

## 1. Course Description

This section will present the title, code, credit hours, prerequisite(s), objective, learning outcomes, content, instructional method, assessment method, policy and reading materials for each course.

### 1.1.Course Title: Advanced Computer Network

<b>University of Gondar, Faculty of Informatics:</b> <i>Department of Information Technology</i>	
Course Number	<b>MSIT5111</b>
Course Title	<b>Advanced Computer Network</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Course Description	This course provides an in-depth examination of the advanced concepts and principles in communications and computer networks. Another key goal is to prepare you for doing research in the field of networking. Topics include: queuing analysis, ATM, frame relay, performance analysis of routings, and flow and congestion controls.
Learning Outcomes	After successful completion of this course students will be able to Concisely define the following key terms: <ul style="list-style-type: none"><li>✓ Identify elements of modern network</li><li>✓ Understand IP routing and multicasting multi-protocol</li><li>✓ Understand optical networks SONET/SDN</li><li>✓ Understand Traffic Engineering - IP-over-ATM and MPLS</li><li>✓ Understand network virtualization, quality of service</li></ul>
Course Content:	<b>Elements of Modern Network</b> <ul style="list-style-type: none"><li>• The network ecosystem</li><li>• The network architecture</li><li>• Ethernet</li><li>• Wi-fi</li><li>• 3G/4G/5Gcellularnetworks</li><li>• Cloud computing</li></ul>

	<ul style="list-style-type: none"> <li>• Internet of Things</li> <li>• Network Convergence</li> </ul> <p><b>IP routing and multicasting</b></p> <ul style="list-style-type: none"> <li>• IP Addressing</li> <li>• Forwarding and Routing</li> <li>• BGP and adaptive routing</li> <li>• IP multicast (IGMP, MBONE, Multicast Routing/Transport/ Congestion Control)</li> </ul> <p><b>Optical Networking</b></p> <ul style="list-style-type: none"> <li>• SONET/SDH and</li> <li>• DWDM</li> </ul> <p><b>Network Virtualization</b></p> <ul style="list-style-type: none"> <li>• Virtualization</li> <li>• Network Function Virtualization</li> <li>• Network Virtualization</li> <li>• Virtual Private Network</li> </ul> <p><b>Traffic engineering</b></p> <ul style="list-style-type: none"> <li>• IP-over-ATM</li> <li>• MPLS</li> <li>• OSPF-extensions</li> <li>• VPNs</li> </ul> <p><b>Quality of Service</b></p> <ul style="list-style-type: none"> <li>• QoS mechanisms, protocols and architectures scheduling, shaping,</li> <li>• RTP and Intserv,</li> <li>• Differentiated services (Diff-serv) and service level agreement, RTP, RSVP</li> </ul>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr.)]
Pre-Requisites	None
Semester	Semester 1

Status of Course	Compulsory
Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	<div>✓ Final Written Examination: 50%</div> <div>✓ Article Review: 20%</div> <div>✓ Assignment/Project 30%</div>
Attendance Requirements	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	<ol style="list-style-type: none"> <li>1. Computer Networks: A Systems Approach (3rd Edition) by Larry Peterson and Bruce Davie. Morgan Kaufmann, 2003. ISBN: 1-55860-832-X.</li> <li>2. Computer Networking: A Top-Down Approach Featuring the Internet by Jim Kurose and Keith Ross, Addison-Wesley. ISBN: 0-201-61274-7.</li> <li>3. TCP/IP Illustrated, Volume 1 by W. Richard Stevens. Addison-Wesley. ISBN: 0-201-63346-9</li> </ol>

## 1.2.Course Title: Distributed Database Management Systems

**University of Gondar, Faculty of Informatics:**  
*Department of Information Technology*

Course Number	<b>MSIT5112</b>
Course Title	<b>Distributed Database Systems</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Course Objectives	The main objective of the course is to explain the advanced topics in the Data Base Management Systems. It also enables the students to acquire more knowledge about the data base concepts and its current issues.
Course Outcome	<p>After successful completion of this course students will be able to:</p> <ul style="list-style-type: none"> <li>✓ Understand the concepts of parallel and distributed databases</li> <li>✓ Know the principles of XML data bases</li> <li>✓ Know the detailed concepts in object oriented databases</li> <li>✓ Design the architecture and utilization of Mobile databases</li> <li>✓ Describe about Multimedia databases</li> <li>✓ Describe differentiate Parallel and Spatial databases</li> </ul>
Course Content	<p><b>Parallel and Distributed Databases:</b></p> <ul style="list-style-type: none"> <li>• Database Architectures</li> <li>• Centralized and Client-Server Architectures</li> <li>• Parallel Systems- Distributed Systems Architectures</li> <li>• Parallel Databases</li> <li>• Distributed Database Concepts</li> <li>• Distributed Data Storage</li> <li>• Distributed Transactions</li> <li>• Distributed Query Processing</li> <li>• Three Tier Client Server Architecture</li> </ul> <p><b>Object and Object Relational Databases:</b></p> <ul style="list-style-type: none"> <li>• Concepts for Object Databases</li> <li>• Object Database Standards, Languages and Design</li> </ul>

	<ul style="list-style-type: none"> <li>• Relational Systems</li> <li>• Object Relational features in SQL/Oracle</li> </ul> <p><b>XML Databases:</b></p> <ul style="list-style-type: none"> <li>• XML Databases-</li> <li>• XML Data Model</li> <li>• XML Schema</li> <li>• XML Querying</li> <li>• Web Databases</li> </ul> <p><b>Mobile Databases:</b></p> <ul style="list-style-type: none"> <li>• Mobile databases Management,</li> <li>• Mobile computing architecture,</li> <li>• Wireless communication,</li> <li>• Client/network relationship,</li> <li>• Characteristics of mobile environment</li> </ul> <p><b>Multimedia Databases:</b></p> <ul style="list-style-type: none"> <li>• Nature of Multimedia Data and Application,</li> <li>• Data Management Issues,</li> <li>• Open Research Problems,</li> <li>• Multimedia Database Applications,</li> </ul> <p><b>Parallel Database:</b></p> <ul style="list-style-type: none"> <li>• Architecture of parallel data bases,</li> <li>• Key elements of parallel Database processing,</li> <li>• Query Parallelism</li> </ul> <p><b>Spatial Data Base:</b></p> <ul style="list-style-type: none"> <li>• Spatial Database characteristics</li> <li>• Spatial Data Model (Elements, Geometries, Layers)</li> <li>• Spatial database queries</li> </ul>
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	<ul style="list-style-type: none"> <li>Techniques of Spatial DB Query (R-Tree · Quad-tree)</li> </ul>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr.)]
Pre-Requisites	None
Semester	Semester 2
Status of Course	Compulsory
Teaching and Learning Methods	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	<ul style="list-style-type: none"> <li>✓ Final Written Examination: 50%</li> <li>✓ Article Review: 20%</li> <li>✓ Assignment/Project 30%</li> </ul>
Attendance Requirements	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	<ol style="list-style-type: none"> <li>1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007.</li> <li>2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.</li> <li>3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2006.</li> <li>4. C.J.Date, A.Kannan and S.Swamynathan,”An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.</li> <li>5. V.S.Subramanian, “Principles of Multimedia Database Systems”, Harcourt India Pvt Ltd., 2001.</li> <li>6. Vijay Kumar, “Mobile Database Systems”, John Wiley &amp; Sons, 2006</li> </ol>

### 1.3.Course Title: Information Storage and Retrieval

University of Gondar, Faculty of Informatics: <i>Department of Information Technology</i>	
Course Number	<b>MSIT5113</b>
Course Title	<b>Information Storage and Retrieval</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Description	Information retrieval is an important research topic in the field of natural language processing. In addition to information retrieval has played an important role in our daily lives, this technology can be extended to various tasks, such as document abstracts, recommendation systems and emotional analysis, etc. This course will be started by a simple search model. It is hoped that students will have the concept of information retrieval. When they have introduced all kinds of search models in full, they will lead students to learn the application of this technology.
Learning Outcomes	On successful completion of the course students will be able to: <ul style="list-style-type: none"><li>✓ Understand and explorer Information retrieval</li><li>✓ Describe indexing, Evolution and Benchmark Corpus</li><li>✓ To be able to understand underlying models and algorithms, and methods for assessing information retrieval systems' performance.</li><li>✓ Understand neural network for IR</li><li>✓ To be able to criticize selected applications rely on information retrieval including information extraction and .Summarization</li></ul>
Course Content:	<b>Introduction to IR</b> <ul style="list-style-type: none"><li>• Definition and history of IR</li><li>• Characterizing the web</li><li>• Artificial intelligence (AI) in IR</li><li>• IR versus Web Search Engine</li></ul> <b>Components of IR</b>

- Indexing
  - Document and Query Representation
  - Text operations
  - Efficient indexing
- Retrieval
  - Retrieval models: Boolean, vector-space, probabilistic, and machine learning models

#### **Evaluation of IR Systems**

- Efficiency evaluation
- Effectiveness evaluation

#### **Parallel and Distributed IR**

- Architecture
- Source Selection
- Query Processing
- Peer-2-Peer Architectures and Systems

#### **Web Search Engine – Introduction and Crawling**

- Web search overview, Web size measurement
- Web Search Architectures, Crawling, Web indexes

#### **Web Search – Link Analysis and Specialized Search**

- Link Analysis, hubs and authorities
- Page Rank and HITS algorithms
- Searching and Ranking
- Relevance Scoring and ranking for Web
- Hadoop & Map Reduce
- Personalized search, Collaborative filtering and content-based recommendation of documents and products

#### **Advanced Issues**

- Web – Snippet generation, Summarization, Question/Query Answering



	<ul style="list-style-type: none"> <li>• Cross- Lingual Retrieval, Multimedia Information Retrieval</li> <li>• Knowledge representation formalisms <ul style="list-style-type: none"> <li>○ Ontology based retrieval</li> </ul> </li> </ul> <p><b>Text Mining Applications in IR</b></p> <ul style="list-style-type: none"> <li>• Information filtering: Organization and relevance feedback</li> <li>• Text classification and clustering <ul style="list-style-type: none"> <li>○ Categorization algorithms: naive Bayes, decision trees and nearest neighbour</li> <li>○ Clustering algorithms: agglomerative clustering, k-means, expectation maximization (EM).</li> </ul> </li> </ul>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr.)]
Pre-Requisites	None
Semester	Semester 1
Status of Course	Compulsory
Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	<ul style="list-style-type: none"> <li>✓ Final Written Examination: 50%</li> <li>✓ Article Review: 20%</li> <li>✓ Assignment/Project 30%</li> </ul>
Attendance Requirements‘	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	<ol style="list-style-type: none"> <li>1. W. B. Frakes and R. Baeza-Yates (Eds.), Information Retrieval: Data Structures &amp; Algorithms, Prentice-Hall</li> <li>2. <i>Introduction to Information Retrieval</i>, Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, Cambridge University Press. 2008</li> </ol>

**1.4.Course Title: Research Methodology for IT**

<b>University of Gondar, Faculty of Informatics:</b> <i>Department of Information Technology</i>	
Course Number	<b>MSIT5214</b>
Course Title	<b>Research Methodology for IT</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>3</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Course Description	<p>Introduction to research methods, including research paradigms and methodologies across Information Technology, problem formulation, research question preparation, design of research approach, literature search and presentation of related work, citing, referencing and paraphrasing, measurement and validity, analysis of results</p> <p>(Quantitative and qualitative), verbal and written presentation skills, and research ethics. Students prepare and defend a thesis proposal or project proposal in an area of their choice.</p>
<b>Learning Outcomes</b>	<p>Those who successfully complete the course will be able to:</p> <ul style="list-style-type: none"><li>✓ Locate and summarize scientific literature and understand and apply correct ways of referencing to and citing from scientific literature,</li><li>✓ Produce a well-developed research proposal,</li><li>✓ Select an appropriate methodology to conduct the research,</li><li>✓ Understand various tasks required to carry out the research,</li><li>✓ Find the resources needed to guide them through the research process, and</li><li>✓ Develop and present scientific research report.</li></ul>

<b>Course Content:</b>	<b>Fundamentals of research:</b> <b>The research Process:</b> <b>Literature review:</b> <b>Data Collection, Analysis and Research Tools:</b> <b>Design Science in Information Technology Research:</b> <b>Research Design, Modelling and Optimization techniques:</b> <b>Research Ethics:</b> <b>Report writing, Citation and reference usage:</b>
Laboratory Exercise	None
Pre-Requisites	None
Semester	Semester 1
Status of Course	Compulsory
Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	✓ Final Written Examination: 50% ✓ Article Review: 20% ✓ Proposal Development 20% ✓ Presentation 10%
Attendance Requirements	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.

<p><b>References</b></p>	<ol style="list-style-type: none"> <li>1 Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams: The Craft of Research (Edition: 3rd Edition), the University of Chicago Press - Chicago Guides t, 2008</li> <li>2 John W.Creswell: Research Design: Qualitative, Quantitative, and Mixed Methods (Edition: 2nd), SAGE Publications, 2002</li> <li>3 C.R. Kothari. (2004). <i>Research Methodology</i>. New Delhi: NEW AGE INTERNATIONAL PUBLISHERS.</li> <li>4 Graziano Antony M, Raulin Michael L., (2004), Research Methods: A process of inquiry, 5th ed., Pearson Education Group PLC.</li> <li>5 Leedy Paul D., Ormrod Jeanne E., Practical Research: Planning and Design, 7thed.</li> <li>6 Trochim William M.K. (2003), Research Methods, 2nd ed., Atomic Dog Publishing, USA</li> <li>7 Kothari C.R. (2004), Research methodology (Methods and Techniques), 2nd ed., New Age International Publisher.</li> <li>8 Different E-Books</li> </ol>
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### 1.5.Course Title: Machine Learning

University of Gondar, Faculty of Informatics: <i>Department of Information Technology</i>	
Course Number	<b>MSIT5215</b>
Course Title	<b>Machine Learning</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Description	Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to build computer systems that learn from experience. This course will explain how to build systems that learn and adapt using real-world applications. Some of the topics to be covered include concept learning, neural networks, genetic algorithms, reinforcement learning hidden Markov, deep learning, assessing and comparing, and combining multiple learners and so forth. This course will familiarize students with a broad cross-section of models and algorithms for machine learning, and prepare students for research or industry application of machine learning techniques
Learning Outcomes	<p>By successfully completing this course you will understand and perform/use:</p> <ul style="list-style-type: none"><li>✓ The student will know about the fundamental concepts in machine learning, the different classes of machine learning algorithms, and ways to choose and apply different basic machine learning algorithms</li><li>✓ The student will learn about ways to evaluate the performance of learning systems</li><li>✓ The student will be able to prepare data and apply machine learning methods to achieve a learning goal within an intelligent system</li><li>✓ The student will be able to judge the suitability of a machine learning paradigm for a given problem and the available data, have an understanding of the capabilities and limitations of the considered machine learning algorithms, and is able to identify problems or misleading results.</li></ul>

	<ul style="list-style-type: none"> <li>✓ Solve various problems using Expert system</li> <li>✓ Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models</li> </ul>
<b>Course Content:</b>	<p><b>Introduction to Machine Learning:</b></p> <ul style="list-style-type: none"> <li>• definition Machine</li> <li>• Fundamentals of Machine Learning</li> </ul> <p><b>Applications of Machine Learning Algorithms:</b></p> <ul style="list-style-type: none"> <li>• Automatic recognition of Handwritten</li> <li>• Computer-Aided Diagnosis</li> <li>• Computer Vision, Speech Recognition</li> <li>• Text Mining, web mining</li> </ul> <p><b>Supervised Learning Algorithms:</b></p> <ul style="list-style-type: none"> <li>• Logistic Regression</li> <li>• Decision Trees</li> <li>• Naïve Bayesian Classification</li> <li>• the k-Nearest Neighbours Classifiers,</li> <li>• Ensemble</li> <li>• Linear Discriminant Analysis</li> <li>• Support Vector Machine</li> <li>• Time-Series Forecasting</li> <li>• Sequential Pattern Analysis</li> </ul> <p><b>Unsupervised Learning Algorithms:</b></p> <ul style="list-style-type: none"> <li>• Clustering</li> <li>• k-Means Clustering</li> <li>• Hierarchical Clustering</li> <li>• Gaussian Mixture Model</li> <li>• Hidden Markov Model</li> <li>• Principal Component Analysis</li> </ul> <p><b>Reinforcement Learning:</b></p>

	<ul style="list-style-type: none"> <li>• Introduction to Reinforcement Learning</li> <li>• Markov Decision Process</li> <li>• Monte Carlo Methods for Prediction &amp; Control</li> </ul> <p><b>Expert System:</b></p> <ul style="list-style-type: none"> <li>• Introduction to Expert Systems</li> <li>• The representation and manipulation of knowledge in a computer</li> <li>• Expert System Architectures</li> <li>• Building Expert Systems</li> </ul> <p><b>Deep learning:</b></p> <ul style="list-style-type: none"> <li>• Regularization</li> <li>• convolutional neural networks</li> <li>• recurrent neural networks</li> <li>• autoencoders</li> </ul> <p><b>Evaluation in ML:</b></p> <ul style="list-style-type: none"> <li>• Metrics</li> <li>• cross-validation</li> <li>• statistics</li> <li>• Addressing the multiple comparisons problem.</li> </ul>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr.)]
Pre-Requisites	None
Semester	Semester 1
Status of Course	Compulsory
Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	<ul style="list-style-type: none"> <li>✓ Final Written Examination: 50%</li> <li>✓ Article Review: 20%</li> <li>✓ Assignment/Project 30%</li> </ul>
Attendance Requirements	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.

<b>References</b>	<ol style="list-style-type: none"><li>1. Ethem ALPAYDIN. Introduction to Machine Learning, Third Edition. The MIT Press, August 2014,</li><li>2. Manohar Swamynathan. Mastering Machine Learning with Python in Six Steps, Appress,2017</li><li>3. Mohssen Mohammed, Muhammad Badruddin Khan, Eihab Bashier Mohammed Bashier Machine Learning: Algorithms and Applications, CRC press, 2017</li><li>4. Ian Goodfellow Yoshua Bengio Aaron Courville, Deep Learning, The MIT press, 2016</li></ol>
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**1.6.Course Title: Information Technology Project Management**

<b>University of Gondar, Faculty of Informatics,</b> <i>Department of Information Technology</i>	
<b>Course code</b>	<b>MSIT5216</b>
<b>Course Title</b>	<b>Information Technology Project Management</b>
<b>Credit hour</b>	<b>3</b>
<b>Course hour</b>	<b>2</b>
<b>Degree program</b>	<b>M.Sc. in Information Technology</b>
<b>Course Objectives</b>	<p>The main objectives of this course are to expose students to the methods and principles of modern IT project management and foster excellence in project management practices. After completing of this course the students will:</p> <ul style="list-style-type: none"><li>✓ Understand the issues involved in IT project management and the factors that affect software IT project quality,</li><li>✓ Be familiar with a range of standards, techniques and tools developed to support IT project management and its production,</li><li>✓ Develop IT project plans, supporting IT project quality plans and risk management plans,</li><li>✓ Actively participate in IT project development by applying project management concepts,</li><li>✓ Demonstrate knowledge of project management terms and techniques</li></ul>

<b>Course Description</b>	This course is mainly designed to prepare IT project managers, novice or experienced, with project management skills needed to better manage IT projects. Built along the IT project management lifecycle, this course covers detailed topics of the basic concepts of IT project management, including initiating, planning, controlling, executing, and closing projects. The course also shows how IT projects should be managed, from inception to post implementation review. The audience who take this course will likely improve their management skills and abilities to define the project scope, create a workable project plan, and manage within the budget and schedule.
<b>Course Content</b>	<b>Project management principles:</b> <b>Project roles and responsibilities:</b> <b>Project definition:</b> <b>Project planning, estimating and resourcing:</b> <b>Project issue management:</b> <b>Project risk management:</b> <b>Project quality management:</b> <b>Project change management:</b> <b>Project controlling and reporting:</b> <b>IT Infrastructure Library (ITIL):</b> <b>Service Science, Management, and Engineering (SSME):</b> <b>Communication management and team building:</b>
<b>Laboratory Exercise</b>	Required [1 Cr.Hr. (3 Hr)]
<b>Pre-requisites</b>	None
<b>Semester</b>	Semester
<b>Status of course</b>	Compulsory
<b>Teaching and learning method</b>	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam</b>
	<div>✓ Final Written Examination:</div> <div>50%</div>

<b>Assessment/Evaluation</b>	<div>✓ Article Review: 20%</div> <div>✓ Assignment/Project 30%</div>
<b>Attendance Requirements‘</b>	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	<ol style="list-style-type: none"> <li>1. Bonham S. (2005). IT project portfolio management, ISBN 1-58053-781-2, ArtechHouse, inc.</li> <li>2. Electronic imaging services inc. ( 2000). A guide to the project management body of knowledge. electronic imaging services, ennsylvania, USA.</li> <li>3. Lan yin-chen (2005). Global information society operating information systems in a dynamic global business environment, University of Western Sydney, Australia.</li> <li>4. Robert E. Umbaugh (1999). Handbook of Information Systems Management, 1999 Edition, ISBN 0849399785</li> <li>5. Sodhi, Jag. (2001). IT project management handbook, management concepts inc., ISBN 1–56726–098–5.</li> <li>6. Wiliams M. (2008). THE PRINCIPLES OF PROJECT MANAGEMENT, SitePoint pty ltd., Australia, Canada, ISBN 978-0-9802858-6-4.</li> <li>7. Young L. (2007). The Handbook of Project Management A practical guide to effective policies, techniques and processes, London and Philadelphia Revised 2nd edition, ISBN-13 978 0 7494 4984 1.</li> </ol>

### 1.7.Course Title: Seminar on Emerging Technologies

<b>University of Gondar, Faculty of Informatics:</b> <i>Department of Information Technology</i>	
Course Number	<b>MSIT5217</b>
Course Title	<b>Seminar on Emerging Technologies</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Course Objectives	The main objective of this course is exposing IT graduates to the current/hot emerging technologies research area. It also gives a platform for the students to innovate and express their ideas in front of future engineering graduates and professionals
Course Outcome	After successful completion of this course students will be able to: <ul style="list-style-type: none"><li>✓ Study and present a seminar on a topic of current relevance in Information Technology or related fields.</li><li>✓ Enhance the debating capability of the student while presenting a seminar on a technical topic.</li><li>✓ Train students to face the audience and freely express and present his ideas without any fear and nervousness, thus creating self-confidence and courage which are essentially needed for an Engineer.</li></ul>
Course Content	<b>Cloud computing:</b> <b>Pervasive computing:</b> <b>Social media:</b> <b>Mobile internet and APPs:</b> <b>The next Web:</b> <b>Big data:</b> <i>**DGC and/or Assigned Professor can modify the content</i>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr.)]
Pre-Requisites	None
Semester	Semester 1

Status of Course	Compulsory
Teaching and Learning Methods	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	<div>✓ Final Written Examination: 50%</div> <div>✓ Article Review: 20%</div> <div>✓ Assignment/Project 30%</div>
Attendance Requirements‘	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	Provided by assigned Professor/Instructor

### 1.8.Course Title: Wireless Networks and Mobile Computing

<b>University of Gondar, Faculty of Informatics:</b> <i>Department of Information Technology</i>	
Course Number	<b>MSIT5121</b>
Course Title	<b>Wireless Networks and Mobile computing</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Description	Wireless and mobile systems have become ubiquitous; playing a significant role in our everyday life. However, the increasing demand for wireless connectivity and the emergence of new areas such as the Internet of Things present new research challenges. This course introduces advanced research topics in wireless networks and mobile communication systems. In each lecture, Student will discuss recent research papers that introduce new wireless designs, algorithms, protocols and applications. The papers are systems oriented and focus on practical challenges and solutions for building wireless and mobile systems. Student will also learn how to design and build wireless systems through a research project.
Course Objectives	The main objective of the course is to explain the principles and current issues in the wireless Network and Mobile Communications.

<b>Learning Outcomes</b>	<p>At the end of course, students will able to understand,</p> <ul style="list-style-type: none"> <li>✓ The advanced concepts of mobile and wireless devices</li> <li>✓ The architecture of wireless systems</li> <li>✓ Identification of the research topics in the mobile communications</li> <li>✓ Designing concepts in the Protocol layers</li> <li>✓ The principles of Telecommunication systems</li> <li>✓ The concepts of GSM and CDMA</li> <li>✓ The principles of Adhoc mesh and sensors</li> <li>✓ Detailed architecture of WAP</li> <li>✓ The functions of WiFi and WiMAX</li> <li>✓ The concepts of Bluetooth and IR</li> </ul>
<b>Course Content:</b>	<p><b>Mobile Radio Propagation:</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types of Radio Waves</li> <li>• Propagation Mechanisms</li> <li>• Free Space Propagation</li> <li>• Land Propagation</li> <li>• Path Loss</li> <li>• Slow Fading</li> <li>• Fast Fading</li> <li>• Statistical Characteristics of Envelope</li> <li>• Characteristics of Instantaneous Amplitude</li> <li>• Doppler Effect</li> <li>• Delay Spread</li> <li>• Inter-symbol Interference</li> <li>• Coherence Bandwidth</li> <li>• Co-channel Interference</li> </ul> <p><b>Cellular Communications:</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• The Cellular Engineering Fundamentals</li> </ul>

- Signal Strength and Cell Parameters
- Capacity of a Cell
- Frequency Re-use
- How to Form a Cluster
- Channel Assignment Strategies
- Fixed and Dynamic Channel Assignment Strategies
- Handoff Process
- Factors affecting Handoff Process
- Handoff Strategies
- Few practical cases of Handoff Scenario
- Interference and System Capacity
- Co-channel Interference (CCI)
- Adjacent Channel Interference (ACI)
- Cell Splitting, Sectoring
- Microcell Zone concept
- Repeaters
- Trunked Radio System

#### **Traffic Channel Allocation:**

- Static Allocation versus Dynamic Allocation
- Fixed Channel Allocation (FCA)
- Dynamic Channel Allocation (DCA)
- Hybrid Channel Allocation (HCA)
- Allocation in Specialized System Structure

#### **Multiple Division Techniques for Traffic Channels:**

- Introduction
- Concepts and Models for Multiple Divisions
- Comparison of Multiple Division Techniques
- Modulation Techniques

#### **Mobile Communication Systems:**

- Introduction



	<ul style="list-style-type: none"> <li>• Cellular System Infrastructure</li> <li>• Registration</li> <li>• Handoff Parameters and Underlying Support</li> <li>• Parameters Influencing Handoff</li> <li>• Roaming Support</li> <li>• Home Agents</li> <li>• Foreign Agents, and Mobile IP</li> <li>• Rerouting in Backbone Routers</li> <li>• Multicasting</li> </ul> <p><b>Security and Privacy:</b></p> <p><b>Wireless Systems:</b></p> <ul style="list-style-type: none"> <li>• Telecommunication Systems</li> <li>• Architecture</li> <li>• Sessions</li> <li>• Protocols</li> <li>• Hand Over and Security</li> <li>• UMTS and IMT-2000</li> <li>• Satellite Systems</li> <li>• IEEE 802.11 – Hiper LAN</li> <li>• Bluetooth</li> <li>• MAC layer</li> </ul> <p><b>Security and Link Management:</b></p> <ul style="list-style-type: none"> <li>• Goals</li> <li>• Tunneling</li> <li>• Wireless Application Protocol (WAP)</li> </ul> <p><b>Emerging technologies:</b></p>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr.)]
Pre-Requisites	None
Semester	
Status of Course	Compulsory

Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	<ul style="list-style-type: none"> <li>➤ Final Written Examination: 50%</li> <li>➤ Article Review: 20%</li> <li>➤ Assignment/Project 30%</li> </ul>
Attendance Requirements‘	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	<ol style="list-style-type: none"> <li>1. Introduction to Wireless and Mobile Systems Third Edition, Dharma Prakash Agrawal</li> <li>Computer Networking (A Top-Down Approach Featuring the Internet) J. F. Kurose and D. W. Ross, Addison-Wesley.</li> <li>1. OFDM Wireless LANs : A Theoretical and Practical Guide, John Terry and Juha Heiskala, Sams, 2002. Available @ MIT Libraries</li> <li>2. Fundamentals of Wireless Communication, David Tse and Pramod Viswanath, Cambridge University Press, 2005.</li> <li>3. Jochen Schiller, “Mobile Communications”, Pearson Education, Delhi, 2000.</li> <li>4. Sandeep Singhal, Thomas Bridgman, Lalitha Suryanarayana, Danil Mouney, Jari Alvinen, David Bevis, Jim Chan and Stetan Hild, “The Wireless Application Protocol : Writing Applications for the Mobile Internet”, Pearson Education Asia,2001.</li> <li>5. Ivan Stojmenovic , Handbook of Wireless Networks and Mobile Computing, John Wiley &amp; sons Inc, Canada, 2002.</li> <li>6. Asoke K Taukder,Roopa R Yavagal,Mobile Computing, Tata McGraw Hill Pub Co. , New Delhi, 2005</li> </ol>

**1.9.Course Title: Advanced Multimedia System**

<b>University of Gondar, Faculty of Informatics:</b> <i>Department of Information Technology</i>	
Course Number	<b>MSIT5122</b>
Course Title	<b>Advanced Multimedia System</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Description	This course contains lectures and paper discussions for each topic. Students have to read multiple papers, discuss with others, and write study reports. The target of this course is to teach students how to do research on multimedia by utilizing tools and research methodology, and how to write and propose a research project by themselves
<b>Learning Outcomes</b>	On successful completion of the Course students will be able to: <ul style="list-style-type: none"><li>✓ Understand the basic concepts of digital multimedia systems</li><li>✓ To explorer various interesting and important research topics on Multimedia system</li><li>✓ To identify various advance topic on multimedia</li><li>✓ To understand various tools and techniques</li><li>✓ To discuss the techniques involved, and demonstrate various multimedia applications</li></ul>

<b>Course Content:</b>	<b>Overview of Multimedia</b> <b>Video summary</b> <b>Color de-quantization</b> <b>Music visualization</b> <b>Text and image sonification</b> <b>Motion capture by videos</b> <b>Multimedia stylization and personalization</b> <b>Speech and gesture recognition</b> <b>Multimedia information retrieval</b> <b>Audio visual integration</b> <b>Multimodal interaction and dialogue</b>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr)]
Pre-Requisites	None
Semester	
Status of Course	Elective
Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	➤ Final Written Examination: 50% ➤ Article Review: 20% ➤ Assignment/Project 30%
Attendance Requirements‘	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	1. Han, Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann 2. Avinash Kaushik, Web Analytics An Hour a Day, Wiley Publishing, 2007 3. Bing Liu, Web Data Mining: Exploring Hyperlinks, Content, and Usage Data 4. Wouter de Nooy, Andrej Mrvar, Vladimir Batagelj: Exploratory Social Network Analysis with Pajek, Cambridge University Press 5. Dietmar Jannach: Recommender Systems: An Introduction, Cambridge University Pres

### 1.10. Course Title: Big Data Analytics

<b>University of Gondar, Faculty of Informatics,</b> <i>Department of Information Technology</i>	
Course code	<b>MSIT5123</b>
Course Title	<b>Big Data Analytics</b>
Credit hour	<b>3</b>
Lecture hour	<b>2</b>
Degree program	<b>M.Sc. in Information Technology</b>
Course Description	Big Data is a collection of datasets that are accumulated in high Velocity with super large Volumes containing a Variety of data types. It is very difficult to process or analyze Big Data by using traditional database management tools or data processing applications. Big Data Analytics is the process of examining large amounts of data of a variety of types (big data) to uncover hidden patterns, unknown correlations and other useful information. Transforming Big Data to the valuable information or decision can provide competitive advantages and result in business benefits. This course will introduce Big Data and its application.
Learning Outcome	At the end of this Course, students will be able to: <ul style="list-style-type: none"><li>✓ Students will learn tips and tricks for Big Data use cases and solutions.</li><li>✓ They will able to build distributed systems with Apache Hadoop.</li><li>✓ They will able to apply Hadoop ecosystem components, spark and their application</li><li>✓ Students will work on the hand-on project to learn the Big Data concept and application.</li></ul>

Course Content	<p><b>Introduction to Big Data</b></p> <ul style="list-style-type: none"> <li>• What are the major causes of big data</li> <li>• Characterizing BigData</li> <li>• Benefits and application areas of Big data</li> </ul> <p><b>Difference and similarities of Data related disciplines</b></p> <ul style="list-style-type: none"> <li>• Data Science</li> <li>• Data Mining</li> <li>• Big Data Analytics</li> </ul> <p><b>Big Data Analytics Methodology/Life Cycle</b></p> <ul style="list-style-type: none"> <li>• The big data analytics life cycle <ul style="list-style-type: none"> <li>○ The difference and similarity with the traditional data mining models</li> </ul> </li> <li>• Computing Environment for Big Data Analytics <ul style="list-style-type: none"> <li>○ Hardware requirement for Big data Analytics</li> <li>○ Software requirement and the map reduce Framework</li> </ul> </li> </ul> <p><b>Three kind of data analytics</b></p> <ul style="list-style-type: none"> <li>• Descriptive, Predictive , Prescriptive</li> <li>• Machine learning/ Deep learning algorithms employed in each category</li> </ul> <p><b>Machine learning Algorithms for supervised learning</b></p> <p><b>Machine learning Algorithms for unsupervised learning</b></p> <p><b>Machine learning Algorithms for Association Mining</b></p> <p><b>Deep Learning</b></p> <ul style="list-style-type: none"> <li>• Difference with machine learning</li> <li>• Difference with ANN</li> <li>• Identify real world scenarios where this paradigm is best</li> <li>• ANN paradigm</li> </ul>
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	<b>How to evaluate Big data analytics models</b> <ul style="list-style-type: none"> <li>• Appropriate test case selection technique to evaluate models?</li> <li>• Scenarios to accept models and reject them</li> <li>• Performances results that are due to chance</li> <li>• How can we measure the practical and statistical significance of results</li> </ul>
Laboratory Exercise	Optional
Pre-requisites	None
Semester	
Status of course	Elective
Teaching and Learning method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation and Grading system	<ul style="list-style-type: none"> <li>✓ Final Written Examination: 50%</li> <li>✓ Article Review: 20%</li> <li>✓ Assignment/Project 30%</li> </ul>
<b>Attendance Requirements‘</b>	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	<ol style="list-style-type: none"> <li>1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.</li> <li>2. Chris Eaton, Dirk deroos et al. “Understanding Big data”, McGraw Hill, 2012.</li> <li>3. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012.</li> <li>4. MapReduce Design Patterns (Building Effective Algorithms &amp; Analytics for Hadoop) by Donald Miner &amp; Adam Shook</li> </ol>

### 1.11. Course Title: Image Processing and Computer Vision

<b>University of Gondar, Faculty of Informatics:</b> <i>Department of Information Technology</i>	
Course Number	<b>MSIT5224</b>
Course Title	<b>Image Processing and Computer Vision</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Description	The course provides intermediate and advanced topics in image processing including image descriptors, image sampling, image compression, image enhancement and restoration, morphological operations on binary images, object tracking and motion estimation, etc.
<b>Learning Outcomes</b>	On successful completion of the course students will be able to: <ul style="list-style-type: none"><li>✓ Describe different modalities and current techniques in image acquisition</li><li>✓ Describe how digital images are represented and stored efficiently depending on the desired quality, color depth, dynamics</li><li>✓ Use the mathematical principles of digital image enhancement and restoration</li><li>✓ Describe and apply the concepts of feature detection and contour finding algorithms</li><li>✓ Analyze the constraints in image processing when dealing with larger data sets</li></ul>
<b>Course Content:</b>	<b>Digital Image:</b> <ul style="list-style-type: none"><li>• Programming with Images,</li><li>• Image Analysis and Computer Vision,</li><li>• Types of Digital Images,</li><li>• Image Acquisition, and</li><li>• Image file Format</li></ul> <b>Color Space and Image Sampling:</b>



- Light, Images,
- Watermark, and
- Sampling theory

#### **Digital Image Processing (DIP):**

- Histograms and Image Statistics,
- Point Operations,
- Filters,
- Noise removal and Binarization,
- Thinning and Normalization,

#### **Image Feature Extraction and Representation:**

- Edge and line
- Regional Segmentation and Representation, and
- Texture description and classification

#### **Basic Operations on Images:**

- Image Restoration and Image Enhancement,
- Convolution,
- Discrete Fourier Transform, and
- Morphological Operations on Binary Images

#### **Object Representation and Computer Vision Techniques:**

- Review of Computer Vision applications;
- Fuzzy-Neural algorithms for computer vision applications
- Motion Analysis
  - optical Flow
  - Background Modelling
  - moving Object Detection and Tracking
  - Behaviour Detection and Modelling

#### **Application:**

- Content-Based Image Retrieval,
- Preprocessing,
- Segmentation,

	<ul style="list-style-type: none"> <li>• Feature Extraction,</li> <li>• Matching,</li> <li>• Classification and</li> <li>• Recognition</li> </ul>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr.)]
Pre-Requisites	None
Semester	
Status of Course	Compulsory
Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	<ul style="list-style-type: none"> <li>✓ Final Written Examination: 50%</li> <li>✓ Article Review: 20%</li> <li>✓ Assignment/Project 30%</li> </ul>
Attendance Requirements	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	<ol style="list-style-type: none"> <li>1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley Pub. Co., New York, 2002</li> <li>2. Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice-Hall, 1989</li> <li>3. Burge and Burger, Principles of digital image processing, 2010</li> <li>4. Chris Solomon &amp; Toby Breckon Fundamentals of Digital Image Processing, A Practical Approach with Examples in Matlab, Wiley-Blackwell 2010: Text book website: <a href="http://www.imageprocessingbook.com/">http://www.imageprocessingbook.com/</a></li> <li>5. Michael Seul, et al., <i>Practical Algorithms for Image Analysis with CD-ROM: Description, Examples, and Code</i>. Edition, Cambridge University Press, 2000, ISBN-13 978-0521660655</li> </ol>

### 1.12. Course Title: Information Security

<b>University of Gondar, Faculty of Informatics:</b> <i>Department of Information Technology</i>	
Course Number	<b>MSIT5225</b>
Course Title	<b>Information Security</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Description	The course provides advanced concepts in instruction in security for network hardware, software, and data including using physical security measures, instituting backup procedures, protecting systems against attacks and intrusions, and gaining protection from malware. And, the course covers applying these concepts to the theme of “Protecting Yourself in the Digital Age.” This course will provide in depth understanding on Introduction to Information Security, Advanced concepts to Cryptography, Network and Computer Security, and Security Management.
Learning Outcomes	<p>At the completion of this course, the student will have demonstrated the ability to:</p> <ul style="list-style-type: none"><li>✓ Understand how information security can counteract attempts to attack an individual’s “infosphere,” the person’s sensitive information.</li><li>✓ Understand how people are the weakest components in any security system.</li><li>✓ Learn the fundamentals of cryptography and how cryptography serves as the central language of information security.</li><li>✓ Develop and Implement Physical Security</li><li>✓ Ensure Infrastructure and Network Security</li><li>✓ Understand Security Baselines</li><li>✓ Understand the Roles of Computer Forensics and the Law in Information Security.</li></ul>

	<ul style="list-style-type: none"> <li>✓ Understand the basic software tools for assessing the security posture of a computer or a network.</li> <li>✓ Understanding how issues of privacy affect information security</li> </ul>
<b>Course Content:</b>	<p><b>Introduction:</b></p> <ul style="list-style-type: none"> <li>• General Security Concepts and Security Trends</li> <li>• Introduction to an “infosphere”-Inside the Security Mind,</li> <li>• Operational Security</li> <li>• People’s Role in Information Security</li> </ul> <p><b>Cryptography and PKI:</b></p> <p><b>Internet Standards and Physical Security:</b></p> <ul style="list-style-type: none"> <li>• Network Security and Infrastructure</li> <li>• Authentication and Wireless</li> <li>• Intrusion Detection Systems and Security Baseline</li> <li>• Attacks and E-mail</li> <li>• Web Security and Software Security</li> </ul> <p><b>Disaster Planning and Risk Management:</b></p> <ul style="list-style-type: none"> <li>• Change and Privilege Management</li> <li>• Computer Forensics and the Law</li> </ul>
Laboratory Exercise	Required [1 Cr.Hr. (3 Hr.)]
Pre-Requisites	None
Semester	
Status of Course	Compulsory
Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	<ul style="list-style-type: none"> <li>✓ Final Written Examination: 50%</li> <li>✓ Article Review: 20%</li> <li>✓ Assignment/Project 30%</li> </ul>
Attendance Requirements‘	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.

<b>References</b>	<ol style="list-style-type: none"><li>1. Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security", Cengage Learning; ISBN: 1285448367</li><li>2. Christof Paa and Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", Publisher: Springer, ISBN: 3642041000</li></ol>
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### 1.13. Course Title: Service Oriented Architecture (SOA)

<b>University of Gondar, Faculty of Informatics:</b> <i>Department of Information Technology</i>	
Course Number	<b>MSIT5226</b>
Course Title	<b>Service Oriented Architecture (SOA)</b>
Credit Hour	<b>3</b>
Lecture Hour	<b>2</b>
Degree Program	<b>M.Sc. in Information Technology</b>
Description	<p>Service-oriented Architecture is the art of modeling an organization's business processes, as a well-factored portfolio of network-addressable business components.</p> <p>In this course, the students will study service oriented architecture from both an architectural and development perspective. We will discuss principles and patterns but also study how these may be implemented in a modern SOA platform.</p> <p>The students will learn the standards of SOA implementation and gain a thorough understanding of the value, benefit, cost, effectiveness, and challenges of moving to an SOA. In this course, the students will master the basics of modeling, designing, and implementing an SOA—and discover the theories and best practices behind interoperability.</p>
Learning objective	<p>This course is designed to provide a thorough introduction to "Service Oriented Architecture" (SOA), which refers to a design pattern made up of components and interconnections that stress interoperability and location transparency. This course covers the latest heterogeneous models for carrying out large scale distributed computing using Web services. It includes both the design of SOA systems as well as practical hands-on programming of a distributed. Web Service based system. The fundamentals of defining, designing, building, testing and rolling-out a SOA system are explored using tools from major Web service vendors. Also, it looks at the impact of SOA on software quality, efficiency, security, performance and flexibility. Students are required to apply this knowledge through a series of design and programming exercises. These exercises involve SOA design, computer programming, system installation and testing</p>

<b>Course Content:</b>	<b>Evolution and Emergence of Web Services and SOA:</b> <b>Introduction to SOA:</b> <b>XML Technologies:</b> <b>Introduction to Web Services, WSDL and SOAP Web Services in Java &amp; .Net:</b> <b>SOA Service Architecture:</b> <b>SOA Delivery Strategies:</b> <b>SOA Design and Analysis:</b> <b>SOA Pattern and Cloud Computing:</b> <b>Business Process Orchestration:</b> <b>SOA Governance and WS* Extensions:</b> <b>SOA Security:</b>
Laboratory Exercise	None
Pre-Requisites	None
Semester	
Status of Course	Elective
Teaching and Learning Method	<b>Lecture, Paper Review, Assignments and Demonstrations, Project work, Exam,</b>
Assessment/Evaluation	✓ Final Written Examination: 50% ✓ Article Review: 20% ✓ Assignment/Project 30%
Attendance Requirements	Minimum 80% during lecture and 100% during practical work sessions except for some unprecedented mishaps.
<b>References</b>	1) Thomas Erl, —Service-Oriented Architecture: Concepts, Technology, and Design, Prentice Hall Publication, 2005. 2) Norbert Bieberstein, Sanjay Bose, Marc Fiammante, Keith Jones, 3) Rawn Shah, —Service-Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap, IBM Press Publication, 2005. 4) Sandy Carter, —The New Language of Business: SOA & Web 2.0, IBM Press, 2007