FAULT-TOLERANT COMMUNICATION NETWORKS
(Elective Subject)

Course Code:	14M1WEC331	Semester:	M.Tech. 3rd Sem.
Credits:	3	**Contact Hours:**	L-3, T-0, P-0

Course Objectives

The objectives are to study

1. Define common terms such as availability, reliability, dependability etc.

2. Induction with the service-based network design approach.

3. Terminology related to network pathology.

4. Role of reliability engineering in fault-tolerant network design.

5. Methodology of protection and restoration.

6. Implementation of fault-tolerant scheme for: (i) optical networks, (ii) SONET/SDH network, (iii) MPLS based network, (iv) adhoc networks

7. Planning for mission-critical networks.

Course Outcomes

After studying this course the students would gain enough knowledge

1. Apply the concepts of reliability and fault-tolerance for the network design.

2. Grade the network services on the basis of predictable.

3. Apply the knowledge for various networks viz. (i) optical networks, (ii) SONET/SDH network, (iii) MPLS based network, (iv) adhoc networks

4. Extend the knowledge for the mission-critical networks.

Course Contents

Unit	Topics	References (chapter number, page no. etc)	Lectures
1.	**Background of Fault-tolerance in Communication Network:** Historical perspective of fault-tolerance in communication, performance predictability, best-effort service, guaranteed service, QoS Fault, Failure and Error: reliability engineering in network design, causes of network failure, uncertainty in network, Imperfections in network design, performance failure, breakdown failure, reliability evaluation, failure distribution, MTTR, MTTF. Concepts of reliability, survivability, dependability, resiliency, recovery, continuity and performability	[1,2,3,7,8]	9

2.	**Network Availability, Protection & Restoration** Continuity and availability in communication network, transition from acceptable to unacceptable service state and Vice-Versa, Concepts and methodology of protection and restoration. [1,2,5]	Kang : Chapter 3	8
3	Fault-tolerant schemes for Optical networks, [2,4]	Kang : Chapter 5 Pucknell : Chapter 2	5
4	Fault-tolerant schemes for SONET/SDH network, [2]	Kang : Chapter 7 Uymera : Chapter 10	5
5	Fault-tolerant schemes for MPLS based network, [2]	Pucknell : Chapter 3 Kang : Chapter 2 (Fabricarion)	5
6	Fault-tolerant schemes for adhoc networks [6]		5
7	Mission-critical network planning [5]		5
		Total Lectures	**42**

Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
   - 10 Marks : Class performance, Tutorials & Assignments
   - 10 Marks : Quizzes
   - 5 marks : Attendance

Text Books

1. Martin L. Shooman, Reliability of Computer Systems and Networks: Fault Tolerance, Analysis, and Design, John Wiley & Sons.
2. Jean-Philippe Vasseur, Mario Pickavet, Piet Demeester Network Recovery: Protection and Restoration of Optical, SONET-SDH, IP, and MPLS, Elsevier.
3. James D. McCabe, Network Analysis, Architecture, and Design, Elsevier
4. Arun K. Somani, Survivability and Traffic Grooming in WDM Optical Networks, Cambridge University Press.
5. Mathew Liotine, Mission-Critical Network Planning, Artech House.

Reference Articles:

1. Xing, Liudong, Haoli Li, and Howard E. Michel. "Fault-tolerance and reliability analysis for wireless sensor networks." International Journal of Performability Engineering 5.5 (2009): 419.

2. Malec, Henry A. "Communications reliability: a historical perspective."Reliability, IEEE Transactions on 47, no. 3 (1998): SP333-SP345.

3. Bjarne E. Helvik, Perspectives on the Dependability of Networks and Services, Telektronikk (100th Anniversary Issue: Perspectives in telecommunications), (3):27 – 44, 2004.