GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2023 (COGC-2023)
Semester-V

Course Title: Ship Fire Prevention & Control
(Course Code: 4351806)

Diploma programmer in which this course is offered	Semester in which offered
Marine Engineering	5th Semester

1. RATIONALE

As a marine engineer it is necessary to understand about the fire and its causes for fire which is one of the major reasons for the accidents caused in the maritime industry. With this a marine engineer is able to understand the type of fire and have the knowledge to take the respective measures in order to avoid dangerous hazard as a good watch keeping practice.

2. COMPETENCY

At the end of the study of V th Semester the student will be able to

- Understand the fires and its types, fire triangle.
- Know about the different types of fire extinguisher
- Study about different types of fire detection system and alarms.
- Acquire broader ideas about firefighting equipments (miscellaneous).
- Understand about fire drill & duties.

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor andaffective domain to demonstrate following course outcomes.

1. understand principles of fire science
2. Explain fire prevention strategies and techniques to minimize the risk of fires on board ships.
3. Relate with the different types of firefighting equipment and systems used on ships.
4. Describe emergency response procedures specific to shipboard fire incidents.
5. Understand various firefighting techniques applicable to shipboard firefighting.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30*	70	25	25	150

(*): Out of 25 marks under the theory CA, 5 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

***Legends:** **L**-Lecture; **T**– Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

Following practical outcomes (PrOs) are the sub-components of the Course Outcomes (Cos). Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

1. Identifying the class of fire .
2. Donning of fire man's outfit with breathing apparatus.
3. Testing and operation of Jet and spray type nozzles and fire hoses..
4. Study and operate total CO2 flooding of Engine room (Model)
5. .Operation of different types of fire detectors.
6. .Use of Potable Fire Extinguishers and refilling.

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list*

The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

6. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

Sr. No.	Unit Title	Strategies
1	**Theory of fire**	Real life examples. Demonstration of real systems. Movies/Animations. Numerical.
2	**Fire Prevention**	
3	**Fire Detection and Safety Systems**	
4	**Fire Fighting Equipment (Fixed & Miscellaneous types)**	
5	**Fire Control, Firefighting & Shipboard Organization.**	

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Work as a leader/a team member.
b) Follow safety practices.
c) Follow ethical practices
d) Maintain tools and equipment
e) Practice environment friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **Theory of fire**	1.a Fire triangle. 1.b Classes of fire	1.1 Introduction, Safety & Principles, Fire triangle, Spontaneous Combustion. Limits of flammability. 1.2 Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship's use. 1.3 Control of Class A, B and C fires.

Unit – II **Fire Prevention**	2.a SOLAS Convention on fire. 2.b Ship electrical installations .	2.1 SOLAS Convention (Class A, B bulkheads), fire detection and extinction systems, escape means. 2.2 Electrical installations, statutory requirements for firefighting systems and equipment on different vessels..
Unit – III **Fire Detection and Safety Systems**	3.a Detectors & types. 3.b Detectors operational limits. 3.c Testing of detectors .	3.1 Fire safety precautions on cargo ships and tankers during working. 3.2 Types of detectors, 3.3 Selection of fire detectors and alarm systems and their operational limits. 3.4 Commissioning and periodic testing of sensors and detection system. 3.5 Description of various systems fitted on ships.
Unit – IV **Fire Fighting Equipment (Fixed & Miscellaneous types)**	4.a Operation of fire fighting equipments. 4.b Classes of fire extinguishers used in ships. 4.c Firemans outfit with the equipment maintenance.	4.1 Fire pumps, hydrants and hoses, Couplings, nozzles and international shore connection . Construction, operation and merits of different types of portable and non-portable fire extinguishers and fixed fire extinguishing installations for ships. CO2 systems. 4.2 Fireman's outfit, its use and care. Maintenance, testing and recharging of appliances. Breathing Apparatus – types, uses and principles.
Unit – V Fire Control, Firefighting & Shipboard Organization:	5.a Control of fire using techniques. 5.b Fighting fire in various space according to its class. 5.c Drills & duties of personnel during fire emergency.	5.1 Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, Cargo holds, galley etc. 5.2 Firefighting in port and dry dock. 5.3 Procedure for re-entry after putting off fire, Rescue operations from affected compartments. 5.4 First aid, Fire organization on ships. 5.5 Fire signal and muster. Fire drill and duties.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Theory of fire**	06	04	03	03	10
II	**Fire Prevention**	06	03	03	04	10
III	**Fire detection and Safety system**	10	04	06	06	16
IV	**Fighting Equipment (Fixed & Miscellaneous types)**	10	04	07	05	16
V	**Fire Control, Firefighting & Shipboard Organization**	10	04	06	08	18
Total		**42**	**19**	**25**	**26**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

Notes:

1. This specification table shall be treated as a general guideline for students and Teachers. The actual distribution of marks in the question paper may slightly vary from above Table.
2. If mid sem test is part of continuous evaluation, unit numbers I, II and unit III up to 3 are to be considered.
3. Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

10. SUGGESTED STUDENT ACTIVITIES

Perform the tasks mentioned in above Practical/Exercise.

NOTE: Students must draw the assembly of marine components as given in the 6.5 table and must get assessed by the concerned faculty at the completion of each component. Students will have to draw any of those 10 marine components which will be counted in internal marks .
Students must be able to draw any one of those 10 marine components by himself/ herself.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14-16** ***(fourteen to***

sixteen) student engagement hours during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

12. SUGGESTED LEARNING RESOURCES

- **List of Books:**

Text Book :

Commentary on SOLAS - Bhandarkar Publication

Reference Book :

SOLAS - IMO Publication
Marine Engineering Practices- IME Publication,Fire Safety Code Book
Firefighting aboard ships - M.G.Stavitsky

13. PO-COMPETENCY-CO MAPPING

Semester V	MACHINE DESIGN & DRAWING (Course Code: 4351802)						
	POs						
Competency & Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline specific knowledge	Problem Analysis	Design/ development of solutions	Engineering Tools, Experimentation& Testing	Engineering practices for society, Sustainability & environment	Project Management	Life-long Learning
Competency	**Prepare production drawings using the computer and relevant software and following standards codes and norms**						
Course Outcomes CO-1) . understand principles of fire science	**3**	**1**	**1**	**1**	**-**	**-**	**1**
CO-2) Explain fire prevention strategies and techniques to minimize the risk of fires on board ships.	**2**	**1**	**1**	**1**	**1**	**-**	**1**
CO-3) Relate with the different types of firefighting equipment and systems used on ships..	**2**	**2**	**1**	**1**	**-**	**-**	**1**
CO-4) Describe emergency response procedures specific to	**3**	**2**	**2**	**1**	**1**	**-**	**-**

shipboard fire incidents.							
CO 5) understand various firefighting techniques applicable to shipboard firefighting.	**2**	**2**	**2**	**1**	**1**	**1**	**1**

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

15. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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17. BOS Resource Persons

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