CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Scheme of Teaching & Examination

M. Tech. (Industrial Safety Engineering)

I Semester

S. No.	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Examination Theory / Practical			Total Marks	Credit L+(T+P)/ 2
				L	T	P	ESE	CT	TA		
1	Mechanical Engg.	586111(37)	Safety Management	3	1	-	100	20	20	140	4
2	Mechanical Engg.	586112(37)	Occupational Health and Hygiene	3	1	-	100	20	20	140	4
3	Mechanical Engg.	586113(37)	Safety in Engineering Industry	3	1	-	100	20	20	140	4
4	Mechanical Engg.	586114(37)	Regulation for Health, Safety and Environment	3	1	-	100	20	20	140	4
5	Mechanical Engg.	586115(37)	Pollution Control in Industries	3	1	-	100	20	20	140	4
6	Mechanical Engg.	586121(37)	Occupational Health and Hygiene Lab.	-	-	3	75	-	75	150	2
7	Mechanical Engg.	586122(37)	Workshop Technology Lab.	-	-	3	75	-	75	150	2
Total				15	5	6	650	100	250	1000	24

L- Lecture
T- Tutorial
P- Practical ,
ESE- End Semester Exam
CT- Class Test
TA- Teacher's Assessment

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: M. Tech. - I **Branch: Mechanical Engg.**
Subject: Safety Management **Code: 586111(37)**
Total Theory Periods: 40 **Total Tutorial Periods: 12**
Total Marks in End Semester Exam. : 100
Minimum number of Class Test to be conducted: 02

Unit-1
CONCEPTS:- Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety.

Unit-2
TECHNIQUES:- Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

Unit-3
ACCIDENT INVESTIGATION AND REPORTING:- Concept of an accident, reportable and non reportable accidents, unsafe act and condition – principles of accident prevention, 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.

Unit-4
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.

Unit-5
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 – Domestic Safety and Training.

References
1. Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago, 1982
2. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York, 1980.
3. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay, 1997.
4. John Ridley, “Safety at Work”, Butterworth & Co., London, 1983.
5. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey, 1973

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: M. Tech. - I **Branch: Mechanical Engg.**
Subject: Occupational Health and Hygiene **Code: 586112(37)**
Total Theory Periods: 40 **Total Tutorial Periods: 12**
Total Marks in End Semester Exam. : 100
Minimum number of Class Test to be conducted: 02

Unit-1

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 programsvibration, types, effects, instruments, surveying procedure, permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standardnon- 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.

Unit-2

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.

Unit-3

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 Musculoskeltal Disorders –carpal tunnel syndrome CTS- Tendon paindisorders of the neck- back injuries.

Unit-4

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.

Unit-5

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.

References

1. *Handbook of Occupational Health and Safety,* NSC Chicago, 1982
2. *Encyclopedia of Occupational Health and Safet*y, Vol. I & II, International Labour Organisation, Geneva, 1985.
3. McCornick, E.J. and Sanders, M.S., *Human Factors in Engineering and Design*, Tata McGraw-Hill, 1982.

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: M. Tech. - I **Branch: Mechanical Engg.**
Subject: Safety in Engineering Industry **Code: 586113(37)**
Total Theory Periods: 40 **Total Tutorial Periods: 12**
Total Marks in End Semester Exam. : 100
Minimum number of Class Test to be conducted: 02

Unit-1

SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES:- General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning 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.

Unit-2

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-shearingpresses- forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

Unit-3

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.

Unit-4

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.

Unit-5

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.

References

1. “Accident Prevention Manual” – NSC, Chicago, 1982.
2. “Occupational safety Manual” BHEL, Trichy, 1988.
3. “Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4. “Safety in Industry” N.V. Krishnan Jaico Publishery House, 1996.
5. Indian Boiler acts and Regulations, Government of India.
6. Safety in the use of wood working machines, HMSO, UK 1992.
7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: M. Tech. - I **Branch: Mechanical Engg.**
Subject: Regulation for Health, Safety and Environment **Code: 586114(37)**
Total Theory Periods: 40 **Total Tutorial Periods: 12**
Total Marks in End Semester Exam. : 100
Minimum number of Class Test to be conducted: 02

Unit-1
Factories act and rules - Workmen compensation act.

Unit-2
Indian explosive act - Gas cylinder rules - SMPV Act - Indian petroleum act and rules.

Unit-3
Environmental pollution act

Unit-4
Manufacture, Storage and Import of Hazardous Chemical rules 1989

Unit-5
Indian Electricity act and rules, Overview of OHSAS 18000 and ISO 14000

References

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd. New Delhi.
3. Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd., New Delhi.
4. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
5. Explosive Act, 1884 and Explosive rules, 1883 (India), (2002), Eastern Book company, Lucknow, 10th Edition
6. The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.
7. ISO 9000 to OHSAS 18001, Dr. K.C. Arora, S.K. Kataria & Sons, Delhi

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: M. Tech. - I **Branch: Mechanical Engg.**
Subject: Pollution Control in Industries **Code: 586115(37)**
Total Theory Periods: 40 **Total Tutorial Periods: 12**
Total Marks in End Semester Exam. : 100
Minimum number of Class Test to be conducted: 02

Unit-1
Air pollution– Classification and properties of Air pollutants-Pollution sources- Control of air pollution – Gravitational settling chambers-Cyclone separators, ESP, Wet scrubber.

Unit-2
Dispersion of Air pollutants-Plume behavior-Control of gaseous pollutants, sulphur dioxides, nitrogen oxides, Carbon monoxide and Hydrocarbons. Air pollution laws and Standards.

Unit-3
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.

Unit-4
Solid waste management- methods of collection – Disposal of solid waste, land filling, Handling of toxic and radio active wastes –Incineration and vitrification.

Unit-5
Pollution control in process industries – Cement, paper, petroleum, fertilizer and petrochemical.

References

1. Rao, C.S., *Environmental Pollution Control Engineering,* Wiley Eastern Ltd., New Delhi, 1992.
2. Herbert F. Lund, Industrial pollution control handbook, McGraw-Hill, 1971.
3. S.P. Mahajan, Pollution Control In Process Industries, 2004.
4. Khopkar S.M., *Enviromental Pollution Analysis*, Wiley Eastern Ltd., New Delhi.
5. Dara S. S., Enviromental Chemistry & Pollution Control, S.Chand, New Delhi.

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: M. Tech. - I **Branch: Mechanical Engg.**
Subject: Occupational Health and Hygiene Lab. **Code: 586121(37)**
Total Lab Periods: 40
Total Marks in End Semester Exam. : 75

List of Experiments (to be performed at least 15 experiments)

1. Study of Stepwise Development of Occupational Health Services.
2. Study of Availability of Occupational Health Services
3. Study for Policy Impact of International Instruments
4. Study of Legislative Structures for Occupational Health Practice
5. Study of Objectives of Occupational Health Practice
6. Study of Functions and Activities of Occupational Health Services
7. Study of Preliminary orientation to the enterprise of Occupational Health Services.
8. Study of Surveillance of the working environment
9. Study for process of Informing employer, enterprise management and workers about occupational health hazards
10. Study of Assessment of health risks
11. Study of Surveillance of workers' health
12. Study of Initiatives for preventive and control measures
13. Study of First aid services and emergency preparedness
14. Study of Occupational health care, general preventive and curative health services
15. Study of Rehabilitation
16. Study of Adaptation of work to the workers
17. Study of Health promotion activities
18. Study of Infrastructures for Occupational Health Services
19. Study for Selection of a Model for Occupational Health Services
20. Study for Future Perspectives for Occupational Health Services Development.

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Semester: M. Tech. - I **Branch: Mechanical Engg.**
Subject: Workshop Technology Lab. **Code: 586122(37)**
Total Lab Periods: 40
Total Marks in End Semester Exam. : 75

List of Experiments

In each of the below mentioned experiments student have to perform experiments in different operating conditions and suggest about the safety measures with their necessity, to be followed in the industrial working conditions.

1. Turning operation.
2. Milling operation.
3. Grinding operation.
4. Drilling operation.
5. Shaping operation.
6. Planning operation.
7. Welding operation.
8. Carpentry operation.
9. Power saw cutting operation.
10. Black smithy / molding operation.