Mehran University of Engineering and Technology, Jamshoro
Department of Software Engineering

PhD Courses (Electives) in Software Engineering

Sub No.	Course Code	Name of Subject	Credits	Marks	Remarks
01	SE800	Advanced Multimedia Technology	3	100	Approved
02	SE810	Data Mining Algorithms	3	100	Approved
03	SE820	Text Mining & Language Processing	3	100	Approved
04	SE830	Programming the Real time Systems	3	100	Approved
05	SE840	Research Programming & Analyzing Results	3	100	Approved
06	SE850	Semantic based Software Development	3	100	Approved
07	SE860	Big Data Analytics	3	100	Approved
08	SE870	Design and Modeling Software Architecture	3	100	Approved
09	SE880	Computer Network Design & System Security	3	100	Approved

Mehran University of Engineering and Technology, Jamshoro
Department of Software Engineering

ORIGINAL SUBMITTED SYLLABUS

Title of Subject Technology	**:**	**Advanced Multimedia**
Code	**:**	SE800
Discipline	**:**	Software Engineering
Effective	**:**	14 PhD-IICT Batch and onwards
Pre-requisite	**:**	Interactive multimedia Systems & Graphics, Image Processing
Assessment	**:**	10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		42

Specific Objectives of course:

- Multimedia Technology constitutes many important topics for novel and future oriented research. The aim of this course is to understand various concepts associated with multimedia technology. Explain some desirable features for multimedia systems and to understand advances in multimedia.

Course outline:

- **Chapter 1:**
  Multimedia Systems and Requirements, Elements of Multimedia, Challenges, Multimedia Signal Representation and Processing, Multimedia-based Distance Education on the Internet: Challenges and Experiences.

- **Chapter 2:**
  Image Processing and Human Visual System, 2D Data Transform with DTFT, DFT, DCT, Over view of Current Techniques in Image Compression, image water masking techniques.
  Image Perception, Image Enhancement with Histogram Analysis, Morphological Operators, Image Restoration, Feature Detection and Pattern Matching, Image Coding With DCT and Wavelet Technologies.

- **Chapter 3:**
  Overview of Current Techniques in Video Compression, Video Coding With Motion Estimation, Image / Video Compression Standards JPEG, MPEG-1, MPEG-2,MPEG-4, MPEG-7, MPEG-21 and H.261/H.262/H.263/H.264, Video water masking techniques.

- **Chapter 4:**

  Multimedia Communications, Video transmission, multimedia steaming Protocols RTP/RTSP/RTCP, Streaming Applications (streaming servers, media conferences, web radio, IP TV, P2P TV), IP Telephony (VoIP), Multimedia networking issues for digital video libraries, storage organization and management; QoS management (real-time delivery and adaptability to the environment); information

management(indexing and retrieval); user satisfaction; and security(especially the management of content rights).

- **Chapter 5:**

  Quality Of Service in Multimedia services, Multimedia services categorization, Network parameters, DiffServ, RSVP, MPLS, QoS in mobile and wireless, Multimedia application adaptation, media transcoding and conversion, Multimedia content annotation

- **Chapter 6:**

  Wireless multimedia networks, Wireless & Multimedia, Motivations, Requirements, Challenges Solutions, Wireless LAN, Wireless PAN, Wireless WAN, Video Streaming over IEEE 802.11, Current IEEE 802.11 mechanisms, Video Streaming in Mobile Ad-hoc Networks, traditional challenges, Wireless Multimedia Sensor Networks (WMSN), applications, architecture of WMSN, IPTV over WiMAX, IPTV architecture, challenges, layered video.

BOOKS RECOMMENDED

1. Berta Buttarazzi, Gil Pechuán Ignacio, K. L. Eddie Law, Sagarmay Deb, Weilan Wang, Yue Qian, Conesa Garcia M. Pilar, Jacek Ilow,Jianjun Qian, Peris Ortiz Marta, Xiaobao Lu, "Advanced Topics in Multimedia Research", InTech [Latest Edition].
2. Al-Haj, Ali Mohammad, ed. Advanced techniques in multimedia watermarking: image, video and audio applications. IGI Global, [Latest Edition].
3. Stanković, Srđan, Irena Orović, and Ervin Sejdić. Multimedia signals and systems. New York, NY: Springer, [Latest Edition].
4. Bhatnagar, Gaurav. Introduction to multimedia systems. Academic Press, [Latest Edition].
5. Furht, Borko, Stephen W. Smoliar, and Hongjiang Zhang. Video and image processing in multimedia systems. Springer Science & Business Media, [Latest Edition].
6. Ganz, Aura, Zvi Ganz, and Kitti Wongthavarawat. Multimedia Wireless Networks: Technologies, Standards and QoS. Pearson Education, [Latest Edition].
7. Rao, Kamisetty Ramamohan, Zoran S. Bojkovic, and Bojan M. Bakmaz. Wireless Multimedia Communication Systems: Design, Analysis, and Implementation. CRC Press, [Latest Edition].

Approval:

Board of Studies:	Res.No.02.02	Dated:23-10-2017
AS&RB:	Res.No.13.5	Dated:03-04-2018
Academic Council:	Res.No.92.15	Dated:23-04-2018

Mehran University of Engineering and Technology, Jamshoro
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ORIGINAL SUBMITTED SYLLABUS

Title of Subject	**:**	**Data Mining Algorithms**
Code	**:**	SE810
Discipline	**:**	Software Engineering
Effective	**:**	**14PhD-IICT Batch and onwards**
Pre-requisite	**:**	Database Management Systems, Statistical Methods
Assessment	**:**	10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		42

Specific Objectives of course:

- The course will enable students to understand fundamental concepts and working principle of algorithms of data mining. The goal of the course is to let the students understand the data mining techniques in order to apply such techniques in several applications domains. This course will allow students to discover knowledge from information repositories.

Course outline:

- **Introduction**
  Data mining, motivating challenges, data mining tasks
- **Data**
  Types of data, Data Quality, Issues related to data collection, Measures of similarity and dissimilarity
- **Classification**
  Basic concepts, Decision Tree, Evaluating performance of classifier, Rule-based classifier, Bayesian classifier, Artificial Neural Network (ANN), Support Vector Machine (SVM)
- **Association Analysis**
  Frequent itemset generation, Rule generation, Apriori algorithm, FP-growth algorithm, Evaluation of association rules
- **Cluster Analysis**
  Clustering, K-means algorithm, Hierarchical algorithm, DBScan algorithm, Cluster Evaluation

BOOKS RECOMMENDED

- Pang-Ning, T., Steinbach, M., & Kumar, V. (Latest Edition). Introduction to data mining. In Library of Congress.
- Larose, D. T. (Latest Edition) Discovering knowledge in data: an introduction to data mining. Wiley.com.
- Han, Jiawei, Micheline Kamber, and Jian Pei. (Latest Edition). Data mining: concepts and techniques. Elsevier.
- Hand, Mannila, and Smyth. (Latest Edition). Principles of Data Mining. Cambridge, MA: MIT Press.

Approval:

Board of Studies:	Res.No.02.02	Dated:23-10-2017
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ORIGINAL SUBMITTED SYLLABUS

Title of Subject	**:**	**Text Mining and Language Processing**
Code	**:**	SE820
Discipline	**:**	Software Engineering
Effective	**:**	14PhD-IICT Batch and onwards
Pre-requisite	**:**	Data Mining concepts & Techniques
Assessment	**:**	10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		42

Specific Objectives of course:

- The course will enable students to to apply algorithms, resources and techniques for implementing and evaluating text analytics systems. Further, this course will demonstrate familiarity with text analytics application. The main goal of this course is to increase student awareness of the power of large amount of text data and computational methods to find patterns in large text corpora. This course will introduce the concepts and methods of text mining technologies rooted from machine learning, natural language processing, and statistics.

Course outline:

- **Introduction to Natural Language Processing (NLP)**
  Overview of the field; defining problems --- machine translation, question answering, information retrieval; history of approaches to NLP --- early knowledge-based approaches, heuristic techniques, statistical approaches, and approaches combining statistics and logic (or knowledge); examples of why language is a tricky thing to process.
- **Document Representation**
  how to convert text to feature vectors, what to count and how to count (stopword, stemming, tfidf, ngram, colloation), Information extraction, and enrich document representations by using information extraction tools and external linguistic resources
- **Document Classification**
  naïve Bayes, nearest-neighbor, Text classification and feature selection: SVM, The many facets of text: classifying text by topic, author, opinion, genre, and style
- **Document Clustering**
  Document clustering (hierarchical clustering and k-Means)
- **Text Analytics**
  Opinion mining and sentiment analysis

BOOKS RECOMMENDED

- Miner, G. (Latest Edition). Practical text mining and statistical analysis for non-structured text data applications. Academic Press.
- Weiss, S. M., Indurkhya, N., Zhang, T. (Latest Edition). Fundamentals of Predictive Text Mining. Springer: New York.
- Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze. (Latest Edition). Introduction to Information Retrieval, Cambridge University Press.
- Aggarwal, Charu C., and ChengXiang Zhai. (Latest Edition). Mining text data. Springer Science & Business Media.

Approval:

Board of Studies:	Res.No.02.02	Dated:23-10-2017
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Mehran University of Engineering and Technology, Jamshoro
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ORIGINAL SUBMITTED SYLLABUS

Title of Subject	**:**	**Programming the Real Time systems**
Code	**:**	SE830
Discipline	**:**	Software Engineering
Effective	**:**	14PhD-IICT Batch and onwards
Pre-requisite	**:**	Computer & Mobile programming, Basic Electronics and Data Structures
Assessment	**:**	10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		42

Specific Objectives of course:

- This course allows students to learn about real-time and quality of service system principles, understand real-time resource management and quality of service issues that arise, and construct sample applications on representative platforms. Platforms range from handheld to mobile computers. The focus is on conceptual development, prototyping, and implementation of real time systems.
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Course outline:

- Introduction
- Real time systems, concepts
- Human centered design, Fabrication and prototyping
- Embedding sensors with computing devices
- Sensor readings, error correction, response time and latency
- Intelligent agent interfaces and context awareness
- Ubiquitous Computing and Augmented Reality
- Activity and location sensing
- Privacy in ubiquitous Computing

BOOKS RECOMMENDED

- Real-Time Embedded Systems: Optimization, Synthesis, and Networking ***By Meikang Qiu, Jiayin Li [Latest Edition]***
- Ubiquitous Computing: Smart Devices, Environments and Interactions ***By Stefan Poslad [Latest Edition]***
- Embedded and Multimedia Computing Technology and Service: (Lecture Notes in Electrical Engineering) Latest Edition ***By James J. Jong Hyuk Park (Editor), Young-Sik Jeong (Editor), Sang Oh Park (Editor), Hsing-Chung Chen (Editor)***

Approval:

Board of Studies:	Res.No.02.02	Dated:23-10-2017
AS&RB:	Res.No.13.5	Dated:03-04-2018
Academic Council:	Res.No.92.15	Dated:23-04-2018

Mehran University of Engineering and Technology, Jamshoro
Department of Software Engineering

ORIGINAL SUBMITTED SYLLABUS

Title of Subject : Research Programming & Analyzing Results

Code : SE840
Discipline : Software Engineering
Effective : 14PhD-IICT Batch and onwards
Pre-requisite : None
Assessment : 10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours : 3 + 0 **Marks :** 100+00
Minimum Contact Hours: 42

Specific Objectives of course:

- This course will make students learn to use the Python programming language to solve problems of interest to them. The students are encouraged to come with a goal on their first day: a project they would like to accomplish. The course will certainly help to process and plot research data as well as to efficiently process multi-dimensional container of generic data.

Course outline:

- Fundamental Python language syntax
- Data structures with lists and dictionaries
- Files and the filesystem
- Parsing CSV data
- JSON and YAML
- Getting data from the internet
- Introducing Matplotlib
- Matplotlib animations
- Introducing NumPy
- Creating packages

BOOKS RECOMMENDED

- Think Python, ***by Allen B. Downey, second edition, O'Reilly [Latest Edition]***
- Learn Python the hard way ***by Zed Shaw [Latest Edition]***
- Introduction to Programming Using Python [Latest Edition] ***by Y. Daniel Liang, Prentice Hall***

Approval:

Board of Studies:	Res.No.02.02	Dated:23-10-2017
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Mehran University of Engineering and Technology, Jamshoro
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ORIGINAL SUBMITTED SYLLABUS

Title of Subject : *SEMANTIC BASED SOFTWARE DEVELOPMENT*

Code : SE850
Discipline : Software Engineering
Effective : 14PhD-IICT Batch and onwards
Pre-requisite : None
Assessment : 10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours : 03 + 0 **Marks :** 100
Minimum Contact Hours: 42

Specific Objectives of course:

- the main areas of semantics
- different ways to define meaning
- the interface of semantics and pragmatics
- ways of analysing and contrasting meanings
- formal semantics using propositional logic
- cognitive semantics
- conceptual semantics
- the interface of semantics and morphology
- the interface of semantics and syntax
- semantic change

Course outline:

- **XML**
  XML basics, XML Tree, XML Syntax, XML Elements, XML Attributes, XML Namespaces, XML Encoding, Viewing XML, XML and CSS
- **DTDs and XML SCHEMAS**
  XML Doctypes, XML Validator, Document Type Definition, XML Schema
- **Resource Description Framework**
  Introduction to RDF, RDF rules, examples of RDF, RDF Elements, RDF Containers, RDF Collections, RDF Schema, RDF Dublin Core, RDF OWL
- **Web Ontology Language**
  Ontology, OWL, OWL Sublanguages, OWL lite, OWL DL, OWL full
- **SPARQL**
  Structure of SPARQL query, SPARQL architecture, Datapoints, Friend of a Friend Ontology
- **SEMANTIC WEB SERVICES**
  Web Service Description Language, Web Ontology Language Schema, Semantic Annotation for Web Service Description Language
- **Advanced Topics**
  Semantic Opinion Mining,

BOOKS RECOMMENDED

- Practical RDF by Shelly Powers. O'Reilly Media; Latest Edition
- Programming the Semantic Web by Toby Segaran, Colin Evans and Jamie Taylor. O'Reilly Media; Latest Edition

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ORIGINAL SUBMITTED SYLLABUS

Title of Subject	**:**	**Big Data Analytics**
Code	**:**	SE860
Discipline	**:**	Software Engineering
Effective	**:**	19 PhD-IICT Batch and onwards
Pre-requisite	**:**	None
Assessment	**:**	10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours	**:**	03 + 0 **Marks:** 100+00
Minimum Contact Hours:		42

Specific Objectives of course:

- **The objective of this course is to enhances students' skill to understand and use big data mechanisms, that occupy a key role in solving huge data analytics issues and other large-scale real-world data problems.**

Course outline:

- **Introduction**
  Introduction to Big Data, motivating challenges, applications
- **Data Analysis**
  Descriptive Statistics and Exploratory Data Analysis; Visualization, Summarization, Distributions and Relationships, Regression Analysis; Inference.
- **Machine Learning**
  Algorithmic models of learning, Bayesian networks, Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.
- **Scalable Big Data Algorithms**
  Scalability issues, Key algorithms with application; Sketching and Streaming algorithms for basic statistics, Dimension Reduction, Graph stream algorithms, Lower bounds for Sketching and Streaming, Numerical linear algebra. Algorithms for big matrices.
- **Hadoop/MapReduce**
  Introduction to MapReduce/Hadoop, Introduction to Spark, Information retrieval and MapReduce, Relational database operators and MapReduce.

BOOKS RECOMMENDED

1. Hadoop: The Definitive Guide, Tom White, O'Reilly [Latest Edition]
2. Hadoop In Action, Chuck Lam, Manning [Latest Edition]
3. Data Mining: Concepts and Techniques, by Jiawei Han et al., Morgan Kaufmann [Latest Edition]
4. Tom Mitchell, Machine Learning, [Latest Edition]
5. Big Data Analytics by Parang Kulkarni, Sarang Joshi [Latest Edition]

Approval:

Board of Studies:	Res.No.02	Dated:25-09-2018
AS&RB:	Res.No.154.16(a)	Dated:04-12-2018
Academic Council:	Res.No. 94.4	Dated:27-03-2019

Mehran University of Engineering and Technology, Jamshoro
Department of Software Engineering

ORIGINAL SUBMITTED SYLLABUS

Title of Subject : Design and Modeling of Software Architecture

Code : SE870
Discipline : Software Engineering
Effective : 19PhD-IICT Batch and onwards
Pre-requisite : None
Assessment : 10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours : 03 + 0 **Marks :** 100
Minimum Contact Hours: 42

Specific Objectives of course:

The course will enable students to understand the architectural patterns, qualitative and quantitative assessment of architectures, quantitative modelling using architecture description languages and qualitative architecture evaluation methods. The course will also address the specific challenges related to scale, dynamics, and heterogeneity as found in system of systems.

Course outline:

- **Introduction**
  Engineering approach to software design, role of software architecture, role of software components, palladio approach.
- **Architectural modelling**
  Models, viewpoint, view types and views, structural viewpoints, behavioral viewpoint, deployment viewpoint, decision viewpoint
- **Architectural analysis**
  Modeling quality, quality attributes, goal-driven approach, component quality, usage profile and their propagation, execution environments, domain specific quality modeling, putting the pieces together.
- **Embedding into the software engineering process**
  Model driven quality prediction, A quality aware component-based development process, application in development process.
- **Architecture Evaluation techniques**
  Driver integrity check, Solution adequacy check, documentation quality check, architecture compliance check, code quality check
- **Domain specific modeling languages**
  System engineering applications (SysML), Embedded software domain (AADL, AUTOSAR, MARTE), service-oriented business systems engineering BPEL, BPMN, SoaML)

BOOKS RECOMMENDED

- Dorina C. Petriu, José Merseguer, and Simona Bernardi, (latest Edition), Model-Driven Dependability Assessment of Software Systems, Springer.
- Ralf H. Reussner, et al., (Latest Edition) Modeling and Simulating Software Architectures: The Palladio Approach, The MIT press.
- Christoph Rathfelder, (Latest Edition) Modelling Event-Based Interactions in Component-Based Architectures for quantitative system evaluation, KIT Scientific Publishing.
- Jens Knodel, Matthias Naab, (Latest Edition), Pragmatic Evaluation of Software Architectures, Springer.

Approval:

Board of Studies:	Res.No.01	Dated:25-09-2018
AS&RB:	Res.No.154.16(a)	Dated:04-12-2018
Academic Council:	Res.No.94.4	Dated:27-03-2019

Mehran University of Engineering and Technology, Jamshoro
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ORIGINAL SUBMITTED SYLLABUS

Title of Subject	**:**	**Computer Network Design & System Security**
Code	**:**	SE880
Discipline	**:**	Software Engineering (1st Semester)
Effective	**:**	19PhD-IICT Batch and onwards
Pre-requisite	**:**	None
Assessment	**:**	10% Sessional 30% Mid Semester 60% Final Semester Examination
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		42

Specific Objectives of course:

At the end of the course the students will be able to:

- Explain key concepts of information security such as design principles, cryptography
- Apply various security and risk management tools for achieving information security and privacy.
- Identify appropriate techniques to tackle and solve problems in the discipline of network security.

Course outline:

- Introduction, Protocols and standards: Definition and Uses of Computer Network, Classification of Computer network, Network Architecture, Internet Standards, Internet Administration; Overview of reference models: H/W selection. , Telephone networks, networking principles.
- Overview and architectures, Deployment, Error Control, Rate Adaptation, Spatial re-use, Cellular re-use, Frequency Allocation, Power Control, Adhoc Networks, Routing in Adhoc networks, making best use of broadcast, mobility.
- Overview of Cryptography and Wireless Networks, Security in Wireless LANs, Security in Cellular Networks, Bluetooth Security, Ad hoc and sensor network security.
- Cellular technology to 2G, 3G,4G and 5G as well as the emergence of WLAN and WPAN as broadband ad hoc networks.
- Internet protocols: Internet basics, IP, TCP, UDP, ICMP, HTTP; World Wide Web (WWW), Security in Internet, E-mail Security.

Economics of security ,User-centered design of security systems ,Cryptographic primitive design ,Security modeling ,Foundational cryptography ,Threat assessment and analysis ,Protocol design

Provable security, Security heuristics, Lightweight cryptography, Malware, Network security, Privacy, Security auditing, Security and computer forensics, Trusted computing.

BOOKS RECOMMENDED

1. Peterson I.; Davie B.;, "Computer Networks A Systems Approach", Prentice Hall, Latest Edition.
2. Kurose J.F..; Rose K.W.; "Computer Networking — A Top Down Approach Featuring the Internet", Addison-Wesley, Latest Edition.
3. Stevens W.R.; "TCP/IP Illustrated, Volume I, Addison-Wesley, Latest Edition.
4. Stevens, ``UNIX Network Programming, vol. 1: Networking APIs: Sockets and XTI,'' Latest ed.
5. Computer Security: Principles and Practice (Latest Edition), by William Stallings and Lawrie Brown.
6. Guide to Wireless Network Security, by Vacca

Approval:

Board of Studies:	Res.No.01	Dated:25-09-2018
AS&RB:	Res.No.154.16(a)	Dated:04-12-2018
Academic Council:	Res.No.94.4	Dated:27-03-2019