V K Jain *Fire Safety in Building* second edition New Age International 2010.
4. Nolan, *Handbook of Fire and protection principles*, Elseiver ,2014.
5. Charles J. Baker, *Fire Fighter's Handbook of Hazardous Materials*, Van No strand Rein Hold, Jones & Bartlett Learning, New York, 2006.
6. <http://www.sciencedirect.com/science/book/9781437778571>
7. <http://www.hse.gov.uk/mining/>

## **15IS27 INDUSTRIAL SAFETY LABARACTORY-II**

**0 0 4 2**

### **Course objectives**

- To provide basic knowledge on the various methods of analysis of water and wastewater
- To emphasize the students to know how to carryout different experiments related to safety.

### **Course Outcomes (COs)**

The student will be able to

1. Demonstrate the various characteristics of water and wastewater sample
2. Analyze a water sample

### **List of Experiments:**

- 1) Whole body vibration measurement
- 2) Study of Fire Extinguishers
- 3) Sound level measurement
- 4) Study of Personal protective equipments
- 5) Rapid detection of bacterial pathogen from waste water by Polymerase chain reaction
- 6) Measurement of luminosity using lux meter
- 7) Sensitivity of ELCB
- 8) Dispersion modeling of various highly dangerous chemicals using ALOHA software
- 9) Friction sensitivity of the explosive composition
- 10) Vibration measurement using the vibration analyzer

**Total: 60 Hours**

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<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

## 15IS28 INTERNSHIP TRAINING

0 0 4 2

### Course Objectives

- To get an industrial exposure through various industrial environmental experiences and learning safety measures.
- To enhance the collective skills between theoretical knowledge and real-time safety implementations.

### Course Outcomes (COs)

The students will be able to

1. select and analysis the effective industry safety methods for the given field applications.

### Guidelines

- The students are expected to undergo meaningful, practical and hands-on-work experiences related to safety measures through industrial training.
- A faculty guide is to be allotted and he / she will guide and monitor the progress of the student's training activities and maintain attendance also.
- Minimum duration of internships period is 3-4 weeks.
- Post internship program, Students should submit a report (within 50 pages) which contains brief observations of training (process, product, layout, safety measures and methods, etc.) and give a presentation.
- Internship should be evaluated through final presentation with viva-voce exam.

**Total: 60 Hours**

## 15GE29 BUSINESS ENGLISH II

1 0 0 1

### Course Objective

- To acquire skills for using English in business environment.
- To communicate appropriately in business contexts.
- To prepare students for taking BEC Vantage level examination conducted by the Cambridge English Language Assessment (CELA).

### Course Outcomes (COs)

1. To enable students to acquire business terms for communication.
2. To use English confidently in the business contexts.
3. To be able to take part in business discussion and write formal and informal business correspondences.

### Unit I

#### SPEAKING

Non-verbal communication – agreeing / disagreeing, reaching decisions, giving and supporting opinions – making mini presentations – extending on conversations – collaborative task – tongue twisters.

**6 Hours**

### Unit II

#### WRITING

Business letters – fax – Shorter Documents: e-mail - memo – message - note – report writing – formal / informal styles.

**9 Hours**

**Total: 15 Hours**

### Reference Books:

1. Guy Brook-Hart, "BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student's Book", 1<sup>st</sup> Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, "Cambridge BEC VANTAGE – Self-study Edition", Cambridge University Press, UK, 2005.



## 15IS51 ENVIRONMENTAL POLLUTION CONTROL

3 0 0 3

### Course Objectives

- To provide in-depth knowledge in Principles of Environmental safety and its applications in various fields.
- To understand air and water pollution and their control.
- To expose the basics in hazardous waste management.

### Course Outcomes (COs)

The student will be able to

1. Illustrate and familiarize the basic concepts scope of environmental safety.
2. Understand the standards of professional conduct that are published by professional safety organizations and/or certification bodies.
3. Demonstrate the ways in which environmental health problems have arisen due to air and water pollution.

### Unit I

#### Air pollution

Air pollution – Classification and properties of Air pollutants - Pollution sources- Control of air pollution – Gravitational settling chambers-Cyclone separators, ESP, Wet scrubber.

9 Hours

### Unit II

#### Control of Gaseous Pollutants

Dispersion of Air pollutants-Plume behavior-Control of gaseous pollutants, Sulphur dioxides, nitrogen oxides, Carbon monoxide and Hydrocarbons. Air pollution laws and Standards.

9 Hours

### Unit III

#### Water Pollution

Water pollution- Classification of water pollutant and their effects on receiving bodies. Advanced wastewater treatments by Physical, Chemical, Biological and Thermal Methods-Effluent quality standards.

9 Hours

### Unit IV

#### Solid waste management

Solid waste management - methods of collection – Disposal of solid waste, land filling, Handling of toxic and radioactive wastes – Incineration and Verification.

9 Hours

### Unit V

#### Pollution Control in Industries

Pollution control in process industries – Cement, paper, petroleum, fertilizer and petrochemical.

9 Hours

### Unit VI<sup>§</sup>

Past Climate Change and the Natural Greenhouse Effect, Climate Change and Human Activities, Factors Affecting the Earth's Temperature, Dealing with the Threat of Global Warming, Ozone Depletion in the Stratosphere, Protecting the Ozone Layer

**Total: 45 Hours**

### Reference(s)

1. C.S Rao,, *Environmental Pollution Control Engineering*, Wiley Eastern Ltd., New Delhi, 2006.
2. P,R Trivedi, , *Environmental Pollution and Control*, Paragon-Nivin Shahdara, New Delhi, 2008.

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<sup>§</sup> Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

3. G.T Miller,, *Environmental Science: Working with the Earth*, 11<sup>th</sup> Edition, Wadsworth Publishing Co., Belmont, CA, 2006
4. E. C Wolfe,, *Race to Save to Save Planet*, Wadsworth Publishing Co., Belmont, CA 2006
5. M.J Hammer,, and M.J Hammer,, Jr., *Water and Wastewater Technology*, Pearson Prentice Hall, 2006
6. [www.gpcb.gov.in](http://www.gpcb.gov.in)
7. [www.cpcb.nic.in](http://www.cpcb.nic.in)

## 15IS52 SAFETY IN CONSTRUCTION

3 0 0 3

### Course objectives

- To know causes of accidents related to construction activities and human factors associated with this accident.
- To understand the construction regulations and quality assurance in construction.
- To impart knowledge about hazards of construction and their prevention methods.

### Course Outcomes (COs)

Students will be able to

1. Identify the problems impeding safety in construction industries.
2. Recognize the types and causes of accidents and design aids for safe construction.
3. Recognize the hazards during construction of power plant, road works ,high rise buildings constructions.

### Unit I

#### Accidents Causes and Management Systems

Problems impeding safety in construction industry- causes of fatal accidents, types and causes of accidents related to various construction activities , human factors associated with these accident–construction regulations , contractual clauses–Pre contract activates, preconstruction meeting–design aids for safe construction –permits to work–quality assurance in construction - compensation –Recording of accidents and safety measures–Education and training.

9 Hours

### Unit II

#### Hazards of Construction and Prevention

Excavations , basement and wide excavation, trenches , shafts – scaffolding, types , causes of accidents, scaffold inspection checklist – false work – erection of structural frame work ,dismantling –tunneling –blasting , pre blast and post blast inspection–confined spaces–working on contaminated sites– work over water–road works–power plant constructions–construction of high rise buildings.

9 hours

### Unit III

#### Working at Heights

Fall protection in construction OSHA3146–OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings , requirement for safe work platforms, stairways , gang ways and ramps–fall prevention and fall protection, safety belts, safety nets ,fall arrestors ,controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, height pass– accident case studies.

9 hours

### Unit IV

#### Construction Machinery

Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes , crane inspection checklist -builder's hoist , winches , chain pulley blocks– use of conveyors – concrete mixers ,concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools ,drills, grinding tools, manual handling scaffolding, hoisting cranes–use of conveyors and mobile cranes– manual handling.

9 Hours

































































