Course Title:	**Operational safety and fault tolerance**
Course Code:	CSE532/1
Program:	Computer science Engineering
Department:	Computer Engineering
College:	Rim AFDHAL
Institution:	ESIP

A. Course Identification

1. Credit hours: **3 (1.5-1.5-0)**
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: 3.1/3
4. Pre-requisites for this course: Real-time systems, Programming, Computer science basics

1. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Self-study	Total workload
1	**Traditional classroom**	…..	11	26
2	**Blended**	15		
3	**E-learning**	.....		
4	**Distance learning**	.....		
5	**Other ()**	.....		

2. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	10
2	**Laboratory/Studio**	-
3	**Tutorial**	5
4	**Others** (specify)	-
	Total	15

B. Course Objectives and Learning Outcomes

Course Main Objective

1. Acquire prior knowledge of basic operational safety and fault tolerance.
2. Understand the operational safety attributes.
3. Apply the analysis method of operational safety.
4. Manipulate the Reliability Diagram.
5. Manipulate the Fault tree.
6. Conclude effectively the basics, principles, and theories related to operational safety and fault tolerance with other disciplines

1. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	State and relate basics, principles, and theories related to the operational safety and fault tolerance.	PLO.K2
1.2	Apply the analysis method of operational safety	PLO.K3
2	**Skills**	
2.3	Manipulate the Fault tree	PLO.S3
2.4	Master the Concepts of operational safety	PLO.S4
2.5	Manipulate the Reliability Diagram.	PLO.S5
2.6	Master the different methods of operational safety	PLO.S6
2.7	Conclude effectively the basics, principles, and theories related to operational safety and fault tolerance with other disciplines	PLO.S7

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to Operational Safety & Fault Tolerance - Definition of operational safety and its importance. - Overview of fault tolerance in critical systems.	1
2	Operational Safety Attributes - Key attributes: availability, reliability, maintainability, and safety (RAMS).	1
4	Concepts of Operational Safety - Safety standards and risk management. - Importance of redundancy and error handling.	2
5	Reliability by Structure (Architecture) - System architecture for improving reliability. - Techniques like fault containment zones, redundancy, and modularity.	1
6	Methods for Analyzing Operational Safety - Common analysis techniques: FMEA (Failure Modes and Effects -Analysis) and FTA (Fault Tree Analysis).	1
8	Reliability Diagrams & System Modeling - Understanding reliability block diagrams. - Modeling system reliability & failure probabilities.	2
9	Fault Trees, Fault Tolerance & Fault Classification - Constructing a fault tree for risk assessment. - Understanding fault tolerance strategies & recovery techniques.	2

	- Types of faults: Hardware, software, human, environmental.	
Total		10

C. 1 Tutorial Content

No	List of Topics	Contact Hours
1	T1: Case Studies in Operational Safety	1
2	T2: Reliability Diagram	2
3	T3: Fault tree, Fault tolerance, Fault classification	2
Total		5

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
PLO.K2	State and relate basics, principles, and theories related to the operational safety and fault tolerance.	Lecturing	Assignments, Quizzes, Exams,
2.0	**Skills**		
PLO.S2	Apply the analysis method of operational safety	Lecturing	Assignments, Quizzes, Exams,
PLO.S3	Manipulate the Fault tree.		
PLO.S4	Master the Concepts of operational safety		Assignments, Report, Quizzes, Exams,
PLO.S5	Manipulate the Reliability Diagram.		
PLO.S6	Manipulate the Reliability Diagram.		
PLO.S7	Conclude effectively the basics, principles, and theories related to operational safety and fault tolerance with other disciplines		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Practical Work (written or oral)	Weekly	00%
2	Quizzes, Homework assignments	Random	00%
3	First mid Term	-	00%
5	Final Exam	6	100%

1.

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
1- Office hours 2- Blackboard interface

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	1. Jean-Claude Laprie – Dependability: Basic Concepts and Terminology, 1992 2. Algirdas Avizienis, Jean-Claude Laprie, Brian Randell – Fundamental Concepts of Dependability, IEEE Transactions, 2004. 3. Andrea Bondavalli, Felicita Di Giandomenico – State of the Art on Dependability Modelling and Analysis for Networks and Distributed Systems, 2013.
Essential References Materials	NA
Electronic Materials	1. YouTube Lectures (MIT, Stanford, CMU, Google Cloud, AWS)
Other Learning Materials	1. https://www.zvei.org/fileadmin/user_upload/Presse_und_Medien/Publikationen/2019/Juli/Fehlertoleranz_in_der_Maschinensicherheit/ZVEI_WP_Fehlertoleranz_EN_Online.pdf 2. https://www.researchgate.net/profile/Cyrille-Artho/publication/322035384_Formal_Techniques_for_Safety-Critical_Systems_FTSCS_2015/links/5bbdc52e45851572315bdcdf/Formal-Techniques-for-Safety-Critical-Systems-FTSCS-2015.pdf#page=132

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**classroom board software …**
Technology Resources (AV, data show, Smart Board, software, etc.)	**data show;**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment.	Students, course coordinator, Alumni, Employers	Direct/Indirect
Extent of achievement of course learning outcomes.	Faculty, Program Leaders, quality department	Direct
Quality of Learning resources	Faculty, Program Leaders,	Direct, Indirect

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Teaching and learning quality and effectiveness.	Students, Faculty Program Leaders,	Direct, Indirect

H. Specification Approval Data

Council / Committee	Computer Engineering Council
Date	11/09/2023