ALAGAPPAUNIVERSITY

(Accredited with A+ Grade by NAAC (CGPA: 3.64) in the Third Cycle), Graded as Category-I University and granted autonomy by MHRD-UGC)

DIRECTORATE OF COLLABORATIVE PROGRAMMES

B.Sc. Fire and Industrial Safety

Regulations and Syllabus

[For those who join the Course in July 2023 and after]

CHOICE BASED CREDIT SYSTEM

GENERAL INSTRUCTIONS AND REGULATIONS

B.Sc. Fire and Industrial Safety conducted by Alagappa University, Karaikudi, Tamil Nadu through its Collaborative Institution. Applicable to all the candidates admitted from the academic year **2023**onwards.

ELIGIBILITY:

A pass in the Higher Secondary Examination (HSC) conducted by the Government of Tamil Nadu, or an examination accepted as equivalent thereto by the Syndicate or Two years ITI for admission to **B.Sc Fire & Industrial Safety.**

1. **For the Degree:**

   The candidates shall have subsequently undergone the prescribed programme of study in an Institute for not less than three academic years, passed the examinations prescribed and fulfill such conditions as have been prescribed, therefore.

2. **Admission:**

   Admission is based on the marks in the qualifying examination.

   Lateral Entry:

   A pass in 3years Diploma in related subject of B.Sc will be admitted directly in 2nd year of B.Scprogramme.

3. **Duration of the course:**

   The course shall extend over a period of **Three years** under Semester pattern.

4. **Standard of Passing and Award of Division:**

   a. Students shall have a minimum of 40% of total marks of the University examinations in each subject. The overall passing minimum is 40% both in aggregate of Continuous Internal Assessment and external in each subject.
   b. The minimum marks for passing in each theory / Lab course shall be 40% of the marks prescribed for the paper / lab.
   c. A candidate who secures 40% or more marks but less than 50% of the aggregate marks prescribed for three years taken together, shall be awarded **THIRD CLASS.**
   d. A candidate who secures 50% or more marks but less than 60% of the aggregate marks prescribed for three years taken together, shall be awarded **SECOND CLASS.**
   e. A candidate who secures 60% or more of the aggregate marks prescribed for three years taken together, shall be awarded **FIRST CLASS.**
   f. Only Part-III subjects were considered for the ranking.
   g. The Practical / Project shall be assessed by the two examiners, by an internal examiner and an external examiner.

5 Continuous internal Assessment:

a. Continuous Internal Assessment for each paper shall be by means of Written Tests, Assignments, Class tests and Seminars
b. **25 marks** allotted for the Continuous Internal assessment is distributed for Written Test, Assignment, Class test and Seminars.
c. Two Internal Tests of 2 hours duration may be conducted during the semester for each course / subject and the best marks may be considered and one Model Examination will be conducted at the end of the semester prior to University examination. Students may be asked to submit at least five assignments in each subject. They should also participate in Seminars conducted for each subject and marks allocated accordingly.
d. Conduct of the continuous internal assessment shall be the responsibility of the concerned faculty.
e. The continuous internal assessment marks are to be submitted to the University at the end of every year.
f. The valued answer papers/assignments should be given to the students after the valuation is over and they should be asked to check up and satisfy themselves about the marks they have scored.
g. All mark lists and other records connected with the continuous internal assessments should be in the safe custody of the institution for at least one year after the assessment.

6 Attendance:

a. Students must have earned 75% of attendance in each course for appearing for the examination.
b. Students who have earned 74% to 70% of attendance to be applied for condonation in the prescribed form with the prescribed fee.
c. Students who have earned 69% to 60% of attendance to be applied for condonation in the prescribed form with the prescribed fee along with the medical certificate.
d. Students who have below 60% of attendance are not eligible to appear for the examination. They shall re-do the semester(s) after completion of the programme.

7 Examination:

Candidate must complete course duration to appear for the university examination. Examination will be conducted with concurrence of Controller of Examinations as per the Alagappa University regulations. **University may send the representatives as the observer during examinations.** University Examination will be held at the end of the each semester for duration of 3 hours for each subject. Certificate will be issued as per the AU regulations. **Hall ticket will be issued to the 1st year candidates and upon submission of the list of enrolled students along with the prescribed course fee subsequent 2nd and 3rd year hall tickets will be issued.**

8 **Miscellaneous**

a. Each student possesses the prescribed textbooks for the subject and the workshop tools as required for theory and practical classes.
b. Each student is issued with an identity card by the University to identify his / her admission to the course
c. Students are provided library and internet facilities for development of their studies.
d. Students are to maintain the record of practical's conducted in the respective laboratory in a separate Practical Record Book and the same will have to be presented for review by the University examiner.
e. Students who successful complete the course within the stipulated period will be awarded the degree by the University.

10. Fee structure

Course fee shall be as prescribed by the University and 50% of the course fee should be disbursed to University. Special fees and other fees shall be as prescribed by the Institution and the fees structure must intimated to the University. Course fees should be only by Demand draft / NEFT and AU has right to revise the fees accordingly.

Pattern	Course Fee payment deadline
Semester	Fee must be paid before 10th September of the academic year

11. Other Regulations:

Besides the above, the common regulation of the University shall also be applicable to this programme.

VISION

- To Produce competent safety professional of excellent technical and managerial skills for national and global development

MISSION

- To provide best education in safety engineering &management, encouraging innovation and entrepreneurship though professional and moral ethics to improve the Environmental Health, safety & Quality of the people worldwide.
- To provide knowledge based technological fire safety and hazard management measures to meet the infrastructural urban development needs of the society and the industry.
- To help in building national capabilities in fire safety engineering, security management, disaster management, hazard management industrial safety education and research to ensure a fire safe nation.
- To pursue research and development R&D in fire safety engineering, hazard management and disseminate its findings.

PROGRAM OUTCOMES (POs)	
After the successful completion of the Fire and Industrial Safety program, students are expected to	
PO 1	Acquire fundamental knowledge and skills on the fire and Industrial safety
PO 2	Gain advanced level knowledge, techniques, skills and modern tools in the field of fire and Industrial Safety
PO 3	Understand the legal aspects and procedures of Safety Inspections and Safety Legislation
PO 4	Develop and Evaluate health and safety program for a variety of industries to promote the health and safety of workers
PO 5	Gain information on operation of fire service equipments and practical fire fighting
PO 6	Acquire skills in the field of Energy Audit, Green Audit , OSHA standards, NEBOSH, etc to improve employment opportunities
PO 7	Aware of the impact of the professional safety solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development

PO 8	Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings
PO 9	An ability to assess safety and legal issues and the consequent responsibilities relevant to the professional
PO 10	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broad cast context of technological change'

Program Education Objective- B.SC(F&IS) Programme

1. Apply principles of transformational leadership to negotiate, mentor, motivate, and lead others toward a shared and ethical organizational vision or goal.
2. Apply knowledge of leadership, change, business models, organizational issues, and regulations to ensure organizational effectiveness, resulting in the improvement of emergency services.
3. Utilize the methods and resources of research, science, and technology to effectively manage emergency services.
4. Utilize appropriate communication strategies and methods to accomplish organizational goals and objectives.
5. Utilize appropriate assessment and planning skills to improve organization and community risk management for emergency services.

Program Specific Objective –B.SC(F&IS)

1. Apply the knowledge and basic sciences, and Safety, Fire Engineering to the solution of complex engineering problems
2. Identify, formulate, study research literature, and analyze complex Safety and Fire Engineering problems reaching substantiated conclusions
3. Design solutions for complex engineering problems and design Safety and Fire components that meet the specified needs.
4. Use Fire engineering research-based knowledge related to interpretation of data and provides valid conclusions.
5. Create, select, and apply modern Safety and Fire Engineering and IT tools to complex engineering activities with an understanding of the limitations.

Programme Specific Outcomes	
After the successful completion of the Fire and Industrial Safety Programme, the students are expected to	
PSO 1	Students are able to design solution for complex major hazardous industries in terms of fixed firefighting installation and fire prevention that meet the specified needs
PSO 2	Students infer the concepts impact of safety engineering solutions related to the fire prevention, industrial risk assessment and accident prevention in environmental, economic and societal context
PSO 3	Students gain relevant knowledge, skills, provisions and rules related to Pollution control in important legislations
PSO 4	Familiarize various firefighting strategies in case of BLEVE, LPG hazards and spillage
PSO 5	Students are familiar with Assess hazards and risk in process and manufacturing industries and devise remedial measures and safety management systems

B.Sc., Fire and Industrial Safety

Sem	Part	Course Code	Courses	Title of the paper	T/P	Cr.	Hrs. / Week	Max.Marks		
								Int.	Ext.	Total
I	I	91011T/ 11H/11F	T/OL	Tamil/Other Languages-I	T	3	5	25	75	100
	II	91012	E	General English –I	T	3	5	25	75	100
	III	91013	CC	Basics of Fire Safety	T	5	5	25	75	100
		91014	CC	Fire Fighting Practical	P	4	6	25	75	100
		91015	Allied	Human Resource Management	T	3	3	25	75	100
		91016	Allied	Personality Development Practical	P	2	3	25	75	100
	IV	91017	SEC – I	Value Education	T	2	2	25	75	100
				Library			1			
				Total		**22**	**30**	**175**	**525**	**700**
II	I	91021T/ H/F/M/ TU/A/S	T/ OL	Tamil/Other Languages-II	T	3	5	25	75	100
	II	91022	E	General English-II	T	3	5	25	75	100
	III	91023	CC	Electrical & Chemical Safety	T	5	5	25	75	100
		91024	CC	Safety Equipments& PPE Practical	P	4	6	25	75	100
		91025	Allied	Warehouse Management	T	3	3	25	75	100
		91026	Allied	Material Handling Techniques Practical	P	2	3	25	75	100
		91027	SEC – II	Environmental Studies	T	2	2	25	75	100
				Library			1			
				Total		**22**	**30**	**175**	**525**	**700**
III	I	91031T/ H/F/M/ TU/A/S	T / OL	Tamil/Other Languages-III	T	3	5	25	75	100
	II	91032	E	General English-III	T	3	5	25	75	100
	III	91033	CC	Construction Safety	T	3	3	25	75	100
		91034	CC	Incident Prevention, Control and Investigation Reporting	T	3	3	25	75	100
		91035	CC	Basics of First Aid Practical	P	3	5	25	75	100
		91036	Allied	Organizational Behaviour	T	3	3	25	75	100
		91037	Allied	Computer Applications Practical	P	2	2	25	75	100
	IV	91038	SEC – III	Entrepreneurship	T	2	2	25	75	100
		91039A 91039B 91039C/	NME-I	1) Adipadai Tamil I	P	2	2	25	75	100
				2) Advance Tamil I	T					
				3) IT Skills for Employment	T					
				4. MOOC'S	T					
				Total		**24**	**30**	**225**	**675**	**900**
IV	I	91041T/ H/F/M/ TU/A/S	T / OL	Tamil/Other Languages-IV	T	3	5	25	75	100
	II	91042	E	General English-IV	T	3	5	25	75	100

	III	91043	CC	Food Hygiene and Safety	T	3	4	25	75	100
		91044	CC	Hazard Identification, Risk Assessment and Risk Control	T	3	4	25	75	100
		91045	CC	Work at Height Practical	P	3	5	25	75	100
		91046	Allied	Retail Environment	T	3	3	25	75	100
		91047	Allied	EIA Practical	P	2	2	25	75	100
	IV	91048A 91048B 91048C	NME	1) Adipadai Tamil I	P	2	2	25	75	100
				2) Advance Tamil I	T					
				3) Small Business Management	T					
				4. MOOC'S	T					
		91049		Industrial Internship Course – 2	I	2		25	75	100
	Total					**24**	**30**	**225**	**675**	**900**
V	III	91051	CC	Safety Inspection and Audit	T	4	4	25	75	100
		91052	CC	Safety in Oil and Gas Industries	T	4	4	25	75	100
		91053A 91053B 91053C	DSE	I) Environmental Safety II) Work Study and Ergonomics III) Dock Safety	T	4	4	25	75	100
		91054A 91054B 91054C	DSE	I) Safety in Textile Industry II) Safety in Mines III) Transportation Safety	T	4	4	25	75	100
		91055A 91055B 91055C	DSE	I) Safety Management Systems II) Safety in Fire Works III) Disaster Management	T	4	4	25	75	100
		91056	CC	Confined Space Entry, Working, Exit and Rescue Operation Practical	P	4	8	25	75	100
				Career Development/ Employability Skills			2			
	Total					**24**	**30**	**150**	**450**	**600**
VI	III	91061	CC	Process Safety Management	T	4	4	25	75	100
		91062	CC	Behavior Based Safety and Industrial Ergonomics	T	4	4	25	75	100
		91063	CC	Safety Audit Practical	P	4	6	25	75	100
		91064A 91064B 91064C	DSE	I) Safety in Process Industries II) Safety in Engineering Industries III) Safety in On and Off Shore Drilling	T	4	4	25	75	100
		91065		Project	PR	8	12	25	75	100
	Total				**-**	**24**	**30**	**125**	**375**	**500**
	Grand Total				**-**	**140**	**180**	**1075**	**3225**	**4300**

T-Theory **1cr=1 hr for Theory paper**
P-Practical **1cr = 2 hrs for Practical paper**

Minimum credit = 140

- IL-Modern Indian Language, E–English
- CC-Core course Core competency, critical thinking, analytical reasoning, research skill & teamwork
- Allied/ GEC –Exposure beyond the discipline
- AECC—Ability Enhancement Compulsory Course (Professional English & Environmental Studies)-Additional academic knowledge, psychology and problem solving etc.,
- SEC-Skill Enhancement Course – Exposure beyond the discipline (Value Education, Entrepreneurship Course, Computer application for Science, etc.,
- NME-Non-Major Elective– Exposure beyond the discipline
- DSE – Discipline specific elective –Additional academic knowledge, critical thinking, and analytical reasoning-Student choice- either Internship or Theory papers or Project+ 2theory paper. If internship – Marks = Internal (150 (75+75) two midterm evaluation throughVivavoce+Report150+ExternalVivavoce100=400, If Project Marks=Internal – 25+ Thesis +Viva voce=75=100 and +3theorypaper =300 =400Extension activity & MOOCs– Voluntary basis

I -Semester				
Course code: 91013	**Basics of Fire Safety**	**T**	**Credits:5**	**Hours:5**
Objectives	1. To understand the basic theory of fire chemistry, the development of fire and its characteristics, and about different types of fire. 2. To study about the product of combustion and their characteristics. 3. Identify the purpose for head protection, why it's important, and how hardhats protect an employee's head 4. Understand employer and employee responsibilities for safety 5. Describe the Hierarchy of Control and the role of personal protective equipment (PPE)			
UNIT 1	**INTRODUCTION OF BASICS SAFETY:** Basics Of Fire – Stage Of Fire- Heat Transfer Methods- Identify The Ignition Source - Class Of Fire, Fire Fighting Methods-Flash Point, And Auto Ignition Temperature-Fire Point-Bleve.Ppe- Introduction Safety, Hazards- Risk-Accident –Incident- Near Miss, Dangerous Occurrence –Basics Of Ppe- Types Of Ppe.			
UNIT 2	**HEAD AND EYE PROTECTION PPE AND FIRE EXTINGUISHER** Introduction Of Head Protection –Hazards- Safety Helmet And Types –Parts And Construction Of Safety Helmet- Care And Maintenance- Safety Glass And Goggles Differentiate – Potential Eye Hazards In Industry- Types Of Goggles. Classification Of Fire- Fire Extinguisher –Types Of Fire Extinguisher-Water, Co2, Dcp, Foam, Halogenated Agent-Fire Extinguisher Operating Methods And Precaution Steps.			
UNIT 3	**HAND AND LEG PROTECTION PPE AND SPRINKLER SYSTEMS** Introduction Of Hand Protection-Injuries –Hazards-Emergency Measures-Prevention Of Hand Injuries-Types Of Hand Protection-Selection- Use And Care Of Hand Protection-Leg Protection Important-Hazards-Protective Measures-Safety Shoe-Maintenance And Care. Water Based Sprinkler System- Sprinkler Heads-Wet Pipe System-Water Supply And Distribution-Piping And Valves –Water Flow Alarm – Dry Pipe System-Sprinkler System Inspection.			
UNIT 4	**ALARM AND DETECTION SYSTEM AND SKIN PROTECTION** Nfpa 72 Classification Of Fire Alarm System-Power Supplies For Alarm System-Initiation Device-Basics Consideration For Installation-Types Of Detectors- Heat Detector –Smoke Detector-Radiant Energy Sensing Detectors. Introduction Of Skin Protections-Causes – Physical Hazards –Chemical Substances-Preventive Measure – Change Cloths Often-Types Of Body Suit -Remove Irritant- Take Shower-Protective Crams.			
UNIT 5	**RESPIRATORY PROTECTION AND SPECIAL WORKPLACE HAZARDS** Introduction – Hazards – Oxygen Deficiency- Harmful Contaminants-Smoke And Fumes-Spray And Mists-Gases And Vapors-Respirators- Color Code Canister-Air Purifying Respirator-Self Contained Breathing Apparatus – Selection Use And Fit. Flammable And Combustible Liquid –Storage And Transportation –Loading And Unloading-Hot Work.			

References:

NFPA Fire protection Handbook – 21st edition – NFPA - 2023
Principles of fire safety engineering – 2nd edition – Das Akhil kumar – PHL learning Pvt.Ltd – 2020.
Fire Officer – principles and practice – Michael J.Ward – NFPA – 2020.
Head, Eye, and Face Personal Protective Equipment New Trends, Practice and Applications - Katarzyna Majchrzycka - CRC Press – 2023.
Personal Protective Equipment – OSHA – 2023.

Web Resources:

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://onlinecourses.nptel.ac.in/noc20_mg43/preview

https://archive.nptel.ac.in/courses/110/105/110105094/

Course outcomes		**Knowledge Level**
CO – 1	To Formulate the water requirement and the pump capacity for fire fighting and understand the basic fire ground operations.	K6
CO – 2	To Classify different types of fire protection systems/ installations in oil and gas industry.	K2
CO – 3	To identify the cost associated with PPE and describe the advantages and disadvantages of PPE and engineering controls	K3
CO – 4	To Describe the evaluation process of determining a successful PPE program	K1
CO – 5	To Define the role of PPE in training and education	K1

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1(L)	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)
CO2	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)	-
CO3	1(L)	1(L)	-	1(L)	-	1(L)	-	1(L)	-	1(L)
CO4	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)	-
CO5	1(L)	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)
W.AV	1	1	1	1	1	1	1	1	1	1

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1(L)	-	1(L)	-	-
CO2	-	1(L)	-	-	1(L)
CO3	1(L)	-	-	1(L)	-
CO4	-	1(L)	1(L)	-	-
CO5	1(L)	-	1(L)	-	-
W.AV	1	1	1	1	1

I -Semester				
Course code: 91014	**FIRE FIGHTING-Practical**	**P**	**Credits:4**	**Hours:6**

OBJECTIVES

1. To Impart the Fire Fighting & Emergency response to the students
2. To Express the Evacuating procedure and emergency response procedures

EXPERIMENTS

1. Identification of classes of fire.
2. Learning the methods of fire fighting.
3. Identification of appropriate fire extinguishers.
4. Evacuating workforce by means of emergency siren/alarm.
5. Steps for emergency planning and preparedness.
6. Emergency response team and their response.
7. Headcount procedures.
8. Fire mock drill & rescue operation.
9. Different types of sirens and siren coding.
10. Debriefing and resuming operations.

REQUIREMENTS

1. All type of Fire extinguishers
2. Emergency Services
3. Suitable water and sand buckets
4. All other required safety equipments for fire demo
5. Provision of Windsock

OUTCOMES

The students will be able to

- To Identify the Fire classifications and fire fighting methods.
- To Practice Fire Rescue and evacuation methods with ERP procedures
- To Operate fire mock drill with Headcount arrangements
- To classify Siren codings and simplify resuming operations.

I -Semester				
Course code: 91015	**Human resource Management**	**T**	**Credits:3**	**Hours:3**

Objectives	1. To understand the evolution of Human resource development and its functions. 2. To know about the processes of HRD and frame work of HRD. 3. To evaluate the HRD program and know about the career development. 4. To know about the HRD activity in organization. 5. To know about the impact of HRD in organization and benchmarking
UNIT 1	**INTRODUCTION ABOUT HRM** Human Resource Development – Evolution Of Hrd - Relationship With Hrm - Human Resource Development Functions - Roles And Competencies Of Hrd Professionals - Challenges To Organization And Hrd Professionals – Employee Behaviour – External And Internal Influence – Motivation As Internal Influence – Learning And Hrd – Learning Strategies And Styles
UNIT 2	**PROCESS AND DESIGN OF HRM** Frame Work Of Human Resource Development - Hrd Processes - Assessing Hrd Needs - Hrd Model - Designing Effective Hrd Program - Hrd Interventions- Creating Hrd Programs - Implementing Hrd Programs - Training Methods - Self Paced/Computer Based/ Company Sponsored Training - On-The-Job And Off-The-Job - Brain Storming - Case Studies - Role Plays - Simulations – T - Groups - Transactional Analysis.
UNIT 3	**EVALUATING HRD PROGRAMS** Evaluating Hrd Programs - Models And Frame Work Of Evaluation - Assessing The Impact Of Hrd Programs - Human Resource Development Applications - Fundamental Concepts Of Socialization - Realistic Job Review - Career Management And Development.
UNIT 4	**DEVELOPMENT OF HR PROGRAMS** Management Development - Employee Counseling And Wellness Services – Counseling As An Hrd Activity - Counseling Programs - Issues In Employee Counseling - Employee Wellness And Health Promotion Programs - Organizational Strategies Based On Human Resources
UNIT 5	**HR PERFORMANCE ANALYSIS** Work Force Reduction, Realignment And Retention - Hr Performance And Bench Marking - Impact Of Globalization On Hrd- Diversity Of Work Force - Hrd Programs For Diverse Employees - Expatriate & Repatriate Support And Development.

References: -

Effective Human Resource Development (HRD) - Dr. Ajit Kumar Ghosh, Dr. Ananya Ghosh – Manas publications – 2023.
The Big Book of HR, 10th Anniversary Edition - Barbara Mitchell · Cornelia Gamlem – Career press – 2022.
Human Resource Management, 16e - Gary Dessler & Biju Varrkey - Pearson Education – 2020.
Human Resources Development (HRD) - Rakesh Kumar Sudan - New Century Publications – 2018.

Web resources:

Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://onlinecourses.nptel.ac.in/noc20_mg43/preview
https://archive.nptel.ac.in/courses/110/105/110105094/

Course outcomes

CO – 1	To describe the HRM evolution and recall the HR professional duties	K1
CO – 2	To understand the importance the training program	K2
CO – 3	To examine the HRD programs in organization	K4
CO – 4	To determine the employee counseling and wellness service	K5

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1(L)	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)
CO2	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)	-
CO3	1(L)	1(L)	-	1(L)	-	1(L)	-	1(L)	-	1(L)
CO4	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)	-
CO5	1(L)	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)
W.AV	1	1	1	1	1	1	1	1	1	1

CO – 5	To discuss the HR programs	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1(L)	-	1(L)	-	-
CO2	-	1(L)	-	-	1(L)
CO3	1(L)	-	-	1(L)	-
CO4	-	1(L)	1(L)	-	-
CO5	1(L)	-	1(L)	-	-
W.AV	1	1	1	1	1

S –Strong (3), M-Medium (2), L- Low (1)

I -Semester					
Course code:91016	**Allied**	**PERSONALITY DEVELOPMENT PRACTICAL**	**P**	**Credits:2**	**Hours:3**

OBJECTIVE:

1. To motivate the students.
2. To improve the students personality development skills.

EXPERIMENTS:

1. MY SELF – (MOTHER LANGUAGE AND ENGLISH)
2. FACE TO FACE CONVERSATION
3. GROUP DISCUSSION
4. APLLY BRAINSTORMING TECHNIQUES
5. CONDUCT MOCK INTERVIEW
6. OBSERVATION AND LISTENING PRACTICE
7. PROBLEM SOLVING
8. RESUME PREPARATION

REQUIREMENTS:

1. TELEVISION
2. MOTIVATION SPEECH VIDEO (BOTH TAMIL AND ENGLISH)
3. ROUND TABLE AND CHAIR
4. AMPLIFIER, MIC WITH SPEAKER

OUTCOMES:

- It will improve the student’s communication skills.
- It will reduce the student`s hesitate in communication.
- It will improve the leadership quality.

I -Semester					
Course code: 91017	**SEC – I**	**Value Education**	**T**	**Credits:2**	**Hours:2**
Objectives	1. To familiarize the basic information about value education. 2. To educate on role of value education. 3. To learn about value crisis. 4. To provide knowledge about value education in college campus. 5. To learn about value education details in society.				
UNIT 1	**INTRODUCTION** Definition – Need For Value Education – How Important Human Values Are – Humanism And Humanistic Movement In The World And In India – Literature On The Teaching Of Values Under Various Religions Like Hinduism, Buddhism, Christianity, Jainism, Islam, Etc. Agencies For Teaching Value Education In India – National Resource Centre For Value Education – Ncert– Iits And Ignou				
UNIT 2	**VEDIC PERIOD** Influence Of Buddhism And Jainism – Hindu Dynasties – Islam Invasion – Moghul Invasion – British Rule – Culture Clash – Bhakti Cult – Social Reformers – Gandhi – Swami Vivekananda – Tagore – Their Role In Value Education				
UNIT 3	**VALUE CRISIS – AFTER INDEPENDENCE** Independence – Democracy – Equality – Fundamental Duties – Fall Of Standards In All Fields – Social, Economic, Political, Religious And Environmental – Corruption In Society Politics Without Principle – Commerce Without Ethics – Education Without Character – Science Without Humanism – Wealth Without Work – Pleasure Without Conscience – Prayer Without Sacrifice – Steps Taken By The Governments – Central And State – To Remove Disparities On The Basis Of Class, Creed, Gender.				
UNIT 4	**VALUE EDUCATION ON COLLEGE CAMPUS** Transition From School To College – Problems – Control – Free Atmosphere – Freedom Mistaken For License – Need For Value Education – Ways Of Inculcating It – Teaching Of Etiquettes – Extra-Curricular Activities – N.S.S., N.C.C., Club Activities – Relevance Of Dr.A.P.J. Abdul Kalam's Efforts To Teach Values – Mother Teresa				
UNIT 5	**PROJECT WORK** 1. Collecting Details About Value Education From Newspapers, Journals And Magazines. 2. Writing Poems, Skits, Stories Centering Around Value-Erosion In Society. 3. Presenting Personal Experience In Teaching Values. 4. Suggesting Solutions To Value – Based Problems On The Campus.				
References: - Satchidananda. M.K. (1991), "Ethics, Education, Indian unity and culture" – Delhi, Ajantha publications. Saraswathi. T.S. (Ed) 1999. Culture", Socialization and Human Development: Theory, Research and Application in India" – New Delhi Sage publications. Venkataiah. N (ed) 1998, "Value Education" New Delhi Ph. Publishing Corporation					

Web resources:
Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://onlinecourses.nptel.ac.in/noc20_mg43/preview
https://archive.nptel.ac.in/courses/110/105/110105094/

Course outcomes

CO – 1	To define the basic concepts of value education.	K1
CO – 2	To outline the knowledge about Vedic period and bakthi culture.	K2
CO – 3	To Discuss the value crisis after independence.	K4
CO – 4	To explain the concepts of value education on college campus.	K5
CO – 5	To compile the value education related details.	K6

On what level it correlated with COs & POs -based on that we have to give marks

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1(L)	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)
CO2	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)	-
CO3	1(L)	1(L)	-	1(L)	-	1(L)	-	1(L)	-	1(L)
CO4	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)	-
CO5	1(L)	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)
W.AV	1	1	1	1	1	1	1	1	1	1

Mapping Course Outcome Vs Programme Outcomes

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1(L)	-	1(L)	-	-
CO2	-	1(L)	-	-	1(L)
CO3	1(L)	-	-	1(L)	-
CO4	-	1(L)	1(L)	-	-
CO5	1(L)	-	1(L)	-	-
W.AV	1	1	1	1	1

S –Strong (3), M-Medium (2), L- Low (1)

II -Semester					
Course code:91023	**Core**	**Electrical & Chemical Safety**	**T**	**Credits:5**	**Hours:5**
Objectives	1. To familiarize the basic information about electricity and hazards. 2. To educate on electrical hazard analysis. 3. To learn about protection from electrical hazards. 4. To provide technical knowledge in chemical exposure and safety. 5. To analyze the handling and storage of hazardous chemicals.				
UNIT 1	**Basics Of Electricity & Hazards Of Electricity** Introduction – Current – Voltage – Power – Resistance – Capacitor - Inductor - Ohm's Law -Types of Electrical Faults-Overloads -Short Circuits-Hazard Analysis – Shock – Arc- Blast - Body Parts & Effects of Shock- Heart, Pulmonary System - Indian Electricity Rules - Statutory Requirements From Electrical Inspectorate- International Standards On Electrical Safety- CPR.				
UNIT 2	**Electrical Hazard Analysis** Primary & Secondary Hazards - Shocks - Burns-Scalds Falls - Safety In The Use Of Electricity Energy Leakage - Clearances & Insulation - Classes Of Insulation - Voltage Classifications - Excess Energy - Current Surges - Over Current & Short Circuit Current- Heating Effects Of Current - Electromagnetic Forces - Corona Effect - Static Electricity Sources - Electrical Causes Of Fire & Explosion Ionization - Spark & Arc - National Electrical Safety Code- Lightning Hazards - Lightning Arrestor -Earthing				
UNIT 3	**Minimizing Electrical Hazards** Fuses -Circuit Breakers & Overload Relays - Protection Against Over Voltage & Under Voltage-Safe Limits Of Amperage -Safe Distance From Lines - Short Circuit Protection- No Load Protection - Earth Fault Protection - Earthing Standards-Grounding - Equipment Grounding - Miniature Circuit Breaker - Earth Leakage Circuit Breaker - Ground Fault Circuit Interrupter - Electrical Guarding - Personal Protective Equipment's.				
UNIT 4	**Evaluating Hazards & Assessing Risks Of Chemicals** Introduction- Types Of Chemicals - Routes Of Entry Sources Of Information-Toxicity- Flammable, Reactive & Explosive Hazards Physical Hazards Nano Materials Biohazards- Radioactive Hazards - Labeling Of Chemicals - Safety Data Sheet-Globally Harmonized System - Exposure Limits Whmis Symbols -Clp Hazard Pictogram Toxicological Properties: Lc50 & Ld50 Flammable Limits - Atmospheric Monitoring-Health Surveillance.				
UNIT 5	**Classification &Management Of Hazardous Chemicals** Classification Of Hazardous Chemicals Green Chemistry Acquisition Of Chemicals - Inventory & Tracking Of Chemicals - Transportation Of Hazardous Chemicals - Emergency Information Panel Hazchem Code - Personal Protective Equipment For Chemicals - Chemical Exposure Risk Assessment-Hierarchy Of Risk Controls-General Guidelines For Safe Storage & Handling - Chemical Storage Tanks Design Considerations.				

References: -

National Electrical Safety Code (NESC) 2023 Handbook - David J. Marne, John A. Palmer – Mc Graw Hill`s – 2023.
Central Electricity Regulatory Commission Rules andRegulations (Paperback, universal law publication) – 2023.
Creating and Maintaining an Electrical Safety Structure: Duties of Management and Chief Responsible Electrical Specialists - Matthias Surovcik – 2022.
Electric Safety: Practice and Standards - Nor Zaihar Yahaya, Excelic Press – 2019.
Safety And Hazards Management in Chemical Industries – Prof. M.N. Vyas - Atlantic Publishers & Distributors Pvt Ltd – 2022.
Hazardous Chemicals: Safety Management And Global Regulations – T.S.S. Dikshith – 2019.

Web resources:

Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://onlinecourses.nptel.ac.in/noc20_mg43/preview
https://archive.nptel.ac.in/courses/110/105/110105094/

Course outcomes

CO – 1	To define the fundamental concepts of electricity and risks.	K1
CO – 2	To express the knowledge about analysis of electrical hazards.	K2
CO – 3	To identify the concepts about electrical protection devices.	K3
CO – 4	To simplify the hazards and risks of chemicals.	K4
CO – 5	To evaluate the safe storage and transportation of chemicals.	K5

On what level it correlated with COs & POs -based on that we have to give marks
Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

II -Semester					
Course code: 91024	**Core**	**SAFETY EQUIPMENTS AND PPE PRACTICAL**	**P**	**Credits:4**	**Hours:6**

OBJECTIVE

1. To equip and use PPE
2. To Practice the usage of PPE in workplace

EXPERIMENT

1. Personal protective equipment:
2. Breathing PPE: Respiratory and non-respiratory-demonstration-self-contained breathing apparatus
3. Head Protection PPE: Safety helmet, belt, hand gloves, goggles, safety shoe, gum boots, ankle shoes, face shield, nose mask, ear plug, ear muff, anti-static and
4. Leg Protection PPE: conducting plastics/rubber materials, apron and leg guard.

EQUIPMENTS REQUIRED

1. Noise level meter: 1 No
2. Friction tester: 1 No
3. Impact tester: 1 No
4. Exhaust gas analyzer: 1 No
5. High volume sampler: 1 No
6. PPE Set: 1 No
7. Fire extinguisher set: 1 No
8. Static charge tester: 1 No
9. First aid kid: 1 No

COURSE OUTCOMES

- To Re call the usage of PPE
- To Justify the usage of PPE in Workplace
- To Classify PPE in Workplace
- To Practice the usage of PPE in Workplace

II -Semester					
Course code: 91025	**Allied**	**Warehouse Management**	**T**	**Credits:3**	**Hours:3**
Objectives	1. To familiarize the basic information about warehousing. 2. To educate on types of inventory. 3. To learn about warehousing management systems. 4. To provide technical knowledge in inventory control. 5. To analyse the material handling systems.				
UNIT 1	**Warehousing Concepts** Introduction To Warehousing – Concepts – Need For Warehousing – Issues Affecting Warehousing – Various Warehousing Facilities – Different Types Of Ware Houses – Characteristics Of Ideal Ware Houses.				
UNIT 2	**Inventory Management And Types Of Inventory** Introduction To Inventory Management – Role In Supply Chain – Role In Competitive Strategy Role Of Inventory – Functions Of Inventory - Types Of Inventory – Wip Inventory – Finished Goods Inventory – Mro Inventories – Cost Of Inventories - Need To Hold Inventory.				
UNIT 3	**Demand Systems** Warehouse Management Systems – Introduction – The Necessity Of Wms – Logics Of Determining Locations And Sequences – Independent Demand Systems – Uncertainties In Material Management Systems – Dependent Demand Systems – Distribution Resource Planning.				
UNIT 4	**Inventrory Control Methods** Abc Inventory Control – Managing Inventories By Abc – Multi – Echelon Inventory Systems Managing Inventory In Multi Echelon Networks – Managing Inventory In Single Echelon Networks. Various Approaches – Distribution Approaches – The True Multi Echelon Approach				
UNIT 5	**Material Handling Systems** The Principles And Performance Measures Of Material Handling Systems – Introduction. Vehicle Travel Path(Time) – Handling Time – Vehicle Utilization – No Of Loads Completed – Congestion – Effective Performance Systems – Fundamentals Of Various Types Of Material Handling Systems – Automated Storage And Retrieval Systems Bar Coding Technology And Applications Rfid Technology.				

References: -

1. J P Saxena, Warehouse Management and Inventory Control- Vikas Publication House Pvt Ltd, FirstEdition,2003.
2. Management Guide to Efficient Money Saving Warehousing, Stephen Frey, Gower, 1982
3. Warehouse Management: Automation andOrganization Of Warehouse and Order Picking Systems [With CDROM], Michael Ten Hompel, Thorsten Schmidt, Springer-verlag, First Edition,2006.

Web resources:

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://archive.nptel.ac.in/courses/110/106/110106045

https://alison.com/course/diploma-in-warehouse-management

COURSE OUTCOMES

CO-1	To recall the importance of quality management and evolution of quality	K1
CO-2	To classify the customers and understand the factors affecting customer perception	K2
CO-3	To categories the various quality control tools and QC process	K4
CO-4	To explain the productivity and its factors	K5
CO-5	To estimate the QC system through the various methods	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

S –

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	2(M)	1(L)	1(L)	1(L)
CO2	2(M)	1(L)	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)
CO3	1(L)	1(L)	1(L)	2(M)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)
CO4	2(M)	2(M)	2(M)	1(L)	1(L)	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.8	1.2	1.4	1.6	1.2	1.6	1.4	1.4	1.4	1.4

Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2(M)	1(L)	2(M)	1(L)	1(L)
CO2	1(L)	2(M)	1(L)	2(M)	1(L)
CO3	2(M)	2(M)	1(L)	1(L)	1(L)
CO4	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.6	1.4	1.4	1.4	1.2

S –Strong (3), M-Medium (2), L- Low (1)

II -Semester					
Course code: 91026	**Allied**	**MATERIAL HANDLING TECHNIQUES PRACTICAL**	**P**	**Credits:2**	**Hours:3**

OBJECTIVES

1. Be able to define Manual Handling.
2. Understand the dangers of hazardous manual handling.
3. Know how to avoid hazardous manual handling.
4. Learn good manual handling technique.
5. Adapt this technique to the types of handling carried out at work.

EXPERIMENT

1. Plan your lift
2. Position your feet
3. Ensure a good posture
4. Maintain a firm grip
5. Lift smoothly
6. Keeping close to the load
7. Put it down… then adjust it

OUTCOMES

The students will be able to

1. To Identify potential manual handling hazards and risks.
2. To Identify who is at risk of harm.
3. To Evaluate the likelihood of each risk.
4. To Implement preventative measures or remove the hazards.
5. To Show the findings and keep the risk assessment updated

REFRENCES

1. Apple.M. James, Plant layout and material handling, 3rdedition, John Wiley and sons, 1991.

2. Fred E. Meyers and Matthew P. Stephens, “Manufacturing Facilities Design and Material Handling”, Prentice Hal, 3rdedition, 2004.

3. Encyclopedia of occupational safety and health, ILO Publication, 1985.

4. Accident prevention manual for industrial operations, N.S.C., Chicago,198

II -Semester					
Course code: 91027	**SEC – II**	**Environmental Studies**	**T**	**Credits:2**	**Hours:2**
Objectives	1.To understand the multidisciplinary nature of environmental studies such as forest, water, mineral and energy and land resources. 2. To portray the ecosystem bio diversity and its conservation. 3. To impart the knowledge of environmental pollution 4.To know the importance of field work to study common plants, insects and birds and visit local areas to document environmental assets.				
UNIT 1	**The Multi Disciplinary Nature Of Environmental Studies:** Definition, Scope and importance-Need For public awareness				
UNIT 2	**Natural resources:** Renewable and non-Renewable resources A)**Forest resources:** Use and Over Exploitation, Deforestation, Case studies, Timber extraction, Mining, Dams And Their Effect on forests and tribal people. **B)Water resources:** Use and Over Utilization of surface and ground water, Floods, Drought, Conflicts over water, Dams-Benefits And Problems. C) **Mineral Resources:** Use And Exploitation, Experimental Effects Of Extracting And Using mineral Resources, Case Studies. **D)Food resources:** World food problems, Changes caused by agriculture and overgrazing, Effects Of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies. **E)Energy resources:** Growing energy needs, Renewable and non –Renewable energy sources, Use of alternate Energy resources, Case Studies. **F)Land Resources:** Land As A Resource, Land Degradation, Main Induced Landsides, Soil-Erosion and Desertification. • Role Of Individual In conservation Of Natural Resources • Equitable Use Of Resources For Sustainable Lifestyle				
UNIT 3	**Ecosystems, Bio-Diversity and its conservation** **Ecosystems:** Concept Of An Ecosystem, Structure And Function Of An Ecosystem, Energy Flow in the Ecosystem, Food Chains, Food webs and Ecological pyramids. **Biodiversity and its conservation: Introduction** definition: Genetic, Species and eco system diversity**,** Bio-Geographical classification of india**,** Value of biodiversity: Consumptive Use, Productive Use, Social Ethical, Aesthetic And Option Values. Bio diversityat global, National and local levels**,** India as a mega-Diversity nation**,** Hotspots Of biodiversity**,** Threats to biodiversity: Habitat loss, Poaching of wildlife, Man Wildlife conflicts**,** Endangered and endemic species of india**,** Conservation of biodiversity: In-Situandex-Situconservation of biodiversity**.**				
UNIT 4	**Environmental Pollution** Causes, Effects And Control Measures Of: A).Air Pollution, B).Water Pollution, C). Soil Pollution, D). Marine Pollution, E). Noise Pollution, F). Thermal pollution, G). Nuclearhazards.				
UNIT 5	**Field work** Visit to a local area to document environmental assets–River/ Forest/ Grassland/ Hill/ Mountain Visit to a local Polluted site –Urban/ Rural/ Industrial/ Agricultural Study of Common plants, Insects, Birds Study of Simple eco system-Pond, River, Hill Slopes, Etc.,				

References: -

1. Agarwal, K.C.(2001). Environmental Biology. Nidi Publication Ltd.
2. Bharucha, E. (2002). The Biodiversity of India (Vol. 1). Mapin Publishing Pvt Ltd, Ahamedabad, India.
3. Brunner,C. R. (1993).Hazardous waste incineration. Mcgraw HillInc.
4. Clark, R. B., Frid, C., & Attrill, M. (2001). Marine pollution (Vol. 5). Oxford: Oxford university press. Cunningham, W. P., Cooper, T. H., Gorham, E., & Hepworth, M. T. (1998).
5. Environmental encyclopedia.De,A.K.(1990). Environmental Chemistry.WileyEasternLtd.

Web resources:

Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://onlinecourses.nptel.ac.in/noc20_mg43/preview
https://archive.nptel.ac.in/courses/110/105/110105094/

Outcomes	On successful completion of the subject, the students acquired knowledge about: • Renewable and non-renewable resources. • Species and Ecosystem Diversity, Bio-Geographical Classification of India, Value of Biodiversity: • Causes, Effects and Control Measures of environmental pollution. • Field work knowledge of studying eco system pond, river, hill and common plants, insects and birds • Documentation of environmental assets

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	2(M)	1(L)	1(L)	1(L)
CO2	2(M)	1(L)	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)
CO3	1(L)	1(L)	1(L)	2(M)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)
CO4	2(M)	2(M)	2(M)	1(L)	1(L)	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.8	1.2	1.4	1.6	1.2	1.6	1.4	1.4	1.4	1.4

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2(M)	1(L)	2(M)	1(L)	1(L)
CO2	1(L)	2(M)	1(L)	2(M)	1(L)
CO3	2(M)	2(M)	1(L)	1(L)	1(L)
CO4	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.6	1.4	1.4	1.4	1.2

S –Strong (3), M-Medium (2), L- Low (1)

III -Semester					
Core	**Course code: 91033**	**Construction safety**	**T**	**Credits:3**	**Hours:3**
Pre-requisite	**Basic Knowledge of Construction safety**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To know causes of accidents related to construction activities and human factors associated with these accident 2.To understand the construction regulations and quality assurance in construction 3. To have the knowledge in hazards of construction and their prevention methods 4.To know the working principles of various construction machinery 5. To gain knowledge in health hazards and safety in demolition work				
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– Education and training				
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.				
UNIT III	**WORKING AT HEIGHTS** Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings, requirement for safe work platforms, stairways, gangways 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.				
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.				
UNIT V	**SAFETY IN DEMOLITION WORK** Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition- Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods –interesting experiences at the construction site against the fire accidents				

References

1. Handbook of OSHA Construction safety and health charles D. Reese and James V. Edison
2. Hudson, R.,"Construction hazard and Safety Hand book, Butter Worth's, 1985.
3. Jnathea D.Sime, "Safety in the Build Environment", London, 1988.
4. V.J.Davies and K.Thomasin "Construction Safety Hand Book" Thomas Telford Ltd., London, 1990

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://onlinecourses.nptel.ac.in/noc21_ce16/preview
https://archive.nptel.ac.in/courses/105/102/105102206/

Course outcomes		**Knowledge level**
CO-1	To Recall the problems impeding safety in construction industries.	K1
CO-2	To Summarise the types and causes of accidents, and designing aids for safe construction.	K2
CO-3	To Categorise the hazards during construction of power plant, road works and high-rise buildings.	K4
CO-4	To Interpret construction regulations and Indian standards for construction and demolition work.	K5
CO-5	To Elaborate the safety procedure for working at heights during construction.	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

S –

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

III -Semester					
Core	**Course code: 91034**	**Incident Prevention, Control and Investigation Reporting**	**T**	**Credits:3**	**Hours:3**
Pre-requisite	**Basic Knowledge of Incident prevention control and Investigation reporting**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To give basic information about accident and accident reporting system 2. To learn about various accident theory 3. To provide knowledge on hierarchy of accident prevention and control 4. To provide technical knowledge about accident investigation and analysis 5. To learn about computation of frequency and severity rate for industrial injuries.				
UNIT I	**Accident Reporting System** Accident-Causes of Accident-Types of Accident-Reportable and Non-Reportable Accidents-Accident Record Maintaining-Accident Internal Management-Accident Reporting as Per the Factories Act 1948-Form No18-Accident Reporting as Per the BOCW Act 1996-Form No 14.				
UNIT II	**Theories of Accident Causation** Heinrich's Domino Theory-Heinrich Domino-Process-Critical Issues-Human Factors Theory-Accident/Incident Theory-Birds Triangle-System Theory-Behavioral Theory-Bird's Triangle-Accident Proneness Theory-Multiple Causation Theory.				
UNIT III	**Accident Prevention And Risk Control** Hierarchy of Risk Control: Elimination, Substitution, Engineering Control, Administrative Control, PPE. Preventive Measure-Control Measure.				
UNIT IV	**Accident Investigation** Introduction-What is Accident Investigation-Process of Accident Investigation: Collecting Evidence & Facts, Analysis of Evidence and Facts, Recommendation & Reporting-Methods of Accident Investigation-Root Cause Analysis-Fish Bone Diagram-Systematic Cause Analysis Technique (SCAT)-Accident Analysis and Barrier Function (AEB)				
UNIT V	**Method For Computation Of Frequency And Severity Rates For Industrial Injuries & Classification Of Industrial Accidents** Accident- Fatal-Disabling Injury-Reportable Disabling Injury-Days Of Displacement (Cost Time)-Partial Displacement-Total Displacement-Man Hours Worked-Classification Of Accidents-Assessment Of Work Injury-Computation Of Frequency, Severity, Incident Rate				

References

1.Accident Prevention Manual for Business and Industry Administration and Programs, 13 th edition

a. ISBN number is 978-0-87912-280-5

2. 11/2 – 2 inch 3 ring binder with pockets

b. Notebook paper for binder

c. Organization of notebook; contents should include:

3.Cover page with first and last name

-Title of course

-Day and time of weekly class meeting

-Dividers labeled, syllabus, PPT. lectures, study questions, handouts, exam

Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://onlinecourses.nptel.ac.in/noc22_mg97/preview
https://freevideolectures.com/course/4411/nptel-industrial-safety-engineering/47

Course outcomes		**Knowledge level**
CO-1	To define the fundamental concept of accident reporting system	K1
CO-2	To compare various accident caution theory	K4
CO-3	To Discuss about principle of accident prevention	K6
CO-4	To Explain the methods for accident investigation	K5
CO-5	To Evaluate the computation of frequency and severity for industrial injuries	K5

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

III-Semester					
Course code: 91035	**Allied**	**Basics of First Aid Practical**	**P**	**Credits:3**	**Hours:5**

COURSE OBJECTIVES

1.To understand cleaning and dressing procedures for injured
2.To Apply the applications of CPR as an immediate response procedure

EXPERIMENTS:

1. First aid for burn injuries.
2. First aid for eye injuries.
3. First aid for cuts and wounds.
4. First aid for electric shock.
5. First aid for chemical splashes on skin & eye.
6. First aid for muscular disorder.
7. First aid for fracture.
8. First aid for bleeding.
9. First aid for open – close complicated fractures.
10. First aid for heart attack.
11.First aid for poisoning

REQUIREMENTS:

1. First aid kit with valid medicines.
2. Stretcher and ambulance service.
3. Eye wash bottle and emergency shower.
4. List of emergency numbers to be displayed.
5. All other required safety & communication.

COURSE OUTCOMES:

1.To Outline First aid procedures for burn and eye injuries.
2.To Summaries First aid procedure for cuts, wounds and electric shock
3.To Simplify First aid procedure for chemical splashes on skin & eye
4.To Interpret First aid procedure for muscular disorder, fracture and bleeding
5.To Elaborate First aid for open – close complicated fractures, heart attack, poisoning

REFERENCES:

1.Guide book on fire & safety-National safety council-2014
2.Practical Guide on Safety, Health & Environment-Volume1-National safety council-2013

III-Semester					
CORE	**Course code:91036**	**Organizational Behaviour**	**T**	**Credits:3**	**Hours:3**
Pre-requisite			**Syllabus Revised**		**2023-2024**
Course Objectives	1. To familiarize the basic information about principles of management. 2. To educate on leadership and social and ethical responsibilities of management. 3. To learn about elements of good control system. 4. To provide knowledge about organizational behaviour and conflict. 5. To learn about work stress and international business.				
UNIT I	Management- Meaning- Characteristics-Concepts –Approaches -Evolution- Fayol's Principles of Management. -Management Theories-Planning –Importance -Merits & Demerits –Principles –Steps –Planning & Forecasting- Decision Making –Methods – Process-Organisation –Principles –Formal & Informal Organisation				
UNIT II	Leadership-Elements -Characteristics -Principles -Theories-Styles- Motivation-Importance –Theories-Delegation of Authority- Centralization & Decentralization-Span of Management-Line & Staff-Manpower Planning- Recruitment &Selection-Steps in Selection Procedure-Management Development -Social &Ethical Responsibilities of Management -Criteria For Social Responsibilities- 10 Commandments of Corporate Social Responsibilities-Ethics of Managers				
UNIT III	Controlling-Elements of Control-Essential of Good Control System-Functions of Controller- Techniques of Control-Characteristics of Effective Control System-Management Information Systems -International Management-Role of Global Managers.				
UNIT IV	Organizational Behaviour- Nature –Scope -Elements -Genesis and Concept - Theories on Personality- Factors Influencing Perception-Process of Learning-Group Behaviour-Classification of Groups-Group Development-Functions of Group-Size of Group-Group Structure-Characteristics of Effective Groups Communication-Conflict-Genesis of Conflict-Stages of Conflict- Conflict Process-Symptoms Among Conflicting Persons-Managing Conflict. Hersey-Blanchard's Situational Theory				
UNIT V	Work Stress-Sources of Stress-Coping Strategies For Stress-Nature of Organisational Effectiveness-Approaches To Effectiveness-Managerial Implication. International Organisational Behaviour- Growth of International Business-Trends in International Business-Cultural Differences and Similarities-Culture Stock-Motivation across Cultures- Organization Structures across Cultures				

References

1. Robert Krcitner, Management, ATTBS
2.Weirich & Koontz, Management - A Global perspective, McGraw Hill
3.Helliregarl, Management, Thomson Learning,2002
4.Robbins.S.P.Fundamentals of Management, Pearson,2003

Related online content (MOOC, Swayam, NPTEL, Website etc.)

https://onlinecourses.swayam2.ac.in/cec20_ge19/preview
https://onlinecourses.nptel.ac.in/noc22_ce70/preview

Course outcomes		**Knowledge level**
CO-1	To describe the basic concepts of management principles.	K1
CO-2	To illustrate about leadership and recruitment shipping.	K2
CO-3	To identify the elements of good control system.	K3
CO-4	To explain the importance of organizational behaviour and conflict.	K4
CO-5	Determine the concepts of work stress and organizational culture.	K5

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1(L)	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)
CO2	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)	-
CO3	1(L)	1(L)	-	1(L)	-	1(L)	-	1(L)	-	1(L)
CO4	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)	-
CO5	1(L)	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)
W.AV	1	1	1	1	1	1	1	1	1	1

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1(L)	-	1(L)	-	-
CO2	-	1(L)	-	-	1(L)
CO3	1(L)	-	-	1(L)	-
CO4	-	1(L)	1(L)	-	-
CO5	1(L)	-	1(L)	-	-
W.AV	1	1	1	1	1

S –Strong (3), M-Medium (2), L- Low (1)

III-Semester					
Course code: 91037	**Allied**	**Computer Applications Practical**	**P**	**Credits:2**	**Hours:2**

OBJECTIVE

1.To learn about basics of MS-WORD, MS EXCEL, MS-POWERPOINT
2.To Implement daily activities using Computer applications

EXPERIMENTS

1.Type the text, check spelling and grammar bullets and numbering list items, align the text to left, right justify and center in MS –WORD.
2.Prepare a job application letter enclosing your bio data in MS –WORD.
3.Prepare a PowerPoint presentation with at least two slides for department inaugural function in MS POWERPOINT.
4.Insert an excel chart into a power point slide.
5.Simple commands perform sorting on name, place and pin code of students database and address printing using label format in MS ACCESS.
6.Worksheet using formulas in MS –EXCEL.
7.An Excel worksheet contains monthly sales of five companies.

COURSE OUTCOME

1.To describe classifications and application of computer with operating languages
2.To Explain about Editing documents in MS-WORD, MS-POWERPOINT, MS-EXCEL
3.To Formulate Excel sheet with Commands, Functions
4.To Create Power point and edit

III -Semester					
SEC-3	**Course code: 91038**	**Entrepreneurship**	**T**	**Credits:2**	**Hours:2**
Pre-requiste	**Basic knowledge of Entrepreneurship**		**Syllabus Revised**		**2023-2024**
Course Objectives	1.To give basic information about Entrepreneurship 2.To Illustrate about entrepreneurial motivation 3.To Discover the Creativity in a Entrepreneurship role 4.To critique the organizational assistance of small and large scale industries 5.To Discuss the Rules and regulations in an Industry				
UNIT I	**Introduction** Meaning and Importance-Evolution of Term 'Entrepreneurship'-Factors Influencing Entrepreneurship'-Psychological Factors-Social Factors-Economic Factor-Environmental Factors-Characteristics of An Entrepreneur-Entrepreneur and Entrepreneur-Types of Entrepreneur-According to Type of Business-According to Use of Technology-According to Motivation-According to Growth-According to Stages-New Generations of Entrepreneurship-Social Entrepreneurship, Health Entrepreneurship, Tourism Entrepreneurship, Women Entrepreneurship Etc-Barriers to Entrepreneurship				
UNIT II	**Entrepreneurial Motivation** Motivation-Maslow's Theory-Herjburg's Theory-Mcgragor's Theory-Mcclelland's Need – Achievement Theory-Culture & Society-Values / Ethics-Risk Taking Behavior.				
UNIT III	**Creativity** Creativity and Entrepreneurship-Steps in Creativity-Innovation and Inventions-Using Left Brain Skills to Harvest Right Brain Ideas-Legal Protection of Innovation-Skills of an Entrepreneur-Decision Making and Problem Solving (Steps in decision Making).				
UNIT IV	**Organisation Assistance** Assistance to an Entrepreneur-New Ventures-Industrial Park (Meaning, Features, & Examples)-Special Economic Zone (Meaning, Features & Examples)-Financial Assistance by Different Agencies-MSME Act Small Scale Industries-Carry on Business (COB) Licence-Environmental Clearance-National Small Industries Corporation (NSIC)-Government Stores Purchase Scheme (E-Tender Process)-Excise Exemptions and Concession-Exemption from Income Tax-Quality Standards With Special Reference to ISO-Financial Assistance to MSME-Modernisation Assistance to Small Scale Unit-The Small Industries Development Bank of India(SIDBI)-The State Small Industries Development Corporation(SSIDC).				
UNIT V	**Rules And Legislation** Applicability of Legislation-Industries Development (Regulations) Act, 1951-Factories Act, 1948-The Industrial Employment (Standing Orders) Act, 1946-Suspension-Stoppage of Work-Termination of Employment-Environment (Protection) Act, 1986-The Sale of Goods Ac, 1950-Industrial Dispute Act 1947				

References

1. Zero to One: Notes on Startups, or How the Build the Future by Peter Thiel
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries
3. India as Global Start-up Hub: Mission with Passion by C B Rao
4. Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future by Ashlee Vance
5. Steve Jobs by Walter Isaacson
6. Innovation and Entrepreneurship: Practice and Principles by Peter F Drucker
7. The Innovator's Solution: Creating and Sustaining Successful Growth by Clayton M Christensen

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://onlinecourses.nptel.ac.in/noc20_mg35/preview
https://archive.nptel.ac.in/courses/110/106/110106141/

Course outcomes		**Knowledge level**
CO-1	To Recall the Introduction to Entrepreneurship with concerning factors and characteristics	K1
CO-2	To Express the Entrepreneurial motivation with different theories	K2
CO-3	To Develop Creativity in Entrepreneurship roles	K6
CO-4	To Evaluate Organizational assistance of Small and Large scale Industries	K5
CO-5	To Elaborate the Rules and legislation for Industries	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1(L)	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)
CO2	-	1(L)	-	-	1(L)	-	1(L)	-	1(L)	-
CO3	1(L)	1(L)	-	1(L)	-	1(L)	-	1(L)	-	1(L)
CO4	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)	-
CO5	1(L)	-	1(L)	-	1(L)	-	1(L)	-	-	1(L)
W.AV	1	1	1	1	1	1	1	1	1	1

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1(L)	-	1(L)	-	-
CO2	-	1(L)	-	-	1(L)
CO3	1(L)	-	-	1(L)	-
CO4	-	1(L)	1(L)	-	-
CO5	1(L)	-	1(L)	-	-
W.AV	1	1	1	1	1

S –Strong (3), M-Medium (2), L- Low (1)

IV Semester					
CORE	**Course code:91043**	**Food Hygiene & Safety**	**T**	**Credits:3**	**Hours:4**
Pre-requisite			**Syllabus Revised**		**2023-2024**

Course Objectives	1. To familiarize the basic information about hygiene. 2. To educate on contamination methods and safe storage of foods. 3. To learn about various food borne diseases. 4. To provide knowledge about sanitation risk management. 5. To learn about HACCP and its applications.
UNIT I	**INTRODUCTION TO HYGIENE** Define Hygiene-Importance of Hygiene – Personal Hygiene – Kitchen Hygiene-Equipment Hygiene- Protective Clothing – Use of Deodorants And Cosmetics in Kitchen: Rest, Exercise And Recreation
UNIT II	**FOOD CONTAMINATION AND STORAGE** Daily Cleaning Procedures In Commercial Kitchen.-Food Storage – Temperature – Danger Zone -Microbiology- Food Contamination – Food Poisoning – Food Adulteration-Hot Holding Temperature – Kitchen Layout- Sanitation & Disinfectant-Cross Contamination-
UNIT III	**FOOD BORNE DISEASES** Define Food Borne Illness – Food Infections – Food Poisoning- Bacterial Infections - Types of food Inspections
UNIT IV	**SANITARY PROCEDURES IN CATERING INDUSTRY.** Sanitary Procedures For Purchasing Foods -Categories of Commodities – Storage Areas Temperature Zones- Thawing, Blanching, Maceration, Blast, Freezing, Pasturization
UNIT V	**HACCP & ITS PRINCIPLES** Haccp- its Importance -Principles HACCP, CCP and CP HACCP Program -Critical Implementation- CCP.

Reference Book

Food hygiene and safety, Dr.Sunetra roday, Tata McGraw Hill.

Related online content (MOOC, Swayam, NPTEL, Website etc.)

https://onlinecourses.swayam2.ac.in/cec20_ge19/preview
https://onlinecourses.nptel.ac.in/noc22_ce70/preview

Course outcomes		**Knowledge level**
CO-1	To define the basic concepts of food hygiene.	K1
CO-2	To express the knowledge about food contamination and storage.	K2
CO-3	To Discuss about various food borne diseases.	K4
CO-4	To determine the importance of sanitary procedures in catering industry.	K5
CO-5	To elaborate the various principles of HACCP.	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

IV Semester					
Core	**Course code: 91044**	**Hazard Identification , Risk Assessment and Risk control**	**T**	**Credits:3**	**Hours:4**
Pre-requisite	**Basic Knowledge of Hazard Identification , Risk Assessment and Risk control**		**Syllabus Revised**		**2023-2024**
Course Objectives	1.To Describe fundamentals of Hazard and risk with Human error analysis 2.To Express Risk analysis with Root cause analysis methods and Cost benefit analysis 3.To Evaluate HAZOP studies with its methodologies 4.To Prioritise Hazard Identification & Risk Assessment with Qualitative and Quantitative site assessment 5.To Develop credibility of risk assessment techniques through Past accident analysis				
UNIT I	**Fundamentals Of Hazard, Risk** Introduction- Hazard & Risk-Risk Register-Checklist-Hazard Characterization-Horseplay-Hazardous Event- Unsafe Act-Unsafe Condition Preliminary Hazard Analysis-Alarp- Concept of Alarp and its Application in Risk Assessment -Safety Warning System-Human Error Analysis.				
UNIT II	**Risk Analysis Methods** Risk Analysis-What is Risk Identification-What is Risk Analysis-Benefits of Risk Analysis-Risk Analysis Process-Root Cause Analysis. Job Safety Analysis-Risk-Benefit and Cost-Benefit Analysis.				
UNIT III	**Safety Management Tools** Hazard and Operability Studies (HAZOP)-HAZOP Methodology-Hazard Analysis (HAZAN)-Fault Tree Analysis (FTA)-Event Tree Analysis (ETA)-Failure Mode & Effect Analysis (FMEA)- FMEA Methodology-Types of FMEA-When to use FMEA-FMEA Procedure-Steps-Risk Priority Number-Control Measure Of FMEA.				
UNIT IV	**Hazard Identification & Risk Assessment** Hira- Objectives of HIRA Study-Principles of Risk Assessment Steps Involved In Hazard Identification And Risk Assessment- Identification of the Hazard- Risk Analysis- Evaluation of Hazard and Risk –Risk Matrix-Risk Control Method-Preventive Measure- Control Measure-Reporting-Implementation &Monitoring-Reviewing-Types of Risk Assessment-Quantitative and Qualitative Risk Assessment-Specific Site Assessment.				
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				

References

1. ENVH 577 Readings (On Canvas site)
2. Harr, J., A Civil Action. Vintage Press, 1996 (on reserve at HS Library)
3. Devra Davis, When Smoke Ran Like Water: Tales of Environmental Deception and the Battle Against Pollution.
4.Phil Brown (editor), Health and the Environment **(HTE)**

Related online content (MOOC, Swayam,NPTEL, Website etc.)

www.atsdr.cdc.gov/HAC/HAGM/
www.epa.gov/superfund/programs/risk/ragsa/index.htm

Course outcomes		Knowledge level
CO-1	To Recall Fundamentals of Hazard and Risk with concept of ALARP	K1
CO-2	To Illustrate Risk analysis methods with Risk Identification	K2
CO-3	To Interpret Safety Management tools with HAZOP	K4
CO-4	To Justify HIRA with Risk Matrix and Risk Control Methods	K5
CO-5	To Elaborate credibility of Risk Assessment Techniques	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	2(M)	1(L)	1(L)	1(L)
CO2	2(M)	1(L)	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)
CO3	1(L)	1(L)	1(L)	2(M)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)
CO4	2(M)	2(M)	2(M)	1(L)	1(L)	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.8	1.2	1.4	1.6	1.2	1.6	1.4	1.4	1.4	1.4

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2(M)	1(L)	2(M)	1(L)	1(L)
CO2	1(L)	2(M)	1(L)	2(M)	1(L)
CO3	2(M)	2(M)	1(L)	1(L)	1(L)
CO4	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.6	1.4	1.4	1.4	1.2

S –Strong (3), M-Medium (2), L- Low (1)

IV Semester					
Course code: 91045	**Allied**	**WORK AT HEIGHT PRACTICAL**	**P**	**Credits:3**	**Hours:5**

OBJECTIVES:

1.To Provide Safety in Work at Height to students
2.To Impart PTW for Work height with illustrations to students.

EXPERIMENTS

1.100% tied off procedure.
2.3 point anchorage while ascending and descending.
3.Wearing the full body harness with double lanyard.
4.Using method of vertical / horizontal lifeline.
5.Training on the use of fall arrestor – rope grab and retractable.
6.Using the safety net for man falling and material handling.
7.Inspection of all fall protection equipments.
8.Learning of technical data's about fall protectors.

REQUIREMENTS

1.Fall protection harness with double lanyard.
2.Rope grab.
3.Vertical / horizontal lifeline.
4.Fall arrestor – retractable.
5.Safety net and Debris net.
6.Mobile ladders.
7.All other training and safety required equipments.

OUTCOMES

The students will be able to

1.To Illustrate tie off procedure and anchorage ascending and descending methods
2.To Interpret the full body harness and method of vertical / horizontal lifeline
3.To Priorities use of fall arrestor and safety net
4.To Justify technical data's on Fall arrestors and Fall protection equipments

IV Semester					
ALLIED – II B	**Course code: 91046**	**Retail Environment**	**T**	**Credits:3**	**Hours:3**
Pre-requiste			**Syllabus Revised**		**2023-2024**

Course Objectives	1.To familiarize the basic information about Functional and characteristics of retailing. 2.To educate on theories of retail development. 3.To learn about strategic planning in retailing and situation analysis 4.To provide knowledge about challenges to retail developments in India 5.To learn about Challenges and threats in global retailing.
UNIT I	Retail: Meaning–Functions and Special Characteristics of a Retailer– Reason For Studying. Retailing–Marketing-Retailer equation–Marketing concepts applied to retailing–Retailing as a Career – Trends in Retailing.
UNIT II	Retail Model And Theories of Retail Development–Lifecycle and Phase In Growth of Retail Markets– Business Models in Retail– Other Retail Models.
UNIT III	Strategic Planning in Retailing: Situation Analysis–Objectives–Need for Identifying Consumer Needs – Overall Strategy, Feed Back and Control– Consumer Decision-Making Process.
UNIT IV	Retail in India: Evolution and Size of Retail in India–Drivers of Retail Change in India–Foreign Direct Investment in Retail– Challenges to Retail Developments in India.
UNIT V	Global Retail Markets: Strategic Planning Process for Global Retailing–Challenges Facing Global Retailers–Challenges and Threats in Global Retailing–Factors Affecting the Success of a Global Retailing Strategy.

References

1. Swapna Pradhan– Retailing Management– Text and Cases, Tata McGrawHill– 2nd
2. edition, 2004
3. Barry Bermanand Joel R Evans– Retailing Management– A Strategic Approach,
4. Prentice Hall of India, 8th Edition, 2002.

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://onlinecourses.swayam2.ac.in/cec20_ge19/preview
https://onlinecourses.nptel.ac.in/noc22_ce70/preview

Course outcomes		**Knowledge level**
CO-1	Understand the basic concepts of Functional and characteristics of retailing	K2
CO-2	Acquire knowledge about Retail model and theories of retail development	K4
CO-3	Discuss the strategic planning in retailing and situation analysis	K4
CO-4	Analyse the Retail in India with challenges to retail developments in India	K4
CO-5	Determine the Challenges and threats in global retailing	K5

On what level it correlated with COs & POs -based on that we have to give marks

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	2(M)	1(L)	1(L)	1(L)
CO2	2(M)	1(L)	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)
CO3	1(L)	1(L)	1(L)	2(M)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)
CO4	2(M)	2(M)	2(M)	1(L)	1(L)	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.8	1.2	1.4	1.6	1.2	1.6	1.4	1.4	1.4	1.4

Mapping Course Outcome Vs Programme Outcomes

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2(M)	1(L)	2(M)	1(L)	1(L)
CO2	1(L)	2(M)	1(L)	2(M)	1(L)
CO3	2(M)	2(M)	1(L)	1(L)	1(L)
CO4	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.6	1.4	1.4	1.4	1.2

S –Strong (3), M-Medium (2), L- Low (1)

IV-Semester					
Course code: 91047	**Allied**	**EIA PRACTICAL**	**P**	**Credits:2**	**Hours:2**

COURSE OBJECTIVE

- Understand the fundamentals about EIA
- Describe critically the factors that influence the development of a EIA
- Know which operations and functions are suitable for dealing with EIA
- Practice data using for EIA and combine it in Workplace Environmental assessment

EXPERIMENT

1. **Screening:** The project plan is screened for scale of investment, location and type of development and if the project needs statutory clearance.
2. **Scoping:** The project's potential impacts, zone of impacts, mitigation possibilities and need for monitoring.
3. **Collection of baseline data:** Baseline data is the environmental status of study area.
4. **Impact prediction:** Positive and negative, reversible and irreversible and temporary and permanent impacts need to be predicted which presupposes a good understanding of the project by the assessment agency.
5. **Mitigation measures and EIA report:** The EIA report should include the actions and steps for preventing, minimizing or by passing the impacts or else the level of compensation for probable environmental damage or loss.
6. **Public hearing:** On completion of the EIA report, public and environmental groups living close to project site may be informed and consulted.
7. **Decision making:** Impact Assessment Authority along with the experts consult the project-in-charge along with consultant to take the final decision, keeping in mind EIA and EMP (Environment Management Plan).
8. **Monitoring and implementation of environmental management plan:** The various phases of implementation of the project are monitored.
9. **Assessment of Alternatives, Delineation of Mitigation Measures and Environmental Impact Assessment Report:** For every project, possible alternatives should be identified, and environmental attributes compared. Alternatives should cover both project location and process technologies.

COURSE OUTCOMES

- To Creatively apply and integrate new knowledge (models/ analysis techniques) for EIA
- To Collect, analyze, and process data for EIA assessment
- To Use EIA tools and applications in Systematic Analyis
- To Plan and conduct field work in Workplace environment
- To Plan and run project-based activities in Work place

REFERENCES:

1. Jain, R.K., Urban, L.V. and Stacey, G.S., Environment Impact Analysis, Von Nostrand Reinhold Company.
2. Lawrence, David P., Environmental Impact Assessment (Practical Solutions to Recurrent Problems), Wiley International, New Jersey.
3. MoEF, GoI, Environment Impact Assessment, Impact Assessment Division, January 2001 (Manual).
4. Water (Prevention and Control of Pollution) Act 1974. Air (Prevention and Control of Pollution) Act 1981.
5. Trivedi, P.R., Natural Resources Con
servation, APH Publishing Corporation, New Delhi

V -Semester					
Core	**Course code: 91051**	**Safety Inspection and Audit**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of Safety Inspection and audit**		**Syllabus Revised**		**2023-2024**
Course Objectives	1.To achieve understanding of safety inspection and audit 2.To enable students to conduct safety audit and write audit report effectively in auditing situation 3.The course could provide basic knowledge of OHSMS and EMS 4.To educate about the various steps to be taken for certification of ISO 14001(EMS) 5.To impart knowledge on environmental impact assessment, life cycle assessment of product and principles of eco labeling				
UNIT I	Safety Inspection Importance of Workplace Inspection Planning of Workplace Inspection Purpose of Workplace Inspection Hazards in Workplace Information's Required in Workplace Inspection Report Inspection Team Duration of Inspection - Frequency of Inspection - Follow Up & Monitoring - Summary				
UNIT II	Safety Audit Introduction Types of Audits Audit Objectives Methodology to Conduct Safety Audit- Pre Audit Activities - Background Information To Be Gathered Data to be Gathered - On Site Activities - Understanding Management Systems Assessing Strengths & Weaknesses - Collecting Audit Evidence - Interviewing - Observation Evaluating Audit Evidence Reporting Audit Findings - Post Audit Activities.				
UNIT III	OH & S Management System Standard Introduction to ISO 45001 – Development of Various OHSMS Standards – Aim of OH & S management System–Success Factors– Plan Do Check Act Cycle- Contents and Scope of ISO 45001-Terms and Definitions –Leadership and Worker Participation – Leadership And Commitment - OH & S policy- Organizational Roles and Responsibilities and Authorities – Consultation and Participation of workers				
UNIT IV	ISO 14001 EMS, ISO 14001, Specifications, Objectives, Environmental Policy, Guidelines and Principles (ISO14004), Clauses 4.1 to 4.5. Documentation Requirements, 3 Levels of Documentation For A ISO 14000based Ems, Steps In ISO 14001				
UNIT V	Environment Impact Assessment ISO 14040 (LCA), General Principles of LCA, Stages of LCA, Report and Review. ISO 14020 (Ecolabeling) – History, 14021, 14024, Type I Labels, Type II Labels, ISO 14024, Principles, Rules for Ecolabeling Before Company Attempts for it. Advantages. EIA in EMS, Types of EIA, EIA Methodologyeis, Scope, Benefits.				

References

1. ISO 45001: 2018 –Occupational Health and safety management systems Requirements with guidance for use
2. ISO14001:2004, Environmental Management Systems Requirements with Guidance for Use" ,ISO, 2004.
3. "Guidelines on Occupational Health and Safety Management Systems (OSH-MS)" International Labour Organization, 2001
4. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980
5. John Ridley, "Safety at Work", Butterworth and Co., London, 1983

Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://archive.nptel.ac.in/courses/110/105/110105160/
https://onlinecourses.nptel.ac.in/noc23_mg48/preview

Course outcomes		**Knowledge level**
CO-1	To recall basic safety audit and prepare a report for safety audit	K1
CO-2	To Illustrate safety inspection and prepare a report for safety inspection	K2
CO-3	To interpret various standards for maintaining OHSMS	K4
CO-4	To Justify ISO 14001standards on Safety audit and inspection	K5
CO-5	To Discuss EIA and ecosystem development	K6

On what level it correlated with COs & POs -based on that we have to give marks

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	2(M)	1(L)	1(L)	1(L)
CO2	2(M)	1(L)	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)
CO3	1(L)	1(L)	1(L)	2(M)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)
CO4	2(M)	2(M)	2(M)	1(L)	1(L)	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.8	1.2	1.4	1.6	1.2	1.6	1.4	1.4	1.4	1.4

Mapping Course Outcome Vs Programme Outcomes

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2(M)	1(L)	2(M)	1(L)	1(L)
CO2	1(L)	2(M)	1(L)	2(M)	1(L)
CO3	2(M)	2(M)	1(L)	1(L)	1(L)
CO4	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.6	1.4	1.4	1.4	1.2

S –Strong (3), M-Medium (2), L- Low (1)

V -Semester					
Core	**Course code: 91052**	**Safety in Oil & Gas Industries**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of Safety in Oil & Gas Industries**		**Syllabus Revised**		**2023-2024**
Course Objectives	1.To give basic information about oil and gas work process 2. To Analyze Root cause and reliability analysis in Oil and Gas industries 3.To Regulate Safety norms and procedures in Offshore 4.To Interpret Accident factors in Oil and gas Industry with Common hazards and Precaution measures 5.To Evaluate Accident Data Analysis based on previous accident records				
UNIT I	**Introduction To Oil And Gas Safety** Introduction –Upstream –Down Stream- Mid Stream- Safety Management Principle – Product Hazard Classification – Product Organization Task-Common Cause Of Work Injuries –Differentiate Of Onshore And Offshore –Accident Caution Theory- Human Error Occurrence Reasons And Consequences-Bath Tub Hazard Curve.				
UNIT II	**Safety Analysis Methods And Reliability Analysis In Oil And Gas Industry.** Introduction –Root Cause Analysis-Hazop(Hazards And Operability Analysis)-Interface Safety Analysis-Job Safety Analysis-Preliminary Hazards Analysis-Failure Mode Of Effective Analysis-Fault Tree Analysis-Markov Methods-Daily Observation Report –Safety Checklist- Safety Training Program- Tool Box Talk – Safety Induction Training- On Job Training-Refreshment Training.				
UNIT III	**Offshore Safety** Introduction –Who Regulates The Offshore Safety-Consequences Of Not Fallowing Safety -Offshore Industrial Risk Picture-Offshore Worker Situation Awareness Concept-Studies And Result –Offshore Industry Accident Reporting Procedure – Important Of Regular Inspection Of Machinery –Offshore Industry Accident Case Studies (Mumbai North Platform, Piper Alpha Accident-Glomar Java Sea Drillship Accident- Baker Drilling Barge Accident-Seacrest Drillship Accident).				
UNIT IV	**Oil And Gas Industry Accident Factors** Introduction- Human Factors That Effects In General-Organization Factor-Group Factor-Individual Factor-Oil Field Fatalities Analysis-Common Hazards In Oil And Gas Industry-Explosion And Fire Hazards-Recommendation Reduce Fatal Oil And Gas Industry Accident- Work Permit System				
UNIT V	**Main Causes Of Accident In Oil And Gas Industry And Accident Data Analysis** Introduction –Confined Space –Hazards- Requirements Of Ventilation And Gas Test – Precaution Steps .Lifting –Hazards – Control Measure Of Lifting Activities-Hazardous Materials –Dehydration –Poor Lighting-Work At Height –Storage And Handling Of Flammable Liquids-Offshore Oil And Gas Industry Accident Data Base And Accident Data Collection Sources.				

References

B.S. Dhillonm, safety and reliability in the oil and gas industry apractical approach, CRC press, Taylor and francis group 2016.

Alireza bahadori, personnel protection and safety equipment for oil and gas industries, gulf professional publishing of Elsevier group 2015

Abdul khalique, Basic offshore safety, routledge 2016

Alireza bahadori, personnel protection and safety equipment for oil and gas industries, gulf professional publishing of Elsevier group 2015

Abdul khalique, Basic offshore safety, routledge 2016

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://archive.nptel.ac.in/courses/114/106/114106017/

https://onlinecourses.nptel.ac.in/noc19_oe02/preview

Course outcomes		**Knowledge level**
CO-1	To Recall the functions of upstream, midstream and downstream segments	K1
CO-2	To Explain Work related to oil and gas industry covering flammability limits, explosive hazards, and other hazardsrelated to health, safety and environment	K2
CO-3	To describe offshore oil and gas industry who are responsible for ensuring safety, health and security for workers as part of their daily routines.	K1
CO-4	To Elaborate about the recommendation to reduce fatal oil and gas industry accidents	K6
CO-5	To Discuss about work permit system like hot work, confined spaced job work entry etc.	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

V -Semester					
Elective	**Course code:91053A**	**Environmental Safety**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of environmental safety**		**Syllabus Revised**		**2023-2024**
Course Objectives	1.To provide in depth knowledge in Principles of Environmental safety and its applications in various fields. 2.To give understanding of air and water pollution and their control. 3.To expose the students to the basis in hazardous waste management. 4.To design emission measurement devices. 5To design emission measurement devices.				
UNIT I	**Air Pollution** Classification And properties Of Air Pollutants – Pollution Sources – Effects Of Air Pollutants On Human beings, Animals, Plants And Materials - Automobile Pollution-Hazards Of Air Pollution-Concept Of Clean coal Combustion Technology - Ultra Violet Radiation, Infrared Radiation, Radiation From Sun-Hazards Duetodepletionofozone-Deforestation-Ozoneholes-Automobileexhausts-Chemicalfactorystackemissions-Cfc.				
UNIT II	**Water Pollution** Classification Of Water Pollutants-Health Hazards-Sampling And Analysis Of Water-Water Treatment –Different industrial effluents and their treatment and disposal-Advancedwastewatertreatment-Effluentqualitystandardsandlaws- Chemical industries, Tannery, Textile effluents-Common treatment.				
UNIT III	**Hazardous Waste Management** Hazardous waste management in india- Wasteidentification, Characterization and classification-Technological Options For Collection, Treatment and Disposal Of hazardous Waste-Selection Charts For the Treatment Of different Hazardous Wastes-Methods Of Collection And Disposal Of Solid Wastes-Health hazards-Toxic And Radioactive Wastes-Incineration And Verification- Hazards Due To bio-Process-Dilution-Standards and restrictions –Recycling and reuse.				
UNIT IV	**Environmental Measurement and Control** Sampling And Analysis – Dust Monitor – Gas Analyzer, Particle Size Analyzer – Lux Meter-Ph Meter–Gaschromatograph – Atomicabsorption spectrometer. Gravitational Settling Chambers-Cyclone Separators-Scrubbers-Electrostatic Precipitator - Bag Filter –Maintenance - Control Of gaseous emission By Adsorption, Absorption and Combustion Methods-Pollution control board-Laws.				
UNIT V	**Pollution Control in Process Industries** Pollution control in process industries -Cement, Paper, Petroleum- Petroleum products-Textile-Tanneries-Thermal power plants–Dying and Pigment industries-Eco-Friendly energy.				

References

1. E. CWolfe,Raceto Save to Save Planet, Wadsworth Publishing Co.,Belmont, CA 2006.
2. G.TMiller,EnvironmentalScience:WorkingwiththeEarth,11th Edition,WadsworthPublishingCo.,Belmont,CA,2006
3. M.JHammer,.,andM.JHammer,.,Jr.,WaterandWastewaterTechnology,PearsonPrenticeHall,2006
4. Rao,CS,"Environmentalpollutionengineering:,WileyEasternLimited,NewDelhi,1st January2018.
5. S.P.Mahajan,"Pollutioncontrolinprocessindustries",TataMcGrawHillPublishingCompany,NewDelhi,2006. VarmaandBraner,"Airpollutionequipment",SpringerPublishers,SecondEdition

Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://nptel.ac.in/courses/112106177
https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Seasonal-fire-causes/Firework

Course outcomes		**Knowledge level**
CO-1	To Describe about the air pollution its classifications and control measures	K1
CO-2	To Explain the water pollutants its classifications and control measures	K2
CO-3	To Simplify the Hazardous waste management its classifications and recycling methods	K4
CO-4	To Justify the environmental measurement and control with sampling and analysis	K5
CO-5	To Elaborate safe practices for Pollution handling in Process industries	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

V -Semester					
Elective	**Course code: 91053B**	**Work Study and Ergonomics**	**T**	**Credits: 4**	**Hours:4**
Pre-requisite	**Basic Knowledge Work Study and Ergonomics**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To study the applications of ergonomic principle sand physiology of workers 2. To know the concepts of personal protective equipment and its usages 3. To create the knowledge in process and equipment design in safety aspects 4. To Priorities Concept modules in Equipment design 5. To Justify Job and personal risk factors				
UNIT I	**WORK STUDY** Study of operations – work content – work procedure – breakdown – human factors – safety and method study – methods and movements at the workplace – substitution with latest devices – robotic concepts–applications in hazardous workplaces–productivity, quality and safety (PQS).				
UNIT II	**ERGONOMICS** Definition– applications of ergonomic principles in the shop floor–work benches–seating arrangements – layout of electrical panels- switch gears – principles of motion economy – location of controls – display locations – machine foundations – work platforms, fatigue, physical and mental strain –incidents of accident–physiology of workers.				
UNIT III	**PERSONAL PROTECTION** Concepts of personal protective equipment – types – selection of PPE – invisible protective barriers –procurement, storage, inspection and testing – quality – standards – ergonomic considerations in personal protective equipment design.				
UNIT IV	**PROCESSAND EQUIPMENTDESIGN** Process design – equipment – instrument – selection – concept modules – various machine tools - in-built safety – machine layout-machine guarding-safety devices and methods – selection, inspection, maintenance and safe usage – statutory provisions, operator training and supervision – hazards and prevention.				
UNIT V	**MAN MACHINE SYSTEMS** Job and personal risk factors–standards -selection and training-body size and posture -body dimension (static/dynamic)–adjustment range–penalties–guidelines for safe design and postures–evaluation and methods of reducing postures train. Man-machine inter face-controls-types of control-identification and selection-types of displays-compatibility and stereo types of important operations -fatigue and vigilance-measurement characteristics and strategies for enhanced performance				

References

1. "Accident Prevention Manual for Industrial Operations",NSCChicago,1982.
2. "Work Study",National Productivity Council,NewDelhi,1995.
3. E.J.Mc Cormick and M.S.Sanders "Human Factors in Engineering and Design", TMH, New Delhi,1982.
4. Hunter, Gomas, "Engineering Design for Safety",McGrawHillInc.,1992.
5. Introduction to Work Study",ILO, Oxford and IBHP ublishing company,Bombay,1991".

Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://www.youtube.com/watch?v=KNFZXNWYVno

Course outcomes		**Knowledge level**
CO-1	To descry be work procedure and applications in hazardous	K 1
CO-2	To Illustrate the human factors in design of Personal protective equipment	K2
CO-3	To Explain the risk factors, guidelines for safe design of man machine systems considering human factors	K5
CO-4	To Justify the Guideline for safe design	K5
CO-5	To elaborate the Strategies for enhanced performance in Man Machine systems	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

V -Semester					
Elective	**Course code:91053C**	**Dock Safety**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge Dock Safety**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To understand safety legislation related to dock activities in India. 2. To understand the causes and effects of accidents during dock activities. 3. To know the various material handling equipment and lifting appliances in dock. 4. To know the safe working on board the ship and storage in the yards. 5. To understand the safe operation of crane, portainers, lift trucks and container handling equipment.				
UNIT I	**History Of safety legislation** History Of Dock Safety Statues In India-Background Of Present Dock Safety Statues-Dock Workers (Safety, Health And Welfare) Act 1986 And The Rules And Regulations Framed There Under, Other Statues like Marking Of Heavy Packages Act 1951 And The Rules Framed There Under -Manufacture, Storage and import of hazardous chemicals. Rules1989 framed under the environment (Protection) Act,1989-Few cases laws To interpret the terms used in the Dock Safety statues. Responsibility of different agencies for safety, Health and welfare involved in dock work–Responsibilities of port authorities–Dock labour board–Owner of shipmaster, Agent of ship–Owner of Lifting Appliances And Loose Gear Etc. – Employers Of Dock Workers Like Stevedores – Clearing And forwarding Agents – Competent Persons And Dock Worker. Forums For Promoting Safety And Health In ports–Safe committees and advisory committees. Their functions, Training of dock Workers.				
UNIT II	**Working on board the ship** Types Of Cargo Ships – Working On Board Ships – Safety In Handling Of Hatch Beams – Hatch Covers including Its Marking, Mechanical Operated Hatch Covers Of Different Types And Its Safety Features –Safety In Chipping And Painting Operations On Board Ships – Safe Means Of Accesses – Safety Instorageetc.–Illuminationofdecksandinholds–Hazardsinworkinginsidetheholdoftheshipandon Decks – Safety Precautions Needed – Safety In Use Of Transport equipment -Internal Combustible engines Like Fort-Lift Trucks-Pay Loaders Etc. Working With Electricity And Electrical Management–Storage –Types, Hazard ouscargo.				
UNIT III	**Lifting Appliances** Different Types Of Lifting Appliances – Construction, Maintenance And Use, Various Methods Of Rigging of Derricks, Safety In The Use Of Container Handling/Lifting Appliances Like Portainers, Transtainer, Top Lifttrucksandothercontainers–Testingandexaminationofliftingappliances–Portainers–Transtainers- Top lift rucks–Derricks in different rigging etc. Use And Care Of synthetic And Natural Fiber ropes – Wire Rope Chains, Different Types Of slings And loose gears.				
UNIT IV	**Transport equipment** The Different Types Of Equipment For Transporting Containers And Safety In Their Use-Safety In The Use Of self loading container vehicles, Container Side Lifter, Fork lift truck, Dock rail ways, Conveyors and cranes. Safe Use Of Special Lift Trucks Inside Containers – Testing, Examination And Inspection Of Containers –Carriage Of Dangerous Goods In Containers And Maintenance And Certification Of Containers For Safe operation Handling Of Different Types Of Cargo – Stacking And Un stacking Both On Board The Ship And Ashore –Loading And Unloading Of cargo Identification Of				

	Berths/Walking For Transfer operation Of Specific chemical from ship to shore and viceversa– Restriction Of loading and unloading operations.
UNIT V	**Emergency action plan And dock workers (SHW) Regulations1990** Emergency Action Plans For Fire And Explosions - Collapse Of Lifting Appliances And Buildings, Sheds etc., - Gas Leakages And Precautions Concerning Spillage Of Dangerous Goods Etc., - Preparation Of On-Site emergency plan And safety report. Dock Workers (SHW) Rules And Regulations 1990-Related To Lifting Appliances, Container Handling, Loading And Unloading, Handling Of Hatch Coverings And Beams, Cargo Handling, Conveyors, Dock railways, Forklift.

References

1. ”Dock Safety” Thane Belapur Industries Association, Mumbai.
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3. Safety and Health in Dock work, IInd Edition,ILO,1992.
4. Srinivasan “Harbour, Dock and Tunnel Engineering”
5. TaylorD.A.,“”Introduction to Marine Engineering

Related online content (MOOC, Swayam, NPTEL, Website etc.)
https://archive.nptel.ac.in/courses/114/105/114105003/
https://nptel.ac.in/courses/114105003

Course outcomes		**Knowledge level**
CO-1	To Describe various operations carried out in a dock.	K1
CO-2	To Classify the different acts and rules for safe dock operations.	K4
CO-3	To Explain the operations of various types of material handling equipments.	K5
CO-4	To Prioritise and response at the time of emergency in a dock.	K5
CO-5	To Elaborate the various problems associated with the use of lifting equipments and in the storage yards.	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	2(M)	1(L)	1(L)	1(L)
CO2	2(M)	1(L)	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)
CO3	1(L)	1(L)	1(L)	2(M)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)
CO4	2(M)	2(M)	2(M)	1(L)	1(L)	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.8	1.2	1.4	1.6	1.2	1.6	1.4	1.4	1.4	1.4

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2(M)	1(L)	2(M)	1(L)	1(L)
CO2	1(L)	2(M)	1(L)	2(M)	1(L)
CO3	2(M)	2(M)	1(L)	1(L)	1(L)
CO4	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.6	1.4	1.4	1.4	1.2

S –Strong (3), M-Medium (2), L- Low (1)

V -Semester					
Elective	**Course code:91054A**	**Safety in Textile Industries**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of safety in textile industries**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To provide the student about the basic knowledge about the textile industries and its products by using various machineries. 2. To enforce the knowledge on textile processing and various processes in making the yarn from cotton or synthetic fibres. 3. To understand the various hazards of processing textile fibres by using various activities. 4. To inculcate the knowledge on health and welfare activities specific to the Textile industries as per the Factories Act.				
UNIT I	**Introduction** Introduction To Process Flow Charts Of I) Short Staple Spinning, II) Long Staple Spinning, III) Viscose Rayon and syntheticfibre, Manufacturer, IV) Spun and filament yarn to fabric manufacture, V) Jute spinning and jute fabric manufacture-Accident hazard, Guarding of machinery and safety precautions in opening, Carding, Combing, Drawing, Flyer Frames And Ring Frames, Doubles, Rotor Spinning, Winding, Warping, Softening/Spinning Specific to jute.				
UNIT II	**Textile hazards I** Accident Hazards I)Sizing Processes- Cooking Vessels, Transports Of Size, Hazards Due To Steam II)Loom Shed–Shuttle looms and shuttles looms III) Knitting machines IV) Non-Wovens.				
UNIT III	**Textile hazards II** Scouring, Bleaching, Dyeing, Punting, Mechanical finishing operations and effluents in textile processes.				
UNIT IV	**Health and Welfare** Health Hazards In Textile Industry Related To Dust, Fly And Noise Generated-Control Measures- Relevant occupational Diseases, Personal Protective Equipment- Health And Welfare Measures Specific To Textile industry, Special precautions for specifichazardous Work environments.				
UNIT V	**Safety status** Relevant Provision Of Factories Act And Rules And Other Statues Applicable To Textile Industry – Effluent treatment and wasted is posal in Textile industry.				

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2. Gro over and Henry DS, "Hand book of textile testing and quality control"
3. "Quality tolerances for water for textile industry" ,BIS
4. Shenai, V.A."Atechnology of textile processing",Vol.I,Textile Fibres
5. Little, A.H.,"Water supplies and the treatment and disposal of effluent"

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://archive.nptel.ac.in/courses/116/102/116102029/

https://archive.nptel.ac.in/content/storage2/courses/103103027/pdf/mod9.pdf

		Knowledge level
Course outcomes		
CO-1	To describe about the textile industries and its operations.	K1
CO-2	To Explain the various concepts underlying in the processes involved in processing offibrestoyarn.	K2
CO-3	To Classify various hazards in the textile industry and will be able to apply the control measures to mitigate the risk emanating from the hazard.	K4
CO-4	To Interpret the various health and welfare activities as per the Factories act and could implement statutory requirements.	K5
CO-5	To Determine various methods meant for mitigating the risk and able to guide his subordinates in executing the work safely.	K5

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S – Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

B.SC (F&IS) V -Semester					
Elective	**Course code: 91054B**	**Safety in Mines**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of safety in mines**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To provide in depth knowledge on Safety of mines of various types. 2. To study, know and understand about the types of mines and various risk involved in the mining operations. 3. To get exposed to various types of accidents happened in mines and how to manage during accidents. 4. To analyze the nature of mining activities and developing a safety system to reduce the risk and also to implement the Emergency preparedness in the working environment of mines and to plan for the disaster management.				
UNIT I	**Open cast mines** Causes and Prevention of Accident From: Heavy Machinery, Belt and Bucket Conveyors, Drilling, Hand tools-Pneumatic Systems, Pumping, Water, Dust, Electrical Systems, Fire Prevention. Garage Safety –Accident reporting system-Working condition-Safe transportation–Handling of explosives.				
UNIT II	**Underground Mines** Fall of roof and sides-Effect of gases-Fire and explosions-Water flooding-Warning sensors - Gasdetectors- Occupationalhazards- Working conditions- Winding and transportation.				
UNIT III	**Tunnelling** Hazards From: Ground Collapse, Inundation and collapse of tunnel Face, Falls From plat forms And danger From Falling Bodies. Atmospheric Pollution (Gases And Dusts) – Trapping –Transport-Noise-Electrical Hazards-Noise And Vibration From: Pneumatic Tools And Other Machines – Ventilation And lighting –Personal protective Equipment.				
UNIT IV	**Risk assessment** Basic concept so frisk –Reliability and hazard potential- Elements of risk assessment– Statistical methods – Control charts-Appraisal Of Advanced Techniques-Fault Tree Analysis-Failure Mode And Effect analysis – Quantitative structure-Activity relationship analysis- Fuzzy model for risk Assessment.				
UNIT V	**Accident Analysis And management** Accidents Classification And Analysis-Fatal, Serious, Minor And Reportable Accidents – Safety Audits-Recent Development Of Safety Engineering Approaches For Mines-Frequency Rates-Accident Occurrence-Investigation-Measures For Improving Safety In Mines-Cost Of Accident-Emergency Preparedness –Disaster management.				

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1. DGMS Circulars- Ministry of Labour, Government of India press, OR Lovely Prakashan-DHANBAD,2002.
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Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://onlinecourses.nptel.ac.in/noc23_mg98/preview
https://onlinecourses.nptel.ac.in/noc22_mg55/preview

Course outcomes		**Knowledge level**
CO-1	To Describe basics of safety aspects in the mining industries.	K1
CO-2	To classify the various types of mining activities like open case mines, underground mines and tunnel ling.	K4
CO-3	To Simplify the various risks involved in the mining activities and come	K4

	to know about the various safety activities to be taken to ensureth safety of the workers.	
CO-4	To Explain the techniques like risk assessment Disaster management and emergency preparedness with the proper knowledge on accident prevention.	K5
CO-5	To effectively Elaborate their knowledge on accident prevention in mines.	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

B.SC (F&IS) V -Semester					
Elective	**Course code: 91054C**	**Transportation Safety**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of Transportation Safety**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To provide the students about the various activities /steps to be followed in safe handling the hazardous goods transportation from one location to another location. 2. To educate the reasons for the road accident and the roles and responsibilities of a safe Driver and the training need soft he driver. 3. To inculcate the culture of safe driving and fuel conservation along with knowing of basic traffic symbols followed throughout the highways				
UNIT I	**Transportation Of hazardous Goods** Transport Emergency Card (Trem) – Driver Training-Parking Of Tankers On The Highways-Speed Of The vehicle – Warning Symbols – Design Of The Tanker Lorries -Static Electricity-Responsibilities Of Driver –Inspection and maintenance of vehicles - Checklist-Loading and decanting procedures–Communication.				
UNIT II	**Road Transport** Introduction –Factors for improving safety on roads–Causes of accidents due to drivers and pedestrians - Design, Selection, Operation And Maintenance Of Motor Trucks-Preventive Maintenance-Checklists-Motor vehicles act –Motor vehicle Insurance And surveys.				
UNIT III	**Driver and Safety** Driver safe typrogramme–Selectionofdrivers–Drivertraining-Tacho-Graph-Drivingtest-Driver'sresponsibility-Accident Reporting And Investigation Procedures-Fleet Accident Frequency-Safe Driving incentives-Slogans In Driver cabin-Motor Vehicle transport Workers Act- Driver relaxation And Rest pauses –Speed And fuel conservation–Emergency planning and Hazmat codes				
UNIT IV	**Road Safety** Road alignment and gradient-Reconnaissance-Rulinggradient-Maximumriseperk.M.-Factors influencing Alignment Like Tractive Resistance, Tractive Force, Direct Alignment, Vertical Curves-Breaking characteristics Of Vehicle-Skidding-Restriction Of Speeds-Significance Of Speeds- Pavement Conditions –Sight distance–Safety at intersections–Traffic control lines and guide posts- Guardrails and barriers- Street lighting and illumination over loading-Concentration of driver. Plant railway: Clearance-Track-Warning methods-Loading and unloading –Moving cars-Safety practices.				
UNIT V	**Shop floor and repair shop safety** Transport precautions-Safety on Manual, Mechanical handling equipment operations-Safe Driving-Movement Of Cranes-Conveyors Etc., Servicing And Maintenance Equipment-Grease Rack Operation-Wash Rack Operation-Battery Charging-Gasoline Handling-Other Safe Practices-Off The Road Motorized equipment.				

References

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2. Babkov,V.F.,"RoadConditionsandTrafficSafety"MIRPublications,Moscow,1986.
3. K.W.Ogden, "Safer Roads –A guide to Road Safety Engineering"
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Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://nptel.ac.in/courses/105105215
https://onlinecourses.nptel.ac.in/noc22_ce41/preview

Course outcomes		**Knowledge level**
CO-1	To Describe the Transportation of Hazardous goods with legal procedures	K1
CO-2	To Explain the road transport safety with preventive maintenance checklists and motor vehicle insurance and surveys	K2
CO-3	To Examine the Driver safety programme with emergency planning and HAZMAT codes	K4
CO-4	To Interpret Road safety with Clearance and pavement conditions	K5
CO-5	To Justify the usage of Transport precautions with safety on manual	K5

On what level it correlated with COs & POs -based on that we have to give marks

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

Mapping Course Outcome Vs Programme Outcomes

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

V -Semester					
Elective	**Course code: 91055A**	**Safety Management Systems**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of Safety management systems**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To provide knowledge about Safety Management and accident prevention with Financial direct and indirect costs and management Information systems. 2. To impart knowledge on planning and organizing for safety in an industry 3. To acquire knowledge on Training methods and out of plant training programmes 4. To Understand the employee participation in safety with techniques of safety promotion				
UNIT I	**Safety Management And Accident Prevention** History Of Safety Management In India And Abroad- Need For Safety, Legal, Economic And Social Considerations, Oshas / Is- 18001 - Role Of Management In Industrial Safety- Management Principles & Practices- Theories Of Accident Occurrences -Principles And Modals Of Accident Prevention, Near Miss Incident - Financial Costs Direct And Indirect, Social Costs Of Accidents – Compilation Procedures For Financial Costs - Budgeting For Safety- Economic Evaluation And Methods In Safety Promotion - Management Information System (Mis) - Sources, Protection, Collection And Compilation Of She Information - Use Of Modern Methods Of Programming, Storing And Retrieval Of Mis For She, Use Of It Tools In Managing She Systems.				
UNIT II	**Planning And Organising For Safety** Safety Policy- Formulation And Cascading Down The Organization - Variety / Forms Of Plans -Strategic Planning And Process Of Implementation - Management By Objectives And Its Role In Safety - Effective Planning For Safety - Haddon's Principle- Safety Department- Organization Structure - Functions And Responsibilities - Authority Power And Qualifications / Attributes Of Safety Officer Department - Effective System Of Communication For She - Barriers And Break Downs In Communication - Communication With Management Employees & Trade Union Communication And Group Dynamics - Modes Of Communication - Manageable Communication.				
UNIT III	**Safety, Health And Environment Education And Training** Assessment Of Needs- Tool Box Talk Design & Development Of Training Programme - Training Methods And Strategies- Modern Methods Of Safety Training - E- Learning - In-Plant Training Programmes- Out-Of-Plant Training Programmes, Seminars, Programmes For New Workers- Training Of Manager, Supervisors & Workers Evaluation And Review Of Training Programmes -Induction Training - Training For Contractors And Visitors - Integrating Safety Into Operating Procedures - Job Instructions Vs Safety Instructions.				
UNIT IV	**Employee Participation In Safety** Purpose, Nature, Scope And Methods - Importance Of Employee / Participation – History Of Trade Unions In India, Role Of Trade Unions In Safety, Health And Environment Integrating She In Collective Bargaining - Safety Suggestion Schemes - Safety Competitions - Safety Incentive Schemes - Promotional Methods - Performance - Appraisal - Modern Methods And Techniques Of Safety Promotion.				

UNIT V	**Behavioural Safety** Organizational Behavior - Human Factors Contributing To Accidents - Psychological Aspects Of Safety, Safety Culture System - Individual Differences -Behavior As Function Of Sell Situation -Perception Of Danger And Acceptance Of Risks - Knowledge And Responsibility Vis-A-Vis Safety Performance - Theories Of Motivation And Their Application Of Safety - Role Of Management, Supervisors And Safety Department In Motivation - Ethical Issues.

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Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://nptel.ac.in/courses/110105160
https://www.digimat.in/nptel/courses/video/110105160/L01.html

Course outcomes		**Knowledge level**
CO-1	To recall basic concepts of accident occurrences and accident prevention based on OSHAS / IS- 18001	K1
CO-2	To Explain about Safety policy with Effective system of communication	K2
CO-3	To Interpret Modern methods of Safety Training	K4
CO-4	To Evaluate Safety Incentive Schemes with Promotional Methods	K5
CO-5	To Elaborate Organizational beahviour with Psychological aspects of Safety	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

V -Semester					
Elective	**Course code: 91055B**	**Safety in Fireworks**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of Fireworks safety**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To study the properties of pyrotechnic chemicals 2. To know about the hazards in the manufacture of various fireworks 3. To understand the hazards in fireworks industries related processes 4. To study the effects of static electricity 5. To learn pyrotechnic material handling, transportation and user safety				
UNIT I	**Properties Of fireworks Chemicals** Fire Properties – Potassium Nitrate (Kn03), Potassium Chlorate (Kcl03), Barium Nitrate (Bano3),Calcium Nitrate (Cano3), Sulphur (S), Phosphorous (P), Antimony (Sb), Pyro Aluminum (A1) Powder-Reactions-Metal Powders, Borax, Ammonia (Nh3) – Strontium Nitrate, Sodium Nitrate, Potassium Perchloride. Fire And explosion, Impact and friction sensitivity.				
UNIT II	**Static Charge and Dust** Concept Prevention Earthing Copperplates Dress materials Static charge meter lightning, Causes-Effects-Hazards in fireworks factories-Lightning arrestor: Concept-Installation-Earthpit-Maintenance-Resistance-Legalrequirements-Casestudies.Dust:Size-Desirable,Non-Respirable- Biological barriers-Hazards-Personal protective equipment-Pollution prevention.				
UNIT III	**Process Safety** Safe-Quantity, Mixing-Filling-Fuse Cutting – Fuse Fixing – Finishing – Drying At Various Stages-Packing-Storage-Hand Tools-Materials, Layout: Building-Distances- Factories Act – Explosive Act And Rules – Fire prevention and Control –Risk related fireworks industries.				
UNIT IV	**Material Handling and transportation:** Manual Handling – Wheel Barrows-Trucks-Bullock Carts-Cycles-Automobiles-Fuse Handling – Paper Caps handling-Nitric Acid Handling In Snake Eggs Manufacture-Handling The Mix In This Factory-Material movement-Godown- Wastepit. Packing-Magazine-Designofvehiclesforexplosivetransportsloadingintoautomobiles-Transportrestrictions-Case Studies-Overhead Power Lines-Driver Habits-Intermediate Parking-Fire Extinguishers-Loose chemicals handling And transport.				
UNIT V	**Waste Control and user Safety** Concepts Of Wastes – Wastes In Fireworks-Disposal-Spillages-Storage Of Residues. Consumer Anxiety-Hazards In Display-Methods In Other Countries-Fires, Burns And Scalds-Sales Outlets-Restrictions-Role Offire service.				

References

1. "Seminar on explosives",Dept.of of explosives.
2. J.A.Purkiss,"Fireworks- FireSafety Engineering"
3. Bill of once,"FireworksSafetymanual"
4. "Goeff,"DustExplosionprevention,Part1"
5. A.Chelladurai,"Fire worksrelatedaccidents"

Related online content (MOOC, Swayam, NPTEL, Website etc.)

https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Seasonal-fire-causes/Fireworks
https://onlinecourses.nptel.ac.in/noc22_me37/preview

Course outcomes		Knowledge level
CO-1	To Describe about the chemical reactions of Fireworks chemicals	K1
CO-2	To Explain the safe manufacture of Fireworks items	K2
CO-3	To Simplify the process safety in fireworks industries	K4
CO-4	To Justify the safety measures applicable against static electricity	K5
CO-5	To Elaborate safe practices for handling of fire work sin factories, transport and atuserend	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

V -Semester					
Elective	**Course code: 91055C**	**Disaster Management**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge Disaster management**		**Syllabus Revised**		**2023-2024**
Course Objectives	• To provide students an exposure to disasters, their significance and types. • To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction • To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR) • To enhance awareness of institutional processes in the country • To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity				
UNIT I	**Introduction To Disasters** Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types Of Disasters – Earthquake, Landslide, Flood, Drought, Fire Etc - Classification, Causes, Impacts Including Social, Economic, Political, Environmental, Health, Psychosocial, Etc.- Differential Impacts- In Terms Of Caste, Class, Gender, Age, Location, Disability - Global Trends In Disasters: Urban Disasters, Pandemics, Complex Emergencies, Climate Change- Dos And Don'ts During Various Types Of Disasters.				
UNIT II	**Approaches To Disaster Risk Reduction (Drr)** Disaster Cycle - Phases, Culture Of Safety, Prevention, Mitigation And Preparedness Community Based Drr, Structural- Nonstructural Measures, Roles And Responsibilities Of- Community, Panchayati Raj Institutions/Urban Local Bodies (Pris/Ulbs), States, Centre, And Other Stake-Holders- Institutional Processes And Framework At State And Central Level- State Disaster Management Authority(Sdma) – Early Warning System – Advisories From Appropriate Agencies.				
UNIT III	**Inter-Relationship Between Disasters And Development** Factors Affecting Vulnerabilities, Differential Impacts, Impact Of Development Projects Such As Dams, Embankments, Changes In Land-Use Etc.- Climate Change Adaptation- Ipcc Scenario And Scenarios In The Context Of India - Relevance Of Indigenous Knowledge, Appropriate Technology And Local Resources.				
UNIT IV	**Disaster Risk Management In India** Hazard And Vulnerability Profile Of India, Components Of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional Arrangements (Mitigation, Response And Preparedness, Disaster Management Act And Policy - Other Related Policies, Plans, Programmes And Legislation – Role Of Gis And Information Technology Components In Preparedness, Risk Assessment, Response And Recovery Phases Of Disaster – Disaster Damage Assessment.				
UNIT V	**Disaster Management: Applications And Case Studies And Field Works** Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment Of Buildings And Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial And Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made Disasters: Case Studies, Space Based Inputs For Disaster Mitigation And Management And Field Works Related To Disaster Management.				

References

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd.,

3. 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
4. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
5. Kapur Anu Vulnerability India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://onlinecourses.swayam2.ac.in/cec19_hs20/preview
https://nptel.ac.in/courses/105104183

Course outcomes		**Knowledge level**
CO-1	To Describe basics of disaster and their differential impacts	K1
CO-2	To Illustrate approaches to disaster reduction with roles and responsibilities of state and national bodies	K2
CO-3	To Classify the types of disasters, causes and their impact on environment and society	K4
CO-4	To Interpret vulnerability and various methods of risk reduction measures as well as mitigation.	K5
CO-5	To Estimate hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	2(M)	1(L)	1(L)	1(L)
CO2	2(M)	1(L)	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)
CO3	1(L)	1(L)	1(L)	2(M)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)
CO4	2(M)	2(M)	2(M)	1(L)	1(L)	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	1(L)	2(M)	1(L)	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.8	1.2	1.4	1.6	1.2	1.6	1.4	1.4	1.4	1.4

S –Strong (3), M-Medium (2),L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2(M)	1(L)	2(M)	1(L)	1(L)
CO2	1(L)	2(M)	1(L)	2(M)	1(L)
CO3	2(M)	2(M)	1(L)	1(L)	1(L)
CO4	1(L)	1(L)	1(L)	2(M)	2(M)
CO5	2(M)	1(L)	2(M)	1(L)	1(L)
W.AV	1.6	1.4	1.4	1.4	1.2

S –Strong (3), M-Medium (2), L- Low (1)

III-Semester					
Course code: 91056	**Allied**	**CONFINED SPACE ENTRY, WORKING, EXIT AND RESCUE OPERATION PRACTICAL**	**P**	**Credits:4**	**Hours:8**

EXPERIMENTS

1.Practise on gas detecting / testing and other inspection of toxic gases.
2.Practise on entry into confined space and rescue operation.
3.Practise on work permit system for confined space entry.
4.Purging/cleaning/removing of toxic gases or any other flammable gases.
5.Direct supervision of confined space attendant / hole watcher.

REQUIREMENTS

1.Portable Gas tester.
2.Proper safety sign boards.
3.Suitable fire extinguisher.
4.First aid box.
5.Emergency escape breathing apparatus.
6.Required PPE.

OUTCOMES

The students will be able to
1.To Operate gas detecting and testing for inspection of toxic gases
2.To Assess Entry and rescue operation in confined space
3.To Evaluate work permit system for confined space entry
4.To Priorities Cleaning and removing of toxic and flammable gases
5.To describe about direct supervision of confined space to Hole watcher and Confined space attendant.

REFERENCES

1.Health Safety and Environment-Training Manual-Oil & Gas Sector-SPIC
2.Tata Mc Graw Hill-Industrial Safety Management-I.M Deshmukh-2016

VI-Semester					
CORE	**Course code: 91061**	**Process Safety Management**	**T**	**Credits:4**	**Hours:4**
Pre-requisite			**Syllabus Revised**		**2023-2024**
Course Objectives	1. To familiarize the basic information about process safety. 2. To provide technical knowledge in process hazard analysis. 3. To educate on process safety elements. 4. To analyze the incident investigation methods. 5. To learn about emergency planning and response.				
UNIT I	**Process safety information** Hazards Of Regulated Substance – Block Flow Diagram – Process Chemistry – Maximumintendedinventory–Upper&Lowerlimits–Consequencesofdeviation – Materials Of Construction – Piping & Instrumentation Diagrams –Electrical Classification – Relief System Design – Ventilation System Design –Design Codes &Standards–Materials &Energybalances– Safetysystems				
UNIT II	**Process Hazardanalysis,Operating Procedures &Training** Introduction –Deciding The Methods Of Pha – Limitations Of Pha's – Prioritizingpha's – Methods For Conducting The Pha: What If, Checklist, Hazop, Fmea,Fta – Pha Team – Pha Findings – Review & Revalidation – Description Ofoperatingprocedure– Elementsofoperatingprocedure–Availabilityofoperatingprocedure–Initialtraining– Intermittenttraining–Onthejobtraining– Refresher training– Training documentation				
UNIT III	**Mechanical Integrity, Management Of Change, Prestart Up Review &Compliance Audits** Mechanicalintegrity–Training–Equipmentdeficiencies&Qualityassurance– Managementofchange–Prestartupreview–Complianceaudits				
UNIT IV	**Incident investigation, Employee participation &Trade secrets** Incident investigation–Investigation methodologies –Investigation questionnaire-Employee participation–Trade secrets				
UNIT V	**Hot Work permit, Contractors &Emergency Response** Hot work permit – Contractor selection–Principle employer responsibilities– Contractor Employer Responsibilities – Emergency Planning & Response				

References

"ProcessSafety ManagementManual" US Departmentof Labor, OSHA3132,Reprintedon2000

"DOEHandbook–ProcessSafetyManagementforHighlyHazardousChemicals",US Departmentof Energy

"RiskManagementPlan(RMP)&ProcessSafetyManagement(PSM)Manual", Newington Energy, General Electric Contractual Services, TritonEnvironmental Inc.

"ChemicalProcessSafety:LearningfromMistakes",RoyE.Sanders,Butterworth-Heinemann, Elsevier.

Related online content (MOOC, Swayam, NPTEL, Website etc.)

https://archive.nptel.ac.in/courses/103/107/103107156

https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ch19

Course outcomes		Knowledge level
CO-1	To define the fundamental concepts of process safety management.	K1
CO-2	To Identify the process hazard analysis methods.	K3
CO-3	To Generate the importance of process safety elements	K4
CO-4	To explain the knowledge about incident investigation.	K
CO-5	To Discuss about handling of emergencies.	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

VI -Semester					
CORE	**Course code: 91062**	**Behaviour Based Safety and Industrial Ergonomics.**	**T**	**Credits:4**	**Hours:4**
Pre-requisite			**Syllabus Revised**		**2023-2024**
Course Objectives	1. To learn the basic information about human behaviour 2. To provide knowledge of group behaviour. 3. To educate the concepts of behaviour based safety. 4. To familiarize the information about workplace ergonomics. 5. To learn about ergonomical system design of workers.				
UNIT I	**Individual Behaviour** Personality Types - Factors Influencing Personality - Theories - Learning - Types Of Learners-The Learning Process-Learning Theories-Organizational Behavior Modification-Misbehavior-Types-Management Intervention Emotions Emotional Labor-Emotional Intelligence Theories- Attitudes Characteristics Components Formation-Measurement Values. Perceptions Importance Factors Influencing Perception Interpersonal Perception Impression Management- Motivation - Importance-Types - Effects On Work Behavior.				
UNIT II	**Group Behaviour** Organization Structure Dynamics Emergence Of Informal Leaders And Working Norms - Group Decision Making- Formation Groups In Organizations Influence Group Techniques-Team Building - Interpersonal Relations-Communication - Control.				
UNIT III	**Behaviour Based Observation And Feedback** Introduction To Bbs(Behavior Based Safety)-Why Behavior Based Safety-Abc Model Of Behavior Change-Abc Behavior Model-Abc Behavior Model Consequences-Abc Behavior Model Feedback -Safety Coaching Through Observation And Feedback-Integrating Behavioral Safety Principles In To Other Management Systems-Critical Impact Of Social Comparison Feedback-Seven Lessons From Behavior Based Safety For Increasing Ppe Use-Addressing Ergonomic Hazards Through Behavior Based Observation And Feedback-Safety Culture.				
UNIT IV	**Ergonomics** Definition-Applications Of Ergonomic Principles In The Shop Floor-Work Benches-Seating arrangements - Layout Of Electrical Panels- Switch Gears - Principles Of Motion Economy-Location Of Controls-Display Locations-Machine Foundations- Work Platforms, Fatigue, Physical And Mental Strain - Incidents Of Accident-Physiology Of Workers.				
UNIT V	**Work Design For Standing And Seated Works** Design For Everyone, Anthropometry And Personal Space, Effectiveness And Cost Effectiveness Fundamental Aspects Of Standing And Sitting, An Ergonomics Approach To Work Station Design, Design For Standing Workers, Design For Seated Workers, Work Surface Design -Guidelines For Design Of Static Work, Effectiveness And Cost.				
References Behaviour-Based Safety in Organizations: Life Before the Accident Paperback – 30 April 2017by H.L. Kaila (Author)					
Related online content (MOOC, Swayam,NPTEL, Website etc.) https://archive.nptel.ac.in/courses/110/105/110105160 https://alison.com/course/behaviour-based-safety-revised					

Course outcomes		Knowledge level
CO-1	To name the fundamental concepts of human behavoiur.	K1
CO-2	To Identify the information about workplace groups.	K3
CO-3	To examine the behaviour based safety and model.	K4
CO-4	To explain the ergonomic principles in workplace.	K5
CO-5	To construct the ergonomical system design of workplace and work	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

Subject Code 91063	SAFETY AUDIT PRACTICAL	P	Credits:4	Hours:6

OBJECTIVES:

- To Inculcate the Industrial Safety Environment to the students
- To Explore the Human Capital Management and Hazardous System

EXPERIMENT

- Safety Management systems.
- Management of health and safety
- Accidents and accident reporting
- Environmental protection
- Fire prevention and emergencies
- Housekeeping and cleanliness
- Occupational health
- Personal protective equipment
- Risk assessment requirements
- Safety Policy
- Safety signs and notices

OUTCOMES

The students will be able to

1. To Minimize the Labor turn over by existence of Safety Measures of an Employee.
2. To Promote the Fatigue Study it will lead to good production.
3. To Implement the Human Resource Management Practices.
4. To impart the Health Consciousness to the Working Community.

REFERENCES

1. Every safety audit as per 'The Code of Practice' on Occupational Safety & Health 'Indian Standard –14489:2018, ISO 45001:2018,EMS- ISO 14001:2015, NBC:2016 and other national and international standard applicable to each particular industry.

B.SC (F&IS) VI -Semester					
Elective	**Course code: 91064A**	**Safety in Process Industries**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of safety in process industries**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To provide knowledge on design features for a process industry and safety in the operation of various equipment in industry. 2. To understand the various hazards and prevention in commissioning stage of industry. 3. To recognise and identify the safe operation of equipment in process industry. 4. To plan and train for emergency planning in a process industry. 5. To get fundamental knowledge on safe storage of chemicals.				
UNIT I	**Safety In Process Design And Pressure System Design** Design Process, Conceptual Design And Detail Design, Assessment, Inherently Safer Design Chemical Reactor, Types, Batch Reactors, Reaction Hazard Evaluation, Assessment, Reactor Safety, Operating Conditions, Unit Operations And Equipments, Utilities. Pressure System, Pressure Vessel Design, Standards And Codes- Pipe Works And Valves Heat Exchangers- Process Machinery- Over Pressure Protection, Pressure Relief Devices And Design, Fire Relief, Vacuum And Thermal Relief, Special Situations, Disposal- Flare And Vent Systems- Failures In Pressure System.				
UNIT II	**Plant Commissioning And Inspection** Commissioning Phases And Organization, Pre-Commissioning Documents, Process Commissioning, Commissioning Problems, Post Commissioning Documentation Plant Inspection, Pressure Vessel, Pressure Piping System, Nondestructive Testing, Pressure Testing, Leak Testing And Monitoring- Plant Monitoring, Performance Monitoring, Condition, Vibration, Corrosion, Acoustic Emission-Pipe Line Inspection.				
UNIT III	**Plant Operations** Operating Discipline, Operating Procedure And Inspection, Format, Emergency Procedures Hand Over And Permit System- Start Up And Shut Down Operation, Refinery Units- Operation Of Fired Heaters, Driers, Storage- Operating Activities And Hazards- Trip Systems- Exposure Of Personnel-Colour Coding Of Pipes And Cylinders – Corrosion Prevention For Underground Pipes.				
UNIT IV	**Plant Maintenance, Modification And Emergency Planning** Management Of Maintenance, Hazards- Preparation For Maintenance, Isolation, Purging, Cleaning, Confined Spaces, Permit System- Maintenance Equipment- Hot Works- Tank Cleaning, Repair And Demolition- Online Repairs maintenance Of Protective Devices Modification Of Plant, Problems- Controls Of Modifications. Emergency Planning, Disaster Planning, Onsite Emergency- Offsite Emergency, A pell.				
UNIT V	**Storages** General Consideration, Petroleum Product Storages, Storage Tanks And Vessel- Storages Layout- Segregation, Separating Distance, Secondary Containment- Venting And Relief, Atmospheric Vent, Pressure, Vacuum Valves, Flame Arrestors, Fire Relief- Fire Prevention And Protection- Lpg Storages, Pressure Storages, Layout, Instrumentation, Vapourizer, Refrigerated Storages- Lng Storages, Hydrogen Storages, Toxic Storages, Chlorine Storages, Ammonia Storages, Other Chemical Storages- Underground Storages- Loading And Unloading Facilities- Drum And Cylinder Storage- Ware House, Storage Hazard Assessment Of Lpg And Lng				

References

Lees, F.P., "Loss Prevention in Process Industries" Butterworth publications, London, 3rd edition, 2005.

Sanoy Banerjee, "Industrial hazards and plant safety", Taylor & Francis, London, 2003.

Fawcett, H. and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley inters, 2nd Edition, 1984.

McElroy, Frank E., "Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1988.

Green, A.E., "High Risk Safety Technology", John Wiley and Sons, 1984.

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://archive.nptel.ac.in/courses/103/107/103107156/

https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ch19/

Course outcomes		**Knowledge level**
CO-1	To Recall the safe design of equipment which are the essential to chemical industry and leads to design of entire process industries.	K1
CO-2	To Examine the problems and find innovative solutions while industries facing problems in commissioning and maintenance stages.	K4
CO-3	To Explain the chemical plant operations.	K5
CO-4	To Evaluate the emergency planning for chemical industry problems.	K5
CO-5	To Assess safe storage systems.	K5

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

VI -Semester					
Elective	**Course code: 91064B**	**Safety in Engineering Industry**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of Safety in Engineering Industry**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To know the safety rules and regulations, standards and codes 2. To study various mechanical machines and their safety importance 3. To understand the principles of machine guarding and operation of protective devices. 4. To know the working principle of mechanical engineering processes such as metal forming and joining process and their safety risks. 5. To develop the knowledge related to health and welfare measures in engineering industry				
UNIT I	**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 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-Forgehammer-Flywheels-Shafts-Couplings-Gears Sprockets Wheels And Chains-Pulleys And Belts-Authorized Entry To Hazardous Installations-Benefits Of Good Guarding Systems.				
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.				
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.				
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. Health and welfare measures in engineering industry-pollution control in engineering industry- industrial waste disposal.				

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.

Related online content (MOOC, Swayam,NPTEL, Website etc.)
https://www.youtube.com/watch?v=v-eltsixu4I
http://www.nitttrc.edu.in/nptel/courses/video/110105094/lec1.pdf

Course outcomes		**Knowledge level**
CO-1	To Describe knowledge in safety rules, standards and codes in various mechanical engineering processes	K1
CO-2	To Illustrate machine guarding systems for various machines such as lathe, drilling, boring, milling etc.,	K2
CO-3	To Distinguish the safety concepts in welding, gas cutting, storage and handling of gas	K4
CO-4	To Interpret their knowledge in testing and inspection as per rules in boilers, heat treatment operations etc.,	K5
CO-5	To Discuss preventive measures in health and welfare of workers' aspects in engineering industry.	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)

VI-Semester					
Elective	**Course code: 91064C**	**Safety In On and Off Shore Drilling**	**T**	**Credits:4**	**Hours:4**
Pre-requisite	**Basic Knowledge of Safety in on and off shore drilling**		**Syllabus Revised**		**2023-2024**
Course Objectives	1. To provide about the various risks and hazards involved in petrochemical industries and its control measures. 2. To impart knowledge on risk analysis, toxic effect and planning for onsite and offsite emergency planning in petrol chemical industries. 3. To acquire knowledge on Controlling of safety systems and Relief systems and to acquire knowledge on design activities of safety and relief systems. 4. To Understand the concepts of Extraction and Transportation				
UNIT I	**PETROLEUM PRODUCTS** Petroleum and Petroleum products – Fuels- Petroleum solvents – Lubricating oils – Petroleum wax, greases – Miscellaneous product				
UNIT II	**ON AND OFF SHORE OPERATIONS** On and off shore oil operation – Construction of Installation – Pipe line Construction – Maintenance and repair activities – Safety and associated hazards				
UNIT III	**DRILLING** Drilling oil – Technique and equipment- Work position –Working condition – safety and associated hazards- lighting and its effects				
UNIT IV	**EXTRACTION AND TRANSPORTATION** Petroleum Extraction and transport by sea – Oil field products – Operation – Transport of crude by sea – Crude oil hazards.				
UNIT V	**STORAGE AND CLEANING** Petroleum product storage and transport –Storage equipment –Precaution –Tank cleaning				

References

1. Encyclopedia of Occupational Health and Safety, Vol. II, International Labour Organisation, Geneva, 1985 & I.
2. Dr. Paul Bommer A Primer of Oilwell Drilling A Basic Text of Oil and Gas Drilling Seventh Edition published by The University of Texas Continuing Education petroleum extension service.2008
3. S. Tanaka, Y. Okada, Y. Ichikawa, Offshore Drilling and Production Equipment, in Civil Engineering, in Encyclopedia of Life Support Systems, Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford, UK, 2005
4. Management and Engineering of Fire Safety and Loss Prevention: Onshore and offshore group &Taylor and francis,1991.
5. Ian Sutton, Off shore safety Management, Elsevier, 2007.

Related online content (MOOC, Swayam,NPTEL, Website etc.)

https://archive.nptel.ac.in/noc/courses/noc17/SEM1/noc17-oe03/
https://archive.nptel.ac.in/courses/114/106/114106042/

Course outcomes		**Knowledge level**
CO-1	To Recall basic information about petroleum products	K1
CO-2	To Illustrate on-shore and off-shore operation of petroleum extraction	K2
CO-3	To Simplify the operation, techniques, associated hazards, and safety measure of petroleum drilling	K4
CO-4	To Explain the operation, techniques, associated hazards, and safety measure of petroleum	K5
CO-5	To Choose the storage equipment and associated hazards and safety precautions of petroleum extraction	K6

On what level it correlated with COs & POs -based on that we have to give marks

Mapping Course Outcome Vs Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3(S)	2(M)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)	2(M)	3(S)
CO2	3(S)	3(S)	2(M)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)	3(S)
CO3	3(S)	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)
CO4	2(M)	3(S)	2(M)	3(S)	3(S)	2(M)	2(M)	3(S)	2(M)	3(S)
CO5	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	3(S)	2(M)	3(S)	2(M)
W.AV	2.8	2.4	2.6	2.4	2.6	2.8	2.2	2.6	2.4	2.6

S –Strong (3), M-Medium (2), L- Low (1)

Mapping Course Outcome Vs Programme Specific outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3(S)	2(M)	3(S)	3(S)	2(M)
CO2	2(M)	3(S)	2(M)	3(S)	2(M)
CO3	3(S)	2(M)	3(S)	3(S)	3(S)
CO4	2(M)	3(S)	2(M)	3(S)	2(M)
CO5	3(S)	2(M)	3(S)	2(M)	3(S)
W.AV	2.6	2.4	2.6	2.8	2.4

S –Strong (3), M-Medium (2), L- Low (1)