



SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH  
FACULTY OF ENGINEERING

# Shri Rawatpura Sarkar University, Raipur



## Examination Scheme & Syllabus

for

**M.Tech.(Health Safety & Environment  
Engineering)**

**Semester-II**

(Effective from the session: 2022-23)



**Faculty of Engineering  
Shri Rawatpura Sarkar University, Raipur  
M.Tech. (Health Safety & Environment Engineering)  
Semester-II**

**Examination Scheme  
(Effective from the session: 2022-23)**

S · N	Course Code	Th /Pr	Subject	Type of Course	Teaching hours per week			TC	Examination Scheme				Total Marks
					L	T	P		Theory		Practical		
									EX	IN	EX	IN	
1	MENHS201T	Th	Safety in Industrial Operation & Design	Core	3	1	-	4	70	30	-	-	100
2	MENHS202T	Th	Fundamentals of Sustainable Development	Core	3	1	-	4	70	30	-	-	100
3	MENHS203A	Th	Elective -II	Core	3	1	-	4	70	30	-	-	100
4	MENHS204T	Th	Safety in construction engineering	Core	3	1	-	4	70	30	-	-	100
5	MENHS205T	Th	Legal Aspects of Safety Health Environment.	Core	3	1	-	4	70	30	-	-	100
6	MENHS206P	Pr	Occupational health studies- Lab	Core	-	-	4	2	-	-	50	25	75
7	MENHS207P	Pr	investigation report writing/Case studies /seminar	Core	-	-	4	2	-	-	50	25	75
<b>Total Contact hr per week: 28</b>				<b>Total Credit:</b>				<b>24</b>	<b>Grand Total Marks:</b>				<b>650</b>

**L- LECTURE T- TUTORIAL P- PRACTICAL  
ELECTIVE-II**

<b>I</b>	Hazards identification, risk analysis & managements	MENHS203A
<b>II</b>	Work Study and Ergonomics	MENHS203B
<b>III</b>	Water supply, Refugee Health and Sanitation in Emergency	MENHS203C



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<b>Course Title</b>	<b>SAFETY IN INDUSTRIAL OPERATION &amp; DESIGN</b>				
<b>Course Code</b>	<b>MENHS201T</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	
<b>Prerequisites</b>	Importance of Safety at various stages of a project in Industry, Interlink between Environmental, Social, Economic factors with Safety Issues.				
<b>Course objectives</b>	<p><b>This course will enable students to:</b></p> <ol style="list-style-type: none"> <li>1. Make students to understand the importance of Inherent Safety with qualitative measurement</li> <li>2. Finding out a proper workplace/ location and making layout of plant for safe/time saving and low cost work practice.</li> <li>3. Modelling of best working conditions (ergonomics and environment) and material handling techniques for engineering works.</li> </ol>				
<b>Course Contents</b>	<p><b>UNIT- I</b>  <b>Inherent safety concepts</b>  Special Design Considerations for Hazardous Operations (Loading &amp; Unloading, Start –Up/ Shutdown, Burner Lighting, Flare Ignition, Storage Tank Operation), Electrical Area Classification and Special Purpose Equipment, Siting &amp; Layout, Petroleum Storage Installations, LNG Terminals, Bulk Handling, Distribution of Petroleum, products/Terminals, Safety with Thermal Power Equipment.</p> <p><b>UNIT-II</b>  <b>Plant locations</b>  Selection of Plant Location- Territorial Parameters - Considerations of Land Water- Electricity- Location for Waste Treatment &amp; Disposal- Further Expansions - Safe Location of Chemical Storages -LPG-LNG-CNG-Acetylene Ammonia-Chlorine-Boilers etc.- Location for Chemical Industries-Tanneries-Power Plants-Quarries Etc. Safe Layout: Safety System-Fire Hydrant Location- Fire Service Rooms- Facilities for Safe Effluent Disposal and Treatment Tanks – Site Consideration - Approach Roads - Plant Railway Lines --Security Towers-Safe Layout for- Process Industries-Engineering Industry-Construction Sites.</p> <p><b>UNIT III</b>  <b>Working conditions</b>  Principles of Good Ventilation: Purpose -Physiological and Comfort Level types-Hood and Duct Design-Air Conditioning-Ventilation Standards. Purpose of Lighting -Types, Advantages of Good Illumination-Lighting Requirements for various Works. -standards. Housekeeping-Principles, Industrial Noise and Vibration-Thermal Stress.</p>				



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	<p><b>UNIT -IV</b> <b>Material handling equipment</b> Principles of Material Handling-Ergonomic Considerations-Methods of Manual Handling-Simple Devices-Hand Contrivances-Lifting Tackles-Lifts-Pulleys-Pulley Blocks-Chain Blocks-Selection and Operations- Fork Lifts, Front End Loaders-Cranes-Hoists-Mobile Cranes-Conveyors- Elevators-Winches-Derricks-Booms-different Ropes-Load Distribution in Slings-Automatic Load Indicators-Load Radius Indicators-Inspection &amp; Testing Procedures- Installation and Maintenance.</p> <p><b>UNIT-V</b> <b>Working at Heights</b> Safe Access - Safe Use of Ladders and Scaffoldings-Types -Requirement for Safe Work Platforms- Stairways - Gangways and Ramps-Fall Prevention &amp; Fall Protection - Safety Belts - Safety nets - Fall Arrestors- Working on Fragile Roofs - Work Permit Systems-Accident Case Studies.</p>
<b>Course outcomes</b>	<p><b>The students will be able to:-</b></p> <ul style="list-style-type: none"><li>• Recall the importance of safety culture in various industry</li><li>• Develop an inherent safe process unit and its evaluation.</li><li>• Find out a hazard free site for making a plant layout.</li><li>• Develop of safe workplace and work culture within a particular system.</li><li>• Report Industrial Incident/ accidents/ issues/ suggestions to authorized person.</li></ul>
<b>Text Books</b>	<ol style="list-style-type: none"><li>1. Guidelines for Engineering Design for Process Safety, 2nd Edition</li><li>2. Loss Prevention in process industries, Frank P. Lees, 2nd Edition.</li></ol>
<b>Reference Books</b>	<ol style="list-style-type: none"><li>1. Hazop &amp; Hazan: Identifying and Assessing Process Industry Hazards, Fouth Edition.</li><li>2. Hardcover – Import, 1 Sep 1999The Handbook of SafetyEngineering: Principles and Applications, Frank R. Spellman, Nancy E. Whiting 2009</li><li>3. Hazap &amp; Hazan-Ref to Icheme (Chemical Engineering) Hardcover – Import, 1 Apr 1992</li></ol>



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<b>Course Title</b>	<b>FUNDAMENTALS OF SUSTAINABLE DEVELOPMENT</b>				
<b>Course Code</b>	<b>MENHS202T</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	
<b>Prerequisites</b>	Basic knowledge of physics and chemistry (Basic science), Basic knowledge of Environment.				
<b>Course objectives</b>	<p><b>This course will enable students:</b></p> <ol style="list-style-type: none"> <li>1. To help the students understand the fundamental key concepts on Sustainable Development. (SD), such as intra- and inter-generational equity, economic, social and environmental, sustainability; strong and weak sustainability, natural capitalism, steady state and green economy;</li> <li>2. To enable students to understand to identify and discuss in detail the key empirical issues on sustainable development, such as renewable energy transitions, urban agriculture, and green architecture;</li> <li>3. To empower students with the expertise to distinguish between “green economy” and “sustainability”, and various efforts at multiple levels of governance: from individual to governments.</li> <li>4. To expose students to a wide variety of research areas to apply and therefore appropriate theoretical knowledge on public policy and international relations to the issue area of sustainable development, in such aspects as international aid, global climate change negotiations, the importance of international regimes as opposed to voluntary private governance;</li> <li>5. To empower Students to make their own lives more sustainable and join social movements to bring about more of sustainable development.</li> </ol>				
<b>Course Contents</b>	<p><b>UNIT-I</b>  <b>Concept of sustainable development</b>            Definition of sustainability - History and emergence of the concept of sustainable development – Our Common Future - Objectives of Sustainable Development - Millennium Development Goals - Environment and Development linkages – Globalization and environment - Population, Poverty and Pollution – Global, Regional and Local environmental issues – Resource Degradation – Greenhouse Gases and climate Change – Desertification – Industrialization – Social insecurity.</p> <p><b>UNIT-II</b>  <b>Sustainability and the triple bottom line</b>            Components of sustainability – Complexity of growth and equity - Social, economic and environmental dimensions of sustainable development –</p>				



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	<p>Environment – Biodiversity – Natural Resources – Ecosystem integrity – Clean air and water – Carrying capacity –Equity, Quality of Life, Prevention, Precaution, Preservation and Public participation. - Structural and functional linking of developmental dimensions – Sustainability in national and regional context</p> <p><b>UNIT-III</b>  <b>Sustainable development and international response</b>          Role of developed countries in the development of developing countries          International summits – Stockholm to Johannesburg – Rio Principles – Agenda 21 - Conventions –Agreements – Tokyo Declaration-Doubling Statement-Trans boundary issues –Integrated approach for resource protection and management</p> <p><b>UNIT-IV</b>  <b>Sustainable development of socio-economic systems</b>          Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes – Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and Sustainable Cities – Sustainable Energy and Agriculture – Sustainable Livelihoods – Ecotourism</p> <p><b>UNIT-V</b>  <b>Framework for achieving sustainability</b>          Sustainability indicators - Hurdles to Sustainability - Operational guidelines – Interconnected prerequisites for sustainable development – Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities, Business and Industry - Science and Technology for sustainable development –Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development.</p>
<p><b>Course outcomes</b></p>	<p><b>At the end of this course students will be able to-</b></p> <ol style="list-style-type: none"> <li>1. Gain knowledge of sustainability</li> <li>2. Gain knowledge on biodiversity</li> <li>3. Study about greenhouse gases</li> <li>4. Learn dynamics of sustainability</li> <li>5. Gain Knowledge on socio-economic systems</li> <li>6. Study about the conventions on sustainable development.</li> </ol>
<p><b>Text Books</b></p>	<ol style="list-style-type: none"> <li>1. Austin, James and Tomas Kohn. 1990. Strategic Management in Developing Countries. The Free Press.</li> <li>2. Berger. 1994. “The Environment and the Economy.” In Smelser and Swedberg (eds.)</li> </ol>



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**Reference  
Books**

1. The Handbook of Economic Sociology. Russel Sage Foundation. D'Arcy, David. Transcript of broadcast, Dec. 5, 2002, "In Houston, a Treasure of Exiled Afghan Art," National Public Radio,
2. Elkington, John. Cannibals with Forks: The Triple Bottom Line for 21st Century Business Oxford: Capstone Publishing, October 1997.
3. Guillen, Mauro and Sandra L. Suarez. 2002. "The Institutional Context of Multinational Activity." In Organization Theory and the Multinational Corporation. 2nd edition. NewYork: St. Martin's Press



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<b>Course Title</b>	<b>SAFETY IN CONSTRUCTION ENGINEERING</b>				
<b>Course Code</b>	<b>MENHS204T</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	
<b>Prerequisites</b>	Principles of safety management, Basic Knowledge of safety at work. Basic knowledge human physiology & the surrounding factors and its effects.				
<b>Course objectives</b>	<p><b>This course will enable students-</b></p> <ul style="list-style-type: none"> <li>• To provide knowledge of various safety practices followed in Construction site.</li> <li>• To provide in-depth knowledge of various work carried in Construction site.</li> <li>• To familiarize the student applicable statutory regulations, acts, Regulations.</li> </ul>				
<b>Course Contents</b>	<p><b>UNIT -I</b>  <b>Equipment and maintenance</b>  Types of equipment's used for construction activities (Earth moving, lifting, conveying, concrete mixer, tunneling, piling, de watering equipment etc). Selection of equipment (suitability), Maintenance strategies, strategies for preventive maintenance.</p> <p><b>UNIT –II</b>  <b>Work environment</b>  Work Environment Effect of work environment (wind, rain, heat, cold, dust and noise), handling hazardous chemicals, tools and equipment, Slips, trips and falls etc. Welfare facilities (drinking water, sanitary, rest etc. Safe movement of workers at workplace</p> <p><b>UNIT –III</b>  <b>WORK MATERIAL</b>  Work Material and substances Various materials used in construction, hazards associated with the use, control measures to reduce the risk, substance misuses (drugs and alcohol) etc and control measures.</p> <p><b>UNIT –IV</b>  <b>Storage of material</b>  Material storage including hazardous, flammable and waste (indoor and open storage), falling materials and controls</p> <p><b>UNIT –V</b></p>				





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	<p><b>Disposal of waste</b> Disposal of waste Safe handling and storage of construction wastes (concrete, spoils, timbers etc.), use of skip for storing wastes, using licensed contractors for disposing waste to the government disposal areas.</p>
<b>Course outcomes</b>	<p><b>At the end of this course students will be able to-</b></p> <ol style="list-style-type: none"><li>1. Mention various Control measures adopted in each Construction activity to avoid Incidents</li><li>2. Demonstrate the safe use of various types of ladders, handheld power tools, Hydraulic Used tools in Construction industry.</li><li>3. Describe various components of cranes, safety features and its function.</li><li>4. Apply the minimum requirements of BOCW act to the Construction site when they work.</li></ol>
<b>Text Books</b>	<ol style="list-style-type: none"><li>4. K.N. Vaid (Ed.), Construction Safety Management, National Institute of Construction Management and Research, Bombay.</li><li>5. V.J. Davies &amp; K. Tomasin, Construction Safety Handbook, Thomas Telford Publishing, London.</li><li>6. James B. Fullman, Construction Safety, Security &amp; Loss Prevention, John Wiley &amp; Sons.</li><li>7. Linger L, Modern Methods of Material Handling.</li></ol>
<b>Reference Books</b>	<ol style="list-style-type: none"><li>1. Building and other Construction Workers (Regulation and the Employment and Conditions of Service) Act, 1996</li><li>2. Safety and Health in Construction, ILO Code of Practice Safety and Health in Construction Convention, 1988 (C 167).</li><li>3. Convention concerning Safety and Health in Construction NSC Publication. Hazardous Waste Management OSHA Code of Federal regulations 1910 and 1926</li><li>4. HSG 150: Health and safety in construction.</li></ol>



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<b>Course Title</b>	<b>LEGAL ASPECTS OF SAFETY HEALTH ENVIRONMENT</b>				
<b>Course Code</b>	<b>MENHS205T</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	
<b>Prerequisites</b>	Occupational Health Safety, Environment Studies Etc.				
<b>Course objectives</b>	<p><b>This course will enable students-</b></p> <ul style="list-style-type: none"> <li>• To provide an overview of safety aspects of general workplace</li> <li>• To discuss a legislative background of electrical safety</li> <li>• To give a basic insight of hazardous areas-classification, Protection techniques for selection &amp; installation of electrical equipment to national/international (OISD/NEC/IEC/IEEE) codes &amp; standard.</li> </ul>				
<b>Course Contents</b>	<p><b>UNIT-I</b>  <b>Electromagnetism</b>          Introduction-Electrostatics-Electromagnetism –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).</p> <p><b>UNIT – II</b>  <b>Primary &amp; secondary hazards</b>          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 –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-Control- National Electrical Safety Code ANSI C2,Class II, Division 1&amp; 2 Lightning - Hazards - Lightning Arrestor - Installation - Earthing - Specifications - Earth Resistance - Earth Pit Maintenance.</p> <p><b>UNIT-III</b>  <b>Fuses &amp; its properties</b>          Fuses - 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 &amp;</p>				



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	<p>Connections-Means of Cutting of Power-Overload and Short Circuit Protection-No Load Protection-Earth Fault Protection-Earthing Standards-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’s.</p> <p><b>UNIT– IV</b>  <b>Roles of environment</b>          Role of Environment in Selection-Safety Aspects in Application-Protection and Interlock-Self Diagnostic Features and Fail Safe Concepts-Surge withstand Capability Test Requirements- Lock Out and Work Permit System. -Discharge Rods and Earthing Devices-Safety in the use of Portable Tools-Cabling and Cable Joints-Preventive Maintenance</p> <p><b>UNIT– V</b>  <b>Classification of hazardous</b>          Classification of Hazardous Zones-Intrinsically Safe and Explosion Proof Electrical Apparatus-Increased Safe Equipment-Selection for Different Zones-Temperature Classification- Grouping of Gases- Barriers and Isolators-Equipment Certifying Agencies.</p>
<p><b>Course outcomes</b></p>	<p><b>At the end of this course students will be able to-</b></p> <ul style="list-style-type: none"> <li>• Describe the phenomenon of electrical hazards associated causes, effects and prevention/protection measures.</li> <li>• Identify &amp; explain different types of current limiting devices &amp; relays and their role in safety</li> <li>• Enumerate legislative background for electrical safety (codes/standards/acts/rules, etc.,)</li> <li>• Elucidate the causes, phenomenon and effects of static charge generation and discharge prevention/protection measures.</li> <li>• Explicate the classification of hazardous areas, the protection schemes to be employed for the electrical equipment to be installed in Hazardous areas.</li> </ul>
<p><b>Text Books</b></p>	<ol style="list-style-type: none"> <li>1. Industrial Fire Protection Engineering – Robert G. Zalosh</li> <li>2. Hydro Carbon Processing Unit Volume I, II</li> <li>3. An Introduction to Fire Dynamics - Dougal Drysdale.</li> <li>4. Automatic Sprinkler performance table, Fire Journal, NFPA, 1970 Edition.</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. Evaporation from plain liquid surface into a turbulent boundary layer – By Brighton P.W.N</li> <li>2. Factory Mutual loss prevention data sheet, 1-20 protection against fire protection.</li> <li>3. Factory Mutual loss prevention data sheet 2-8, Earthquake, Protection for</li> </ol>



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	sprinkler system. 4. NFPA 13, NFPA 30B, NFPA 49, SPFE Book of Fire Protection Engineering.
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<b>Course Title</b>	<b>OCCUPATIONAL HEALTH STUDIES-LAB</b>				
<b>Course Code</b>	<b>MENHS206P</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	-	-	4	2	
<b>Prerequisites</b>	Environment Engineering & Pollution Control				
<b>Course objectives</b>	<p><b>This course will enable students-</b></p> <ul style="list-style-type: none"> <li>• Recognize and evaluate occupational safety and health hazards in the workplace, and to determine appropriate hazard controls following the hierarchy of controls.</li> <li>• Students will furthermore be able to analyze the effects of workplace exposures, injuries and illnesses, fatalities and the methods to prevent incidents using the hierarchy of controls, effective safety and health management systems and task oriented training.</li> </ul>				
<b>Course Contents</b>	<p><b>LIST OF EXPERIMENTS</b></p> <ol style="list-style-type: none"> <li>1. To study the Monitoring chemical hazards measuring chemical presence in different forms.</li> <li>2. To study the biological agents causing occupational diseases.</li> <li>3. Work station assessment Designing and use of work station.</li> <li>4. To study the Hazard identification.</li> <li>5. To study the Health and safety statistics.</li> </ol>				
<b>Course outcomes</b>	<p><b>At the end of this course students will be able to-</b></p> <ul style="list-style-type: none"> <li>• Evaluate workplace to determine the existence of occupational safety and health hazards</li> <li>• Identify relevant regulatory and national consensus standards along with best practices that are applicable.</li> <li>• Select appropriate control methodologies based on the hierarchy of controls.</li> <li>• Analyze injury and illness data for trends.</li> </ul>				



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<b>Course Title</b>	<b>INVESTIGATION REPORT WRITING/CASE STUDIES /SEMINAR</b>				
<b>Course Code</b>	<b>MENHS107P</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	-	-	4	2	
<b>Prerequisites</b>	Noise Level, Vibration, Bam Friction				
<b>Course objectives</b>	<b>This course will enable students-</b> <ul style="list-style-type: none"><li>• Case studies are chosen for teaching based on how rich the narrative is, and whether the people in the study are required to make a decision or solve a problem.</li><li>• When using case studies, the focus is not on the data or the analysis.</li><li>• The students analyze the case and try to find ways to find solutions and solve problems.</li></ul>				
<b>Course Contents</b>	<b>LIST OF EXPERIMENTS/CASE STUDIES</b> <ol style="list-style-type: none"><li>1. Make a report on different types of health effects in different work place.</li><li>2. Make a report Automobile Garage Sewing Mill Power Plant Construction site.</li><li>3. List the control measures to reduce health effects in work place such as industries.</li><li>4. First Aid Examination of causality.</li><li>5. Make a report in municipalities effect in work place.</li><li>6. Case studies in slum area health studies of city.</li></ol>				
<b>Course outcomes</b>	<b>At the end of this course students will be able to-</b> <ol style="list-style-type: none"><li>1. Achieve Knowledge of Design and development of experimental skills.</li><li>2. Understand the principles of design of experiments.</li></ol>				



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**Elective –II**

<b>Course Title</b>	<b>HAZARDS IDENTIFICATION, RISK ANALYSIS &amp; MANAGERMENTS</b>				
<b>Course Code</b>	<b>MENHS104A</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	
<b>Prerequisites</b>	Principles of safety management, Basic Knowledge of safety at work, Basic knowledge human physiology & the surrounding factors and its effects.				
<b>Course objectives</b>	<p><b>This course will enable students-</b></p> <ul style="list-style-type: none"> <li>• To provide knowledge in Quantitative Risk Analysis Process Industries</li> <li>• To provide in-depth knowledge of risk Control and Management</li> <li>• To familiarize the student with various types of Hazard Identification techniques.</li> </ul>				
<b>Course Contents</b>	<p><b>UNIT-I</b>  <b>Hazard identification and risk analysis</b>            Introduction - Hazard - Process - Hazard - Monitoring - Risk - Issues - Perception - Management Assessment-Analysis-Safety Audits-Management System Audits-Check Lists- Material Safety Data-What If Analysis-Event Tree-Fault Tree Analysis-Hazard and Operability.            Studies- Coarse Hazard Studies-Human Error Analysis-Safety Review System-Hazard Warning Methods-Hazard Warning Analysis- Plant Safety Audit.</p> <p><b>UNIT-II</b>  <b>Software for risk analysis</b>            Basic Concepts of Risk Analysis - Quantitative - Qualitative Methods - Hazard Models System- Hazard Assessment Systems - Principles of Applications of Software's- FETI – Hazard Operability Studies (HAZOP) - EFFECTS - Hazard Analysis (HAZAN) - PHAST - SAFETI -Failure Mode and Effect Analysis (FMEA).</p> <p><b>UNIT-III</b>  <b>Risk control &amp; management</b>            Impact estimation: Property, People, Man and Machine System, Job and Personal Risk Factors- Standards-Selection and Training-Body Size and Posture-Body Dimension (Static/Dynamic)- Adjustment Range- Penalties. Guide Lines for Safe Design and Postures- Evaluation and Methods of Reducing Posture Strain. Man-Machine Interface-Controls-Types of Control-Identification and Selection-Types of Displays-Compatibility and Stereotypes</p>				

Board of Studies



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	<p>of Important Operations-Fatigue and Vigilance- Measurement Characteristics and Strategies for Enhanced Performance Human Factor Engineering &amp; Behavioral based safety.</p> <p><b>UNIT-IV</b>  <b>Behavioral based safety</b>  Strategies for Enhanced Performance Human Factor Engineering &amp; Behavioral based safety. Guide Lines for Safe Design and Postures- Evaluation and Methods of Reducing Posture Strain. Man-Machine Interface-Controls-Types of Control-Identification and Selection-Types of Displays-Compatibility and Stereotypes of Important Operations-Fatigue and Vigilance- Measurement Characteristics.</p> <p><b>UNIT-V</b>  <b>Biological hazards</b>  Biological agent, various types of biological agent, assessment of biological and control of biological agents at workplaces (hierarchy of controls).</p>
<p><b>Course outcomes</b></p>	<p><b>At the end of this course students will be able to-</b></p> <ol style="list-style-type: none"> <li>1. Identify various Hazards related to the work practices and activity using various technique.</li> <li>2. Carryout Risk assessment methods to various Industries and work practices and activity</li> <li>3. Understand advantage and disadvantage of various risk analysis techniques</li> <li>4. Compute the consequence modelling using ALOHA</li> <li>5. Create Bow tie diagram, ETA, FTA and FMEA</li> <li>6. Create various components in MSDS and its uses</li> <li>7. Access the Human error, Fatigue involved for various categories of Person in an Industry.</li> </ol>
<p><b>Text Books</b></p>	<ol style="list-style-type: none"> <li>1. Industrial Loss &amp; Critical Investigation (John Walkins)</li> <li>2. An introduction to Production management Techniques. (Wickens Christopher, Lee John).</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. Operation Forecasting &amp; modelling, CLYDE.B, STRONG, M.</li> </ol>



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**Elective –II**

<b>Course Title</b>	<b>WORK STUDY AND ERGONOMICS</b>				
<b>Course Code</b>	<b>MENHS204B</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	
<b>Prerequisites</b>	Operation research, Industrial engineering & industrial management.				
<b>Course objectives</b>	<p><b>This course will enable students-</b></p> <ul style="list-style-type: none"> <li>• To provide basic understanding to the students about the concept and significance of work study and ergonomics.</li> <li>• To impart thorough knowledge to the students about various techniques of work-study for improving the productivity of an organization.</li> <li>• To inculcate the skill among the students for analyzing and improving existing methods of working on the shop floor of an organization.</li> <li>• To impart through knowledge and skills to students with respect to allowances, rating, calculation of basic and standard time for manual operations in an organization.</li> <li>• To provide the knowledge to the students about various wages and incentives schemes.</li> <li>• To inculcate analyzing skills among the students with respect to work place design, working postures and lifting tasks.</li> <li>• To provide thorough knowledge about assessment about occupational exposure to heat stress, noise, vibrations and rspm.</li> </ul>				
<b>Course Contents</b>	<p><b>UNIT-I</b>  <b>Productivity &amp; work study</b></p> <p>Definition of productivity, factors affecting productivity, definition, objective &amp; scope of work study, human factors in work study, work study &amp; management, work study &amp; supervisor, work study &amp; worker.</p> <p><b>UNIT-II</b>  <b>Method study &amp; work measurement</b></p> <p>Definition, objective &amp; scope, charts to record movements in shop, process charts, flow process charts, Multiple activity charts, two handed process charts, SIMO chart, principles of motion economy. Definition, objectives, techniques of work measurement, work sampling, need of confidence levels, sample size determination, random observation with simple problems.</p> <p><b>UNIT-III</b>  <b>Time study</b></p>				





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	<p>Definition, time study equipment's, selection of jobs, steps in time study, breaking jobs into elements, recording information, rating, standard performance, scales of rating, factors affecting rate of working, allowances, standard time determination</p> <p><b>UNIT-IV</b>  <b>Introduction to industrial design</b></p> <p>Elements of design structure for industrial design in engineering application in modern manufacturing systems. Ergonomics and Industrial Design: Introduction, general approach to the man-machine relationship, workstation design-working position.</p> <p><b>UNIT-V</b>  <b>Color models &amp; aesthetic concepts</b></p> <p>RGB, CMY, HSV, Color and light, color and objects-color and the eye-color consistency-color terms reactions to color and color continuation-color on engineering equipment's. Concept of unity-concept of order with variety-concept of purpose style and environment –Aesthetic expressions. Style –components of style house style, observation style in capital goods, case study.</p>
<p><b>Course outcomes</b></p>	<p><b>At the end of this course students will be able to-</b></p> <ol style="list-style-type: none"> <li>1. Students will be able to calculate the basic work content of a specific job for employees of an organization. Thereby they will be able to calculate the production capacity of man power of an organization.</li> <li>2. Students will be able to analyze and calculate the level of risk in a job causing stress, fatigue and musculoskeletal disorders and design appropriate work systems.</li> <li>3. Students will be able to rate a worker engaged on a live job and calculate basic, allowed and standard time for the same.</li> <li>4. Students will be able to analyze the existing methods of working for a particular job and develop an improved method through questioning technique.</li> <li>5. Students will be able to devise appropriate wage and incentive plan for the employees of an organization</li> <li>6. Students will be able to assess the occupational environmental factors like heat stress, noise, and vibration and RSPM level in the industry.</li> </ol>
<p><b>Text Books</b></p>	<ol style="list-style-type: none"> <li>1. Barnes Ralph M., "Motion &amp; Time study: Design and Measurement of Work", Wiley Text Books, 2001.</li> <li>2. Marvin E, Mundel &amp; David L, "Motion &amp; Time Study: Improving Productivity", Pearson Education,2000.</li> <li>3. Benjamin E Niebel and Freivalds Andris, "Methods Standards &amp; Work Design", Mc Graw Hill, 1997.</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. International Labour organization, "Work-study", Oxford and IBH publishing company Pvt. Ltd., N.Delhi, 2001.</li> </ol>



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	2. Sanders Mark S and McCormick Ernest J, "Human Factors in Engineering and Design", McGraw-Hill Inc., 1993
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**Elective-II**

<b>Course Title</b>	<b>WATER SUPPLY, REFUGEE HEALTH AND SANITATION IN EMERGENCY</b>				
<b>Course Code</b>	<b>MENHS204C</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	
<b>Prerequisites</b>	Basic Knowledge of water supply Engineering, waste water treatment & Global disaster and their causes.				
<b>Course objectives</b>	<p><b>This course will enable students-</b></p> <ol style="list-style-type: none"> <li>1. To explain the relationship between the environment and water, sanitation and hygiene related diseases;</li> <li>2. To present standards and key indicators related water supply, sanitation and hygiene in emergencies;</li> <li>3. To provide basic information about control measures for improving environmental conditions;</li> <li>4. Discuss the importance of addressing long term needs of the community at the onset of the emergency and throughout its duration.</li> </ol>				
<b>Course Contents</b>	<p><b>UNIT-I</b>  <b>Hazards monitoring and emergency management</b>            Tracking and modeling – early warning systems – warning protocols – India disaster resource network – environmental hazards – public health aspects of disaster management – emergency services systems - urban hazards and disasters – an introduction to disaster planning. Introduction to emergency management planning - organization and structure for emergency management- emergency management research – methods/analysis – public information for emergency management – principles and practice for disaster relief and recovery – logistics, support system – computer applications in emergency management</p> <p><b>UNIT-II</b>  <b>Humanitarian laws &amp; humanitarian interventions</b>            Human rights, international humanitarian law and refugee conventions, guidelines on internally displaced persons, public health surveillance, control of communicable and non-communicable Partnerships and roles in different stages of emergencies, e.g. humanitarian reform, role of national governmental and non-governmental actors, community participation, prevention/recovery strategies, diseases, mental health, reproductive health, violence and injuries, water and sanitation, nutrition, refugee camp planning.</p> <p><b>UNIT-III</b>  <b>Environmental health risks, site selection &amp; planning</b>            Introduction – environmental health risks in emergencies – needs and standards – public health approach to water supply and sanitation in emergencies – partners in</p>				



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	<p>the humanitarian response working with disaster affected people – social diversity local context Emergency settlements, site selection and planning – introduction – physical planning of emergency settlement – settlement location and physical layout: implications for water supply and sanitation.</p> <p><b>UNIT-IV</b>  <b>Water supply &amp; drainage</b>  Water supply – planning and implementation – water sources – treatment – pumping – tinkering – storage – distribution – collection and use – testing. Waste water – storm water – community involvement.</p> <p><b>UNIT-IV</b>  <b>Excreta disposal.</b>  Phased response – organizational options – staffing needs – monitoring latrine programmers – technical options – options for problem sites</p> <p><b>UNIT-V</b>  <b>Solid waste</b>  Health risk of solid waste from health centers – dead bodies</p>
<p><b>Course Outcomes</b></p>	<p><b>At the end of this course students will be able to-</b></p> <ol style="list-style-type: none"> <li>1. To explain the relationship between the environment and water, sanitation and hygiene related diseases;</li> <li>2. To follow standards and key indicators related water supply, sanitation and hygiene in emergencies;</li> <li>3. To design Soak pit, Infiltration trench, Evaporation pan for Waste water management</li> <li>4. To discuss the importance of addressing long term needs of the community at the onset of the emergency and throughout its duration.</li> <li>5. To identify and control problems in the environment, water, sanitation and hygiene situation during an emergency.</li> <li>6. To apply standards to water supply, sanitation and hygiene in emergencies.</li> </ol>
<p><b>Text Books</b></p>	<ol style="list-style-type: none"> <li>1. Harvey, P.A., Baghri, S. and Reed, R.A. (2002) Emergency Sanitation: Assessment and programme design, WEDC, Loughborough University, UK.</li> <li>2. Adams, John Managing Water Supply and Sanitation in Emergencies. Oxfam:</li> <li>3. Oxford.</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. Assar, M. Guide to sanitation in Natural disasters</li> <li>2. . House, Sarah and Reed, Bob Emergency Water Sources: Guidelines for selection and treatment. WEDC, Loughborough University:Loughborough.</li> </ol>



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