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

***OBE based System (1st - 8th Semesters)** **Batch** **17SW**

Course Scheme

YEAR	SEMS	S. No.	SUBJECTS	CREDIT HOURS	MARKS	TOTAL CREDITS
FIRST	*1ST	1	Functional English	3+0	100+00	
		2	Applied Calculus	3+0	100+00	
		3	Computer Programming	3+1	100+50	
		4	Electronics Engineering	3+1	100+50	
		5	Basic Electrical Engineering	3+1	100+50	15+3=18
	*2ND	6	Islamic Studies / Ethics	2+0	50+00	
		7	Pakistan Studies	2+0	50+00	
		8	Linear Algebra & Analytical Geometry	3+0	100+00	
		9	Digital Computer & Logic Design	3+1	100+50	
		10	Object Oriented Programming	3+1	100+50	
		11	Professional Ethics	2+0	50+00	15+2=17
SECOND	*3RD	12	Software Economics & Management	2+0	50+00	
		13	Differential Equation & Fourier Series	3+0	100+00	
		14	Introduction to Software Engineering	3+0	100+00	
		15	Computer Architecture & Organization	3+0	100+00	
		16	Data Structure & Algorithms	3+1	100+50	14+1=15
	*4TH	17	Laplace Transforms & Discrete Mathematics	3+0	100+00	
		18	Database Management & Administration	3+1	100+50	
		19	Operating System Concepts	3+1	100+50	
		20	Microprocessor Technologies	2+1	50+50	
		21	Operations Research	3+0	100+00	14+3=17
THIRD	*5TH	22	Software Construction & Development	2+1	50+50	
		23	Statistics & Probability	3+0	100+00	
		24	Human Computer Interaction	3+0	100+00	
		25	Agent based Intelligent Systems	3+0	100+00	
		26	Information Security	3+0	100+00	
		27	Communication & Presentation Skills	3+0	100+00	17+1=18
	*6TH	28	Discrete Structures	3+0	100+00	
		29	Software Project Management	3+0	100+00	
		30	Mobile Application Development	3+1	100+50	
		31	Data Science & Analytics	3+1	100+50	
		32	Technical & Business Writing	3+0	100+00	15+2=17
FOURTH	*7TH	33	Formal Methods in Software Engineering	3+0	100+00	
		34	Multimedia Communication	3+1	100+50	
		35	Software Re-engineering	3+0	100+00	
		36	Web Engineering	3+1	100+50	
		37	Final Year Project/Thesis - I	0+3	00+100	12+5=17
	*8TH	38	Simulation & Modelling	3+0	100+00	
		39	Cloud Computing	3+1	100+50	
		40	Software Quality Engineering	3+1	100+50	
		41	Final Year Project/Thesis - II	0+3	00+100	9+5=14
						111+22=133

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

Title of Subject **:**		**Applied Calculus(MTH108)**
Discipline	:	Software Engineering (1st Semester)
Effective	:	19SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	03 + 00 Marks: 100
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Evaluate the functions and their derivatives.	C4	2
2	Assess the Integral calculus with applications	C4	2
3	Apply the vector calculus in the field of engineering	C4	2

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Introduction to functions: Mathematical and physical meaning**,** graphs and types of function.
Introduction to limits: Theorems of limits and their applications to functions. Right hand and left hand limits. Continuous and discontinuous functions and their applications.
Derivatives: Introduction to derivatives. Geometrical and physical meaning of derivatives. Partial derivatives and their geometric significance. Application problems (rate of change, marginal analysis).
Higher Derivatives: Leibnitz theorem, Rolle's theorem,Mean value theorem. Taylors and Maclaurins series.
Evaluation of limits using L' Hospital's rule: Indeterminate forms (0/0), (∞/∞), (ox∞), (∞-∞), 1^{∞}, ∞^0, 0^0.
Application of Derivatives: Asymptotes, curvature and radius of curvature, differentials with application.
Application of partial Derivatives: Euler's theorem, total differentials; maxima and minima of function of two variables.
Integral Calculus: Methods of integration by substitution and by parts. Integration of rational and irrational algebraic functions. Definite integrals, improper integrals. Gamma and Beta functions; reduction formulae.
Application of Integral Calculus: Cost function from marginal cost, rocket flights; area under curve.
Vector Calculus: Vector differentiation and vector integration with their physical interpretation and applications.∇operator, gradient, divergence and curl with their application.

Books Recommended:

- Benice, D.D., Brief calculus and its applications,
- Raymond, A.B., Applied calculus
- Yousuf, S.M., Calculus and analytical Geometry, IlmiKitabKhana, Lahore, latest edition.

Approval:

Board of Studies:	**Resolution No. 01**	**Dated: 26-03-2018**
Board of Faculty:	**Resolution No. 3.1**	**Dated: 11-04-2018**
Academic Council:	**Resolution No. 17(ii)**	**Dated: 23-04-2018**

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

Title of Subject **:**		**Applied Physics (EL119)**
Discipline	:	Software Engineering (1st Semester)
Effective	:	19SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	03 + 00 Marks: 100
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Define the basic concepts and fundamental laws of electrostatic and magnetism.	C1	1
2	Explain the comprehensive knowledge of semiconductor physics, optics and lasers	C2	1
3	Describe the fundamental knowledge of modern physics	C1	1

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Electrostatics: Coulomb's law, electric field and potential, capacitance, dielectrics. Electrodynamics: Magnetic field and force, sources of magnetic field, electromagnetic induction, inductance. Solid-state physics: Crystal lattices, unit cells, energy bands, allowed and forbidden states, conductors, semiconductors, insulators. Semiconductors: Composition, purity, n- and p-type materials, carrier properties and distribution. Carrier action: Diffusion, drift, generation, recombination. Conductivity, mobility, p-junction diode, diode curve, forward-biased diode, reverse-biased diode, bipolar junction transistor and its biasing, MOSFET and its biasing, Hall effect. Optics: Optical absorption, photo-luminescence, photoconductivity, photoelectric effect, lasers, superconductivity. Heat and Thermodynamics in relation to cooling of electronics. Electric fields, Gauss' law, electric potential, capacitance and dielectrics, current and resistance, magnetic fields, sources of magnetic field, Faraday's law, inductance, direct current circuits, alternating current circuits, diode characteristics, transistor characteristics nature of light, geometric optics, laws of geometric optics, interference of light waves, diffraction, polarization.

Recommended Books:

1. David Halliday, Robert Resnick, and Jearl Walker, "Fundamentals of Physics", John Wiley & Sons, ISBN: 0471465097, Latest Edition
2. Arthur Beiser, "Schaum's Outline of Applied Physics", McGraw-Hill, ISBN: 0071426116 Latest Edition
3. Huges. E., "Electrical Technology," Longman, Latest Edition.
4. B.L. Thraja" Electrical Technology, Latest Edition

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 1**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject **:**		**Functional English (ENG101)**
Discipline	:	Software Engineering (1st Semester)
Effective	:	19SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	03 + 00 Marks: 100
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Write varied contents including official letters, e-mails, and applications and summarize the texts using appropriate grammatical mechanisms and cohesive devices.	C2	12
2	Apply skimming, scanning and detailed reading and listening strategies to understand gist of the text/conversation.	C3	2
3	Demonstrate their skills using English language to express their point of view, show arguments and deliver a presentation in a real life situations.	C3	10

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☑

Course outline:

Reading: Interactive Reading, apply the skills of surveying skimming, scanning and detailed reading and identify topic sentence

Writing: Audience Related Writing, composition of sentences, Paragraph, short descriptive writing, précis and letter and application, identify contextual clues with the help of cohesive devices.

Listening: Collect gist and important points from a listening text or any other oral source viz. Lecture, speech or conversation

Speaking: Taking part in different real life situations, answer question, argue and explain one's point of view, ask for information and turn taking techniques and presentation skills.

Grammar: Mechanics of English Language, Punctuation, vocabulary, conversion of words, tenses and sentence structure

Recommended Materials: Dawn newspaper, Reader Digest, New Scientist and other interesting materials selected by teachers

Books: A. J, Thomson and A. v. Martinet and Practical English Grammar
Sarwar Zakia, (Edt) 1991 English Study Skills A Spelt Publication Karachi.
R.R. Jordon, 1980 Collins Study skills in English. William Collins Sons & Co. Glasgow Great Britain.
Jones Rhodri, 1986, A New English Course (An Approach to GCSE English Language for Individual Study or Class Use)
K. James at al, 1986, Listening Comprehension and Note-Taking Course (Collins Study Skills In English)
Selected Text from Dawn, Readers Digest, New Scientist and other relevant material of teacher's Choice.

Approval:

Board of Studies:	**Resolution No.**	**Dated:**
Board of Faculty:	**Resolution No.**	**Dated:**
Academic Council:	**Resolution No.)**	**Dated:**

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

Title of Subject **:Introduction to Information & Communication Technologies (SW-113)**

Discipline	:	Software Engineering (1st Semester)
Effective	:	19SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	02 + 01 Marks: 50 + 50
Minimum Contact Hours:		30 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Explain and identify the various components and concepts related to ICT	C2	1
2	Use ICT to solve real world problems.	C3	1
3	Use necessary software for supporting, everyday usage of Computer and Communication Systems.	P3	5

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **COMPUTER SYSTEMS**
  Types of Computers, Parts of computers, hardware, input/output devices, storage devices, software, system software, operating systems, application software, computer users, graphical user interface, interacting with your computer, Interpreter and Compilers.
- **DATA PROCESSING AND STORAGE**
  Data representation, bit and bytes, text codes, data processing, CPU, machine cycles, internal clock, factors affecting processing speed, modern CPU, parallel processing, organization and identification of data, backing up data, optimizing disk performance, files and databases
- **WORKING WITH COMPUTER LOGIC**
  Number Systems, Decimal, Binary, Octal, Hexadecimal, Binary Addition, Multiplication and Division, Boolean algebra Concepts, Electronic logic gates, Truth table, Canonical forms, Karnaugh maps, Quine Mc-Clusky methods, Introduction to combinational logic design.
- **IMPACT OF ICT ON SOCIETY**
  How ICT effects the society, applications in education sector, finance, business, home, etc. Advantages and Disadvantages.

Practical Work to be carried out:

1. Understanding your operating system and troubleshooting basic problems
2. Efficiently using Internet and Search Engines
3. Getting familiar with MS Word
4. Working with Advanced features of MS Word
5. Technical Writing with MS Word
6. Working with MS PowerPoint
7. Enhancing presentations using animations and business models
8. Getting familiar with MS Excel
9. Working with formulae and functions in MS Excel
10. Using a sophisticated text editor for programming
11. Getting familiar with Git and GitHub
12. Team Collaboration using a Remote Access Software
13. Creating Google Forms
14. Getting familiar with basic HTML Syntax
15. Case Study

Recommended Books:

- Peter Norton, Introduction to computers, Latest Edition.
- *Brian K. Williams, Stacey C. Sawyer, Using information technology* : a practical introduction to computers & communications, Latest Edition

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Programming Fundamentals (SW-112)**
Discipline	**:**	Software Engineering (1st Semester)
Effective	**:**	19 Batch & onwards
Pre-requisite	**:**	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours:		45 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Explain and implement concepts of functions, structures, pointers in C++	C3	1
2	Use arrays and pointers to solve complex problems using arrays and pointers	C3	1
3	Code document, test and implement a well-structured, robust computer program using C++ programming language.	P3	5

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge	☑	7	Environment and Sustainability	☐
2	Problem Analysis	☐	8	Ethics	☐
3	Design/Development of Solutions	☐	9	Individual and Team Work	☐
4	Investigation	☐	10	Communication	☐
5	Modern Tool Usage	☑	11	Project Management	☐
6	The Engineer and Society	☐	12	Lifelong Learning	☐

Course outline:

- Introduction to Programming and languages
- Algorithms, Flowcharts and pseudocode
- Overview of programing (C, C+, Python)
- Writing, compiling and debugging
- Coding style
- Statements
- Variables and datatypes
- Operators and expressions
- Selection
- Relational operators
- Conditional Statements
- Conditional operators
- Switch, break, continue
- Logical operators
- Modular programming
- Structures in functions and Arrays
- File pointers

- Error handling
- Revision
- Project Demos

Practical Work to be carried out:

1. Basics of C++ Programming and IDE Environment
2. Variables and Constants
3. Data Types and Expressions
4. LOOPS
5. Decision making statements
6. Structures.
7. Functions.
8. Pointers.
9. Arrays
10. Objects and Classes.
11. Inheritance and Polymorphism
12. Strings.
13. Operator overloading.
14. Streams and Files.
15. Case Study/ Semester Project

Recommended Books:

- Peter Norton, Introduction to computers, Latest Edition.
- Robert Lafore, Object Oriented Programming in Turbo C++, Latest Edition.
- Deitel and Deitel, C++ How to Program, Prentice Hall Publications, Latest Edition
- Paul J. Deitel and Harvey M. Deitel, C: How to Program, Prentice Hall, latest edition.
- The C Programming Language by Kernighan and Ritchie, latest edition.
- Code Complete by Steve McConnell, latest edition.
- The Art of Computer Programming (TAOCP) by Donald E. Knuth, latest edition

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject **:**		**Ethics Studies (SS104)**
Discipline	:	Software Engineering (2nd Semester)
Effective	:	17SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	02 + 00 Marks: 50
Minimum Contact Hours:		30 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Create stable and healthy civilized atmosphere.	C2	6
2	Develop uniformity of moral beliefs and behavior.	C2	8

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

Course outline:

Ethics: Definition of Ethics, Position of ethics in different religions.

Islam: Introduction, Role of Beliefs and Arakans in character building, Rights of Non-Muslim, Ill effects of corruption and respect of law.

Hinduism: Introduction, Role of doctrines in character building, Religious books, Concept of Re-Birth and its influence in social life, Celebration days and their social effects, Comparative study of cast systems in the contemporary atmosphere.

Buddhism: Introduction, Doctrines, Eight Nobel Paths of Buddha and its benefits, Critical study on concept of Renunciation of material & worldly life.

Christianity: Introduction, Doctrines, Religious books, Celebration days.
Judaism: Introduction, Doctrines, Religious books, Ten Commandments of Moses and its importance in social life.
Moral values of different religions: Patience, Modesty, Moderation, Tawakal, Taqwa, Lawful earning, Sincerity, Positivity, Forgiveness and Softening.
Bad morals: lying, pride, selfishness, Fame, Greed, Extravagantness, Bribe, Social injustice, Religious biasness and Discrimination on the basis of race, color and faith
Text Books:

1. Dr. A Rasheed, Comparative Study of Religions Tahir sons Karachi, latest edition.

2. AadilFaraz, IkhlaqiyatMazahib-e-Aalamkinazar main, ApnaIdara Lahore latest edition.

Reference Books:

1. Jeoge D. Chryssides, the study of religions – an introduction to key ideas and methods, London, latest edition.
2. GhulamRasool Cheema MazahibAalamkaMutalia, Ilm o Irfan publishers Lahore latest edition.

Approval:

Board of Studies:	**Resolution No. 01**	**Dated: 26-03-2018**
Board of Faculty:	**Resolution No. 3.1**	**Dated: 11-04-2018**
Academic Council:	**Resolution No. 17(ii)**	**Dated: 23-04-2018**

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

Title of Subject	**:**	**Introduction to Software Engineering (SW-125)**
Discipline	**:**	Software Engineering (2nd Semester)
Effective	**:**	19 Batch & onwards
Pre-requisite	**:**	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		45 + 00

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Discuss key principles and common methods for Software Project management	C2	1
2	Apply software quality assurance and testing principles to medium size software systems	C3	1

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Overview of Software Engineering, Professional Software Development, Software Engineering Practice, Software Process Model, Agile Software Development, Agile process models, Agile development techniques, Requirement engineering process, Functional non-functional requirements, Interactional, structural and behavioral models, Architectural design, Design and implementation, UML Diagrams, Software testing and quality assurance, software evolution, project management and project planning, software process improvement.

Books Recommended:

1. Software Engineering Sommerville, Latest Edition,
2. Software Engineering- A practitioner's approach by Rogers Pressman.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No.**	**Dated: ----------**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject **:**		**Islamic Studies (SS111)**
Discipline	:	Software Engineering (2nd Semester)
Effective	:	17SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	02 + 00 Marks: 50
Minimum Contact Hours:		30 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Effectively maintained his/her identity in a multicultural world	C2	8
2	Find solutions to his/her problems from own cultural practices, rather than be influenced by external ideologies.	C2	6
3	Know why Muslims fail to equip themselves with essential survival tools needed in the world today.	C2	8

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

Course outline:

Quran and Uloom ul Quran: Surah Al-Hujurat., Surah Al-Furqan (These both surahs cover all topics related to ethical values of Islamic society including Taqwa, Taqwa, Simplicity, Lawful earning, Social Justice, Rights of Parents, elders, neighbors, Fear of Allah and Truthfulness), Excellence of Holy Quran (Aijazul Quran), History of collection and compilation of Holy Quran.**Basic Beliefs of Islam:** Tauheed, its importance, effects on the life of believer, shirk and its types, Existence of Angles, Holy Scriptures, Prophethood, its need and necessities, characteristics and Finality of Prophethood, Concept on life hereafter.**Life history of Holy Prophet Muhammad (ﷺ):** Life history at Makkah (Before Prophethood), Life history at Makkah (after Prophethood), Life history at Madina {including Brotherhood, Charter of Madina, Victory of Makkah and Last Sermon of Holy Prophet Muhammad (ﷺ), Importance of Hadith and Sunnah, Ten selected Ahadiths (Covering topics related to Proper usage of time, Hospitality, quality of shyness, love and affection to humanity, facilitate to others and tolerance etc). **Fundamentals of Islam:** Testifying Kalima Shahadah, Prayer, its importance, pre-conditions, obligations and effects, Zakat, its aims & objectives, Requirements, Legal recipients, Nisab and benefits, Fasting, its philosophy, requirements and benefits, Pilgrimage, requirements, types, obligations, procedure and benefits, Jihad and its types.**Islam and Science:** Quran and Science, Importance of science and technology in Islam, Historical contribution of Islam and Muslims in the development of science, Verses of Holy Quran those cover different fields of science e.g. social, management and natural science.

Text books :

A.A. Umrani, **Islam: The universal Religion**, Naseem book depo, latest edition.

A.Q. Natiq, **Sirat-e-Mustaqeem**, Urdu bazzar Karachi, latest edition.

Reference books:

S.M. Saeed, **Islam aurHamariZindagi**, Naseem book depo, latest edition.

M. Shabudden, **Quran Science and Muslims**, Al Maktabah Al Ashrafiya, Lahore, latest edition.

Approval:

Board of Studies:	**Resolution No. 01**	**Dated: 26-03-2018**
Board of Faculty:	**Resolution No. 3.1**	**Dated: 11-04-2018**
Academic Council:	**Resolution No. 17(ii)**	**Dated: 23-04-2018**

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

Title of Subject **:**		**Linear Algebra and Analytical Geometry (MTH112)**
Discipline	:	Software Engineering (2nd Semester)
Effective	:	17SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	03 + 00 Marks: 100
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Perform the basic operation of matrix algebra and solution of system of linear equations.	C4	2
2	Develop the concepts of two and three dimensional geometry	C4	2
3	Analyze area and volume of bounded regions by using multiple integrals	C4	2

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Introductions to matrices and elementary row operations. Brief introduction of matrices. Types of matrices. Introduction to elementary row operations. Echelon and reduced echelon forms. Rank of a matrix. Inverse of a matrix using elementary row operations.
System of linear equations. System of non-homogeneous and homogeneous linear equations. Gaussian elimination method, Gauss Jordan method. Consistence criterion for solution of homogeneous and non-homogeneous system of linear equations. Application of system of linear equations.
Determinants. Introduction to determinants. Properties of determinants of order n. Rank of a matrix by using determinants.
Analytic geometry of 3-dimensions. Introduction; Coordinates in R3.
Line: Coordination of a point dividing a line segment in a given ratio. Straight line, in R^3. Vector form of a straight line, parametric equations of a straight line, equation of a straight line in symmetric form, direction ratios and direction cosines, angle between two straight lines; distance of a point from a line.
Plane: Equation of a plane, angle between two planes, intersection of two planes, a plane and a straight line; skew lines. Cylindrical and spherical coordinates.
Sphere: General equation of sphere. Latitude and longitude directions; direction of Qibla.
Multiple Integrals. Evaluation of double and triple integrals in Cartesian and polar coordinates.

Books Recommended:

- D.D. Benice, Brief Calculus and its Applications

- R.A. Barnett, Applied Calculus
- S.M. Yusuf, Calculus and Analytical Geometry
- S.M. Yusuf, Mathematical Methods

Approval:

Board of Studies:	**Resolution No. 01**	**Dated: 26-03-2018**
Board of Faculty:	**Resolution No. 3.1**	**Dated: 11-04-2018**
Academic Council:	**Resolution No. 17(ii)**	**Dated: 23-04-2018**

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

Title of Subject : **OBJECT ORIENTED PROGRAMMING (SW-121)**
Discipline : Software Engineering (2nd Semester)
Effective : 19 Batch & onwards
Pre-requisite : Programming Fundamentals
Assessment : Theory**:** 20% Sessional, 20% Mid examination, 60% Final examination.
Practical: 40% Sessional, 60% Final examination
Credit Hours : 3 + 1 **Marks :** 100 + 5 0
Minimum Contact Hours: 45+45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Explain principles of object oriented paradigm, class libraries, exception handling.	C2	1
2	Use class instances & their relationships to build object oriented solutions	C3	1
3	Implement OOP concepts to develop piece of code (Programs)	P3	5

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **OOP CONCEPTS AND INTRODUCTION TO JAVA**
  Objects, Classes, Messages, OOP principles, Encapsulation, Inheritance, Polymorphism, What is Java, History of Java, Features of Java, Class library, Java Environment, Byte code, JVM, Java Applications & Applets, Comments, White Spaces, Identifiers, Separators, Keywords, Reserved words, Variables, Data Types, Operators, Mathematical functions and constants, Expressions, Escape Sequences, Type Conversion and Casting

- **INTRODUCTION TO APPLETS**
  How to write applets, HTML code for applets, applet viewer, paint() Method, drawstring, Option Pane , Applet Life cycle

- **JAVA CONTROL STATEMENTS**
  Java Selection statements (if, if-else, switch), Loop Statements (while, do-while, for), nested loops, break and continue statements

- **ARRAYS AND STRINGS**

  Array Variables, Defining arrays, Accessing Elements, Initializing arrays, Array Length, Multidimensional Arrays, Array of characters, Strings and common Operations on Strings

- **INTRODUCING CLASSES INHERITANCE**

  General Form of a Class, Variables and Methods in Class Definition, Defining Methods, Declaring Objects, Returning a value, Parameter List, Constructors, Parameterized Constructors, this Keyword, Method overloading, Types of Arguments, Objects as parameters, Returning Objects, Access Specifies, Understanding static, Nested and Inner Classes, finalize method, Inheritance Basics, Member Access and Inheritance, Using Super, Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract Classes

- **PACKAGES AND INTERFACES**

  Understanding Packages, Defining a package, Packages and Directory Structure, Understanding CLASSPATH, Standard Packages, Importing Packages, Interfaces, Implementing Interfaces, Extending Interfaces, Multiple Interfaces, Anonymous Classes

- **EXCEPTION HANDLING**

  Exception Handling Basics, Exception Types, Uncaught Exceptions, Using Try and Catch, Multiple Catch Clauses, Nested Try Statements, throw statement, throws clause, finally Block, Built-in Exceptions

- **MULTITHREADINGINTRODUCING THE AWT AND JAVA GUI**

  Understanding threads, Class Thread, Thread Life Cycle, Priority, Synchronization, Run able Interface, AWT classes, Windows Fundamentals, Graphics Context, Color and Font Controls, Drawing Lines, Rectangles, Ovals etc, Labels, Buttons, Text Fields, Checkboxes etc, Event Handling, Layout Managers, Menu Bars, Dialog Boxes

- **IMAGES, SOUND AND ANIMATION**

  Displaying Images, Image Observers, Media Tracker, Double Buffering, Playing Sound Clips, Sound API

Practical Work to be carried out:

1. Installation of Java, Basic Program Structure, Identifiers and Primitive data types
2. Demonstrating various operators in Java
3. Working with iterative structures
4. Working with conditional structures
5. Implementation of arrays
6. Implementing the concepts of encapsulation
7. Implementing the concepts of inheritance
8. Implementing the concepts of Polymorphism
9. Exception and Error Handling.
10. Demonstrating Threads and Multi Threaded Programming logics
11. Understanding I/O Fundamentals
12. Building GUI components
13. Applying various Layouts managers
14. Java Event handling.
15. Java Database Connectivity

Recommended Books:

- H. M. Deitel, P.J. Deitel, "Java How To Program", Latest Edition , Prentice Hall
- Ivor Horton, "Beginning Java 2", Wrox Corp, Latest Edition.
- Patrick Naughton, Herbert Schildt, 'Java 2 : The Complete Reference", Latest Edition.,Osborne/McGrawHill
- Joseph L. Weber, ":Special Edition Using Java 2 Platform", Prentice Hall India, Latest Edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject **:**		**Pakistan Studies (PS106)**
Discipline	:	Software Engineering (2nd Semester)
Effective	:	17SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	02 + 00 Marks: 50
Minimum Contact Hours:		30 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Trace the Muslim Nationalism in South Asia and the creation of Pakistan	C2	6
2	Explore the Constitutional, Political and Diplomatic History of Pakistan	C2	12
3	Analyze the Geo-strategic importance of Pakistan and contemporary challenges to Pakistan	C2	7

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☑

Course outline:

The Historical Background of Pakistan
Evolution and growth of Muslim society in Subcontinent
Muslim Revivalist and Reformist Movements
The Factors that shaped the Muslim Nationalism in the Subcontinent
The Factors that led birth to Pakistan
Ideology of Pakistan with special reference to Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah
Role of Sindh in Making of Pakistan
History of Internal and External Affairs of Pakistan:
The Constitutional and Political Developments in Pakistan (1947-1973)
The Constitution of 1973; Salient Features and Amendments
Political Development in Pakistan (1973 to date)
Determinants of Foreign Policy of Pakistan
Pakistan's Relations with Big Powers
Contemporary Pakistan (Issues and Challenges):
Geo-Strategic Significance of Pakistan
Economic Potential and its Utilization

Challenges to National Security of Pakistan
Internal Political, Economic and Legal Problems
Futuristic Outlook of Pakistan

Books Recommended:

- Abdul Sattar, (2017), *Pakistan's Foreign Policy 1947–2016 A Concise History* (4th ed.), Karachi: Oxford University Press.
- Cohen Stephen, (2011), *The Future of Pakistan*. Washington: Brookings Institute Press.
- Hussian, Zahid, (2007), *Front line Pakistan: The Struggle with Militant Islam*, New York: I.B.Tauris.
- Jalal, Ayesha, (2014), *The Struggle for Pakistan: A Muslim Homeland and Global Politics*, The Belknap Press of Harvard University Press.
- Kazimi, M. R., (2008), *A Concise History of Pakistan*, Karachi: Oxford University Press.
- Khan, Hamid, (2017), *Constitutional and Political History of Pakistan* (3rd ed.), Karachi: Oxford University Press.
- Long, Roger D., (2015), *A History of Pakistan*, Karachi: Oxford University Press.
- Rais, RasulBakhsh, (2017), *Islam, Ethnicity, and Power Politics: Constructing Pakistan's National Identity*, Karachi: Oxford University Press.
- Riedel, Bruce, (2011), *Deadly Embrace: Pakistan, America, and the Future of Global Jihad*, Washington: Brookings Institute Press.
- Sayeed, K. B., (1960), *Pakistan: The Formative Phase*, Karachi: Oxford University Press.
- Talbot, Ian, (2014), *Pakistan: A New History*, Karachi: Oxford University Press.
- Wolpert, Stanley, (1997), *Jinnah of Pakistan*, Karachi: Oxford University Press.

Approval:

Board of Studies:	**Resolution No. 01**	**Dated: 26-03-2018**
Board of Faculty:	**Resolution No.**	**Dated:**
Academic Council:	**Resolution No.**	**Dated:**

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

Title of Subject	**:**	**Professional Practices (SW-123)**
Discipline	**:**	Software Engineering (2nd Semester)
Effective	**:**	19 Batch & onwards
Pre-requisite	**:**	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Explain moral responsibilities and obligations in their professional carrier.	C2	1
2	Make ethical decisions and to apply multi ethical ways in order to prevent and resolve any ethical dilemma in Professional life.	A3	6,8,12

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☑

Course outline:
Computing Profession, Computing Ethics, Philosophy of Ethics. The Structure of Organizations, Finance and Accounting, Anatomy of a Software House, Computer Contracts, Intellectual Property Rights, The Framework of Employee Relations Law and Changing Management Practices, Human Resource Management and IT, Health and Safety at Work, Software Liability, Liability and Practice, Computer Misuse and the Criminal Law, Regulation and Control of Personal Information. Overview of the British Computer Society Code of Conduct, IEEE Code of Ethics, ACM Code of Ethics and Professional Conduct, ACM/IEEE Software Engineering Code of Ethics and Professional Practice. Accountability and Auditing, Social Application of Ethics.

Books Recommended:

1. Professional Issues in Software Engineering by Frank Bott, Allison Coleman, Jack Eaton and Diane Rowland, CRC Press; Latest Edition (2000). ISBN-10: 0748409513
2. Computer Ethics by Deborah G. Johnson, Pearson; Latest Edition (January 3, 2009). ISBN-10: 0131112414
3. A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet (3rd Edition) by Sara Baase, Prentice Hall; Latest Edition (2008). ISBN-10: 0136008488
4. Applied Professional Ethics by Gregory R. Beabout, University Press of America (1993). ISBN-10: 0819193747.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Database Systems (SW-215)**
Discipline	**:**	Software Engineering (3rd Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	Programming Fundamentals
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 +50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain the fundamental concepts of database systems, functional dependencies, true essence of data integrity and normalization.	C2	1
2	Use SQL statements including DDL, DCL, DML, TCL, DCL for database definition and manipulation.	C3	1
3	Using Procedural Language Extension of SQL.	C3	1
4	Designing & implementing properly structured databases that match the standards based under realistic constraints and conditions.	P3	5,9

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **FILES AND DATABASE CONCEPTS**

  Traditional File Based System, Database Approach, Database Environment Roles, Advantages and Disadvantages of Database System, Three Level Architecture, Database Languages, Data Models and Conceptual Modeling, DBMS Functions, Multi-user DBMS Architecture, Data Dictionaries; Relational Model, Relational Integrity, Views, Codd Rule, Database Planning, Entity Relationship Modeling, Structural Constraints, ERD Model Problems, ERD Tools, Normalization, Anomalies, Functional Dependencies.

- **INTRODUCTION TO MANAGING DATA**

  Characteristics of DBMS, Concept of RDMS & its characteristics, Codd's Law for RDBMS, Introduction to ORACLE Tools

- **STRUCTURED QUERY LANGUAGE (SQL)**

  Interacting SQL*Plus, Data Manipulation in DBMS, the ORACLE Data types, Two Dimension Matrix creation, Insertion of Data into tables

- **MANAGING TABLES**
  Select Statement and its supporting Clauses and with its various applications, Insertion of Data into Tables, Updating the Contents of Tables, Deletion Operations

- **MODIFYING THE STRUCTURE OF TABLE**
  Adding & Modifying new and existing columns, Restrictions on the Alter tables, Removing tables, Deleting & Dropping tables

- **DATA CONSTRAINTS**
  Column & Table level constraints, Primary & Foreign Key concepts, Application of other Data constraints

- **ORACLE FUNCTIONS**
  Character Function, Numeric Functions, Date Functions, Single row Function, and Group functions.

- **JOINING**
  Introduction to Joining, Equi-Join, Non-Equi join, self-joining, vertical joining (union, intersect and minus Clause)

- **INDICATES, VIEWS AND SEQUENCES**
  Creating & mapping indexes, Application of views, creating & managing views & sequences.

- **GRANTING PERMISSIONS**
  Permission on the objects, Granting permissions, Object privileges, Revoking permissions

- **PL/SQL**
  Introduction to PL/SQL, PL/SQL execution environment, Block structure, ORACLE transaction

- **ERROR HANDLING IN PL/SQL**
  Introduction, Declaring Exceptions, Implicit & Explicit Exceptions, Predetermined internal PL/SQL exceptions.
- **CURSORS**
  Introduction to Cursors, Explicit cursor, implicit cursor, creating & Managing Explicit / Implicit Cursors, Attributes, Explicit & Implicit cursor Attributes cursor for loops.
- **STORED PROCEDURES/TRIGGERS**
  Introduction, Internal structures, Deleting procedures, Advantages of procedures, Deleting stored procedures.
- **STORED FUNCTIONS**
  Introduction, Internal structures, Deleting functions, Advantages of Functions, Deleting stored functions.

Practical Work to be carried out:

1. Installation of ORACLE.
2. Data Modeling.
3. Normalization.
4. Demoralization.
5. Database Connectivity.
6. SQL Injections and Prepared Statements.

7 Joins.
8 Sub-Queries.
9 Views and Indexes.
10 Access Control.
11 PL/SQL, control structure and data types.
12 Cursors
13 Exception Handling.
14 Stored procedures and Stored functions.
15 Project

Recommended Books:

1. Database Systems: A Practical Approach to Design, Implementation, and Management, Book by Carolyn E. Begg and Thomas M. Connolly Latest Edition.
2. Relational Database Management System: A Project-based Tutorial by Gerard Blokdyk, Latest Edition.
3. Oracle 11g with PL/SQL Approach by Cadcim Technologies , Sham Tickoo & Sunil Raina Latest Edition

---

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Data Structures & Algorithms (SW-212)**
Discipline	**:**	Software Engineering (3rd Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	Programming Fundamentals
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 +50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain various data structures such as arrays, lists, trees, graphs etc.	C3	1
2	Construct algorithms associated with each data structure.	C4	2
3	Demonstrate the implementation of algorithms programmatically.	P4	5

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- Fundamentals of data structures: An overview of computer programming,
- Data types, abstract data types, C/C++ background,
- Review of pointers, Pointer arithmetic, Pointer indirections
- Computational complexity of algorithms and their time-space analysis:
- Running time calculations, asymptotic notations for algorithmic complexity analysis.
- Lists Data Structure: Simple arrays, Linked lists, Linear search vs binary search
- Lists Data Structure: Double linked lists, Circular linked lists.
- Stacks & Queues: Sequential/array implementation of stacks and queues,
- Linked list implementation of stacks and queues.
- Arithmetic expressions: Polish notation, Recursion: Recursive implementation of stacks and queues.
- Sorting: Bubble sort, Insertion sort, Selection sort.
- Sorting: Merge sort, Quick sort, Counting Sort & Radix sort, Heap sort (tentative).
- Trees: Data structure definition and generic implementation, Tree traversals and its application, Binary tree, binary search tree, Expression trees, AVL trees.
- Huffman coding, B-Tree.
- Graphs: Adjacency matrix implementation, Linked list implementation
- Graphs Search: Depth-first traversal of graphs, Breadth-first traversal of graphs, Shortest distance algorithms

- Hashing and searching: Hashing techniques, Implementation of Hashing techniques
- Priority Queues: Binary Heap and its applications

Books Recommended:

1. Robert Lafore, "Data structures and Algorithm analysis in java", Latest Edition
2. Weiss Mark Allen, "Data structures & Algorithms Analysis", Latest Edition
3. Herbert Schildt, "The Complete Reference Java2", Latest Edition
4. Semour Lipschutz, "Data Structure", Schaum's outline series, Latest Edition
5. Data Structures and Algorithm Analysis in C by Mark Weiss. Addison Wesley; ISBN: 0-201-49840-5, latest edition.
6. Data Structures and Algorithm Analysis in C++ by Mark Weiss. Addison Wesley; ISBN 0321-44146-X, latest edition
7. Introduction to Algorithms, Thomas H. Cormen et al, latest edition

Practical Work to be carried out:

1	To become familiar with conditional and control structures in Java.
2	Implementation of Objects and classes.
3	Implementation of Arrays in Java
4	Implementation of Linear Search Algorithms.
5	Implementation of Binary Search Algorithms.
6	Implementation of Linked list.
7	Implementation of Queues.
8	Implementation of Stacks.
9	Implementation of Merge sort & Heap sort.
10	Implementation of Bubble sort, Quick Sort and insertion sort.
11	Implementation of Recursion.
12	Implementation of Trees.
13	Implementation of Graph.
14	Implementation of Binary tree traversals.
15	Case study

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Operations Research (SW-217)**
Discipline	**:**	Software Engineering (3rd Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	Linear Algebra & Analytical Geometry
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Describe the fundamental concepts of operations research and linear programming	C2	1
2	Examine sensitivity analysis for solving business problems and use duality concepts.	C4	2
3	Adopt knowledge skills to optimize assignment and transportation problems.	C5	3

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **Introduction**

  Operations Research basic concept, applications, approaches

- **Linear Programming**

  Linear programming problem formulation, Blending Problem, Gruel Problem, Security Scheduling, Financial Planning

- **Solving Linear Program using Graphical Method**

  Graphical Solution, Unbounded & Infeasible Problem, Changes in RHS, Active and Inactive Constraints, Sensitivity Analysis, Changes in objective function co-efficient, change in the right-hand side of constraints

- **Simplex Method**

  Development of simplex method, application, advantages and limitations of simplex method, problems on simplex method

- **The Dual Problem**

  Dual Problem, Conversion of Primal to Dual problems, Significance of Dual Problems

- **Special Applications of Linear Programming**

  Transportation Problem, Solving Transportation Problem, Solving Transportation Problem, NWCM Method, Vogel Approach Method, Stepping Stone Method, Modified Distribution, Other Considerations, Degeneracy in Transportation Problem, Assignment Problem, Hungarian Method,

Other Assignment Considerations, and Media Selection.

- **Integer Programming**
  Integer Programming, Application of O-I Variables, An IP Warehouse Location Problem

Recommended Books:

1. G.D. Eppen "Introductory Management Science" Prentice Hall Publications, Latest Edition.
2. William Bernard Taylor "Introductory Management Science" Prentice Hall Publications, Latest Edition.
3. Hamdy A. Taha "Operations Research" BPB Publications.ei Han & Kamber M., Data Mining: Concepts & Techniques,Morgan Kaufman Publisher, Latest Edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Software Economics & Management (SW - 211)**
Discipline	**:**	Software Engineering (3rd Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	Introduction to Software Engineering
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain fundamentals of software economics engineering by considering the basic but important terminologies.	C3	1
2	Examine cost estimation methods by giving careful attention towards economics lifecycle and uncertainty.	C4	2,7,11

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☑
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **Engineering Economics**
  - Role of engineers in business
  - Economic decisions v/s design decisions
  - Large scale engineering projects and types of strategic economic decisions
  - Fundamental principles of engineering economics
- **Interest Rate and Economic Equivalence**
  - Interest: The Cost of Money
  - Economic Equivalence
  - Development of Formulas for Equivalence Calculation
  - Unconventional Equivalence Calculations
- **Understanding Money and Its Management**
  - Nominal and Effective Interest Rates
  - Equivalence Calculations with Effective Interest Rates and with Continuous
- **Payments**
  - Changing Interest Rates
  - Debt Management
  - Investing in Financial Assets
- **Present-Worth Analysis**
  - Project Cash Flows
  - Initial Project Screening Methods: payback Screening and Discounted Cash
- **Flow Analysis**
  - Variations of Present-Worth Analysis

    - Comparing Mutually Exclusive Alternatives
- **Annual Equivalent-Worth Analysis**
    - Annual Equivalent-Worth Criterion
    - Capital Costs versus Operating Costs
    - Applying Annual-Worth Analysis
    - Life-Cycle Cost Analysis
    - Design Economics
- **Rate-of-Return Analysis**
    - Rate of Return and Methods of Finding It
    - Internal Rate-of-Return Criterion
    - Mutually Exclusive Alternatives
- **Cost Concepts Relevant to Decision Making**
    - General Cost Terms; Classifying Costs for Financial Statements
    - Cost Classifications for Predicting Cost Behavior
    - Future Costs for Business Decisions
    - Estimating Profit from Production
- **Depreciation and Corporate Taxes**
    - Asset Depreciation: Economic versus Accounting
    - Book and Tax Depreciation Methods (MACRS)
    - Depletion
    - Income Tax Rate to be used in Economic Analysis
    - The Need for cash Flow in Engineering Economic Analysis
- **Developing Project Cash Flows**
    - Cost-Benefit Estimation for Engineering Projects
    - Developing Cash Flow Statements
- **Project Risk and Uncertainty**
    - Origins of Project Risk
    - Methods of Describing Project Risk: Sensitivity, Break-Even and Scenario Analysis
- **Special Topics in Engineering Economics**
    - Replacement Decisions
    - Capital Budgeting Decisions
    - Economic Analysis in the Service Sector

Books Recommended:

1. Software Engineering Economics and Declining Budgets by Pamela T. Geriner, Thomas R. Gulledge, William P. Hutzler, Springer Verlag, (Latest Edition)
2. Estimating Software Costs: Bringing Realism to Estimating, Capers Jones, McGrawHill Osborne Media; (Latest Edition)
3. Software Cost Estimation and Sizing Methods, Issues, and Guidelines, Shari Lawrence Pfleeger, Rand Publishing, (Latest Edition)
4. Contemporary Engineering Economics by Chan S. Park, latest edition, Pearson, ISBN: 9780134105598
5. Engineering Economic Analysis by Donald G. Newnan, Jerome P. Lavelle, Ted G. Eschenbach, latest edition, Oxford University Press, ISBN: 978- 0199339273
6. Engineering Economy by Leland T. Blank and Anthony Tarquin, latest edition

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Software Requirement Engineering (SW216)**
Discipline	**:**	Software Engineering (3rd Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	Introduction to Software Engineering
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks :** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Examine requirements engineering process and analyze software for developments of cost effective and efficient technical solutions.	C4	2
2	Design Software Requirement Specification (SRS) document using clear and unambiguous requirements.	C5	3
3	Interpret requirements of real world problems.	C6	4

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Introduction to Requirements Engineering, Software Requirements, classification of requirements, Requirements process, Levels/layers of requirements, Requirement characteristics, Analyzing quality requirements, Software requirements in the context of systems engineering, Requirement evolution, requirement traceability, requirement prioritization, trade-off analysis, risk analysis and impact analysis, Requirement management, interaction between requirement and architecture, Requirement elicitation, elicitation sources and techniques, Requirement specification and documentation, specification sources and techniques, Requirements validation and techniques, Management of Requirements, Introduction to Management, Requirements Management Problems , Managing Requirements in an Acquisition Organization, Supplier, Organizations, Product Organizations

Books Recommended:

1. Wiegers K. &Beatty J., Software Requirements, Microsoft Press, Latest edition.
2. Elizabeth Hull, Ken Jackson and Jeremy Dick, Requirements Engineering, Springer-Verlag London Limited, Latest edition.
3. Chemuturi M., Requirements Engineering and Management for Software Development Projects, Springer New York, Latest Edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Computer Networks (SW226)**
Discipline	**:**	Software Engineering (4th Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 +50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Describe basics of networks, internetworking devices, layered network architectures and routing protocols.	C2	1
2	Analyze features, services and operations of various network, transport and application layer protocols of communication stack.	C4	2
3	Solve network layer logical addressing problems efficiently	P3	3
4	Configure and troubleshoot network devices. Analyze network traffic and apply techniques related to the design and analysis of computer networks using simulation tools.	P3	5

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- Internet: Definitions and protocols.
- Network core: packet/circuit switching, Internet structure.
- Principles of network applications: Web and HTTP.
- Electronic Mail: SMTP, POP3, IMAP.
- DNS: P2P applications.
- Transport-layer services: Multiplexing and demultiplexing.
- Connectionless transport: UDP.
- Principles of reliable data transfer.
- Connection-oriented transport: TCP Flow control and connection management.
- Principles of congestion control.
- TCP congestion control.
- Network Layer: Virtual circuit and datagram networks, routers.
- IP: Internet Protocol: Datagram format, IPv4 addressing, ICMP, IPv6.

- Routing algorithms: Link state, Distance Vector, Hierarchical routing, Routing in the Internet, RIP, OSPF.
- Link Layer: Error Correction and Detection Techniques, Carrier Sense Multiple Access.

Practical Work to be carried out:

1. To work with with cable specification, installation and troubleshooting.
2. To design a peer to peer network.
3. To become familiar with use of Ping, Traceroute and tracert
4. To become familiar with the basic configuration of a switch using packet tracer software
5. Configure a network topology using packet tracer software
6. To become familiar with command line interface (CLI) and examining router interfaces, setting passwords and saving configuration files of routers.
7. To configure the STATIC routes between two routers and to configure the DEFAULT routes between two routers to allow data transfer without the use of dynamic routing protocols.
8. To configure the distance vector routing protocol on two routers.
9. To configure the RIP dynamic routing protocol on two routers.
10. To become familiar with subnetting concepts.
11. Solving network layer logical addressing problems efficiently
12. To configure the IGRP dynamic routing protocol on two routers.
13. To configure the EIGRP dynamic routing protocol on two routers.
14. To become familiar with network security.
15. Basic Access Control Lists.

Recommended Books:

1. Computer Networks and Internets with Internet Applications, Comer, Douglas E., Prentice-Hall Inc, Latest Edition.
2. CCNA INTRO self-study guide, CISCO, Latest Edition.
3. Data Communication and Networking, BEHROZ A. FOROUZAN. Latest Edition.
4. Data and computer communication, Williams Stallings, Latest Edition.
5. Computer networks with internet technology, William Stallings, Latest Edition.
6. Johnson, Allan. LAN Switching and Wireless, CCNA Exploration Labs and Study Guide (Lab Companion). Cisco Press, latest edition.
7. Rullan, John. Accessing the WAN, CCNA Exploration Labs and Study Guide (Lab Companion). Cisco Press, latest edition.
8. Kreigh, Jack. "CCIE Routing and Switching Lab Exam Prep." Latest edition

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject : **Data Warehousing (SW-228)**
Discipline : Software Engineering (4th Semester)
Effective : 18 Batch & onwards
Pre-requisite : Database Systems
Assessment : Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours : 03 + 0 **Marks:** 100
Minimum Contact Hours: 45

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain concepts, architectural design and implementation of data warehouse	C3	1
2	Interpret business requirements and provide their solutions	C6	2, 4
3	Design and build data warehouse to match the business requirements	C5	3

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **Introduction to Data Warehousing**
  The Evolution of Data Warehousing; Purpose of developing Data Warehouse; Difference between Operational and Decision Support Systems; Data Warehousing; Features, benefits and applications of Data Warehouse; Data Marts & its types.

- **Planning and Requirements**
  Planning your Data warehouse; Reasons for requirements; Interviewing for Requirements; Analyzing Legacy System

- **Logical & Physical Data Modeling**
  The Database: Heart of the Data Warehouse; Database Design Life Cycle; Designing for OLTP and Designing for Decision Support; Logical Database Design; Physical Database Design

- **Denormalization & Dimensional Modeling**
  Denormalization, Data Marts, and Data Warehouses; Denormalizing Through Prejoins; Column Replication or Movement; Pre-aggregation; Dimensional Modeling: Star Schema, Snowflake Schema, and Fact Constellation Schema.
- **Data Extraction, Transformation and Loading**
  ETL (Extract, Transform, Load) Process overview; ETL versus ELT; Data Extraction,

Transformation, Cleansing, Integration and Staging.

- **Online Analytical Processing (OLAP) Implementation Techniques**
  Demand for OLAP; Major Features and Functions: Cubes, Hyper-cubes, Drill-Down and Roll-Up, Slice and Dice; OLAP Models: MOLAP, ROLAP, And HOLAP.

Recommended Books:

1. Paulraj Ponniah. "Data Warehousing Fundamentals", John Wiley & Sons, Latest Edition.
2. Thomas Connolly. "Database Systems", Latest Edition.
3. Jiawei Han & Kamber M., Data Mining: Concepts & Techniques, Morgan Kaufman Publisher, Latest Edition.
4. NCR Teradata University Program Guide, Latest Edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Introduction to Entrepreneurship and Creativity (ENT121)**
Discipline	**:**	Software Engineering (4th Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks:** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Use knowledge and practical skills for managing business investments and fundraising for startups.	C3	6,8
2	Implement entrepreneurship processes to address startup challenges.	C3	7,12
3	Apply e-business strategies for firm growth.	C3	9,10

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☑

Contents:

Introduction to Entrepreneurship, Nature and Importance of Entrepreneurship, types of entrepreneur, process of entrepreneurship. Recognizing Opportunities and Generating Ideas, finding gaps, process of generating creative ideas, Encouraging and protecting new ideas, protecting ideas from being lost and stolen, Feasibility Analysis, Industry and Competitor Analysis, Writing a Business Plan, Developing an Effective Business Model, Setting up the company, Process of financial management, Building a New-Venture Team, Getting Funding or Financing, Local Venture Capitalist or Business Angel, The Importance of Intellectual Property, E-business strategy, Preparing for and Evaluating the Challenges of Growth, Strategies for Firm Growth, Franchising, Selling, mergers

Recommended Books:

- Entrepreneurship: Successfully Launching New Ventures, 4th Edition. Bruce R. Barringer, Oklahoma State University R. Duane Ireland, Texas A&M University © (2012) |Pearson
- Innovation and Entrepreneurship, (2014) by Peter F. Drucker Harper Collins publishers UK
- "Patterns of Entrepreneurship", (2009) by Jack M Kaplan
- Naqi, Dr. S. M, (2007), Entrepreneurship – A Recipe for Economic Development: Lahore, Naqi Hyder & Associates.
- Kuratko Donald F and Hodgetts (2001) Richard M, Entrepreneurship- A Contemporary Approach: New York, South-Western, Thomas Learning

---

Approval:

Board of Studies:	**Resolution No. 10.03**	**Dated:29-03-2018**
Board of Faculty:	**Resolution No. 1.5**	**Dated:13-04-2018**
Academic Council:	**Resolution No. 93.4**	**Dated:17-09-2018**

MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO
DEPARTMENT OF TELECOMMUNICATION ENGINEERING

Entrepreneurship

Pre-requisites	Nil
Co-requisite	Nil
Course Code	SS411
Semester	7th
Effective	17TL batch and onwards
Theory Marks	50
Practical Marks	0
Credit Hours	2 + 0
Minimum Contact Hours	28 + 0
Assessment (Theory)	20% sessional work, 20% mid-semester, 60% final examination

Course Objectives

The course aims to identify entrepreneurship in theory and its economic contribution, positive or negative, in practice. In particular, the course considers whether the policy intervention can encourage entrepreneurship activity and if so, how this may best be achieved.

Learning Outcomes

Upon completion of this course, students will be able to,

- missing ...

Contents

I. Foundations of Entrepreneurship

- Concept of Entrepreneurship and Entrepreneur
- Different forms of Entrepreneurship

II. Making the Possible Real

- Core of Entrepreneurship
- Entrepreneur and Entrepreneurship
- Characteristics of an Entrepreneur
- Essential skills for Entrepreneur
- Cognitive foundations of Entrepreneurship
- Entrepreneurial revolution

III. Entrepreneurship

- An evolving concept
- Understanding Entrepreneurial opportunities and Industry analysis
- Developing corporate Entrepreneurship
- Innovation and the Entrepreneurship
- Minority Entrepreneurs
- Total quality management in Entrepreneurship
- Women Entrepreneurship

MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO
DEPARTMENT OF TELECOMMUNICATION ENGINEERING

MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO
DEPARTMENT OF TELECOMMUNICATION ENGINEERING

Recommended Books

1. Entrepreneurship in Theory and Practice: Paradoxes in Play - Sara Lowe Nielsen, Kim Klyver, Majbritt Rostgaard Evald, Torben Bager
   (2nd Edition, ISBN-10: 1785364472 or ISBN-13: 978-1785364471)
2. Entrepreneurship: An Evidence-Based Guide - Robert A. Baron
   (1st Edition, ISBN-10: 1781000395 or ISBN-13: 978-1781000397)
3. Entrepreneurship: A Process Perspective - Robert A. Baron, Scott A. Shane
   (2nd Edition, ISBN-10: 0324365586 or ISBN-13: 978-0324365580)
4. Entrepreneurship - Donald F. Kuratko, Richard M. Hodgetts
   (7th Edition, ISBN-10: 0324323417 or ISBN-13: 978-0324323412)
5. Fundamentals of Entrepreneurship - H. Nandan
   (3rd Edition, ISBN-10: 8120347501 or ISBN-13: 978-8120347502)

Approval:	Board of Studies, MUIST'D	Res. No. 1.04	Dated: 17-03-2014
	Advanced Studies and Research Board	Res. No. 128.05	Dated: 29-04-2014
	Academic Council	Res. No. 83.11	Dated: 30-05-2014

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

Title of Subject	**:**	**Operating Systems (SW-225)**
Discipline	**:**	Software Engineering (4th Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	Introduction to Information & Communication Technologies
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 + 50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Describe the core concepts of operating system ,memory ,process and file management.	C2	1
2	Determine the applications and principles on which the core functions of the operating systems are built on.	C3	1
3	Execute modern operating systems using learned knowledge and skills.	P4	5

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- Basic Elements: Evolution of the Microprocessor, Instruction Execution.
- Interrupts: Interrupts and the Instruction Cycle, Interrupt Processing, Multiple Interrupts.
- Memory: The Memory Hierarchy, Cache Memory, Direct Memory Access.
- Operating System: Objectives and Functions, The Evolution of Operating Systems, Developments Leading to Modern Operating Systems.
- Virtual Machines: Virtual Machine Architecture.
- Multiprocessor and Multicore Organization: OS Design Considerations for Multiprocessor and Multicore.
- Processes: Process Definition, Process States, Process Description, Process Control, OS Execution.
- Processes and Threads: Types of Threads, Multicore and Multithreading.
- Principles of Concurrency.
- Mutual Exclusion, Hardware Support, Semaphores.
- Multi-Process Synchronization: Producer/Consumer Problem.
- Message Passing: Readers/Writers Problem.
- Deadlocks: Principles of Deadlock, Deadlock Prevention, Detection and Avoidance, An

Integrated Deadlock Strategy.

- Memory Management: Memory Partitioning, Paging, Segmentation, Virtual Memory, Hardware and Control Structures for Virtual Memory.
- Fetch Policy, Placement Policy, Replacement Policy, Resident Set Management, Cleaning Policy, Load Control.

Practical work to be carried out

1. Installation Procedure of Windows
2. To become familiar with Command Prompt
3. Working with Batch Files and Windows Power Shell
4. Getting familiar with Control Panel and Task Scheduler
5. Working with Windows File Protection and User Privileges
6. Becoming familiar with Network Manager and Windows File Sharing
7. Installing a Desktop Sharing Environment using SSH
8. Creating Ghost Installations and working with Utility Software
9. Installing a Linux Environment/Setting up a Virtual Environment for Linux
10. Getting familiar with Ubuntu GUI
11. Familiarization with some of the most frequently used Linux Commands
12. Introduction to Shell Scripting
13. Simulating CPU Scheduling Algorithms
14. Simulating Memory Management Techniques
15. Case Studies

RECOMMENDED BOOKS:

1. Operating Systems: Internals and Design Principles William Stallings, Latest Edition
2. Operating Systems: D. R. Choffnes, Harvey Deitel, and Paul Deite Latest Edition
3. Incorporating Unix and Windows Colin Ritchie, Latest Edition
4. Operating System Concepts, Abraham Silberschatz, Latest Edition
5. Silberschatz, P. B. Galvin and G. Gagne, “Operating System Concepts, Internals & Design Principles”, latest Ed., Wiley.
6. William Stallings "Operating Systems: Internals & Design Principles", latest Ed., Prentice Hall.
7. S. Tanenbaum and A. S. Woodhull “Modern Operating Systems”, latest Ed., Prentice Hall.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Software Design and Architecture (SW-227)**
Discipline	**:**	Software Engineering (4th Semester)
Effective	**:**	18 Batch & onwards
Pre-requisite	**:**	Introduction to Software Engineering, Software Requirement Engineering
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	02 + 01 **Marks:** 50+ 50
Minimum Contact Hours:		30 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Examine software architecture, differentiate architecture styles, methods for best use of architecture	C4	2
2	Formulate design patterns to generate code for different applications	C5	3
3	Evaluate the UML models of designed softwares and compare them	C6	4

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- Software Design Concepts, Design principles
- System design and software architecture
- Architectural design issues
- Software Architecture, Architectural Structures & Styles-,
- Architectural Patterns, Interactive systems with MVC architecture
- Middleware and service-oriented architecture
- Component based design and development
- Model driven development
- Object-Oriented Design with UML, Exploring inheritance and object composition
- Data design, Persistent layer design
- Functional Design
- User interface design
- Web applications design
- Mobile application design

Practical Work to be carried out:

1. Introduction to UML and to become familiar with use case diagrams

2. Class Diagram
3. Interaction diagrams
4. State Transition Diagram
5. Sequence diagram
6. To implement Singleton Pattern
7. To implement Abstract Factory Pattern
8. To implement Adapter Pattern
9. To implement Decorator Pattern
10. To implement Observer Pattern
11. To implement Iterator Pattern
12. CRC Modeling
13. Procedural design (Pseudo code)
14. Procedural design (Decision table)
15. Case study

Recommended Books:

1. Software Architecture in Practice, Len Bass, Paul Clements, Rick Kaman , Pearson Addison (Text Book)
2. Software Architecture in Practice, Latest Edition
3. Evaluating Software Architectures: Methods and Case Studies.
4. Teach Yourself UML in 24 Hours, Joseph Schmuller, Latest Edition
5. Software Engineering, A Practitioner's Approach, Pressman R. S.& Maxim B. R., latest Edition, McGraw-Hill.
6. Object-Oriented Analysis, Design and Implementation, Brahma Dathan, Sarnath Ramnath, latest Edition, Springer, University Press.
7. Essential Software Architecture, Gorton I., latest Edition, Springer – Verlag

---

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Agent Based Intelligent Systems (SW-318)**
Discipline	**:**	Software Engineering (5th Semester)
Effective	**:**	17 Batch & onwards
Pre-requisite	**:**	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks:** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain basic principles of Agent based Intelligent Systems, related theory and terminology.	C3	1
2	To understand and analyze NLP and NLP based techniques	C4	2
3	Create agent-based systems for different computing problems.	C5	3

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

INTRODUCTION

Agent based modelling Definitions, Agents, concept of Rationality, Structure and Types of Agents, intelligent Agents, Environment types & properties.

INTELLIGENT AGENT SYSTEMS

Problem Solving, Searching - Heuristics -Constraint Satisfaction Problems - Game playing.

NATURAL LANGUAGE PROCESSING

NLP basic, NLP applications and research areas, NLG, NLU, NLP problems and possible solutions, Analysis levels in NLP, NLP system and algorithms.

AGENTS AND UNCERTAINITY

Acting under uncertainty – Probability Notation-Bayes Rule and use - Bayesian Networks-Other Approaches-Time and Uncertainty-Temporal Models- Utility Theory - Decision Network – Complex Decisions.

INTELLIGENT AGENTS & NEURAL NETWORKS

Artificial Neural Networks, Characteristics of ANN, Topologies of ANN, Basic Learning Laws of

Recommended Books:

1. Russell S.; Norvig P.; “Artificial intelligence – A Modern Approach”, Latest Edition, Prentice Hall.
2. Michael Wooldridge, "An Introduction to Multi Agent System", John Wiley Latest Edition.
3. Coppin B.; “Artificial Intelligence Illuminated”, Latest Edition, Jones and Bartlett Publishers USA.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Communication and Presentation Skills (ENG-311)**
Discipline	**:**	Software Engineering (5th Semester)
Effective	**:**	17 Batch & onwards
Pre-requisite	**:**	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks:** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Draft varied texts including formal letters, CV, cover letter for jobs, and Technical Reports using mechanisms of academic writing integrated with paraphrasing and summarizing techniques.	C3	10
2	Describe and infer the texts critically and apply the knowledge in real life situations by participating in public speaking acts and group discussions.	C2	9

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Reading: Text Analysis, critical thinking
Skimming, scanning and detailed reading

Writing: Academic Writing/Technical Report Writing
Drafting letters with different types of messages with different registers and purposes, prepare CV's and covering letters according to job requirement

Listening: Listening Comprehension
Formal and informal lectures and presentations take notes and collect specific information

Speaking: Speaking in real life situations
Conversational strategies, elements of public speaking: Giving lectures and presentation on specific topics
Ask questions and explain point of view in discussion
(Demonstrate turn taking technique)

Recommended Books

Rise B. Axelrod and Charles R. Cooper,1996 *The Concise Guide to Writing technique.*
Chilver.J,1992, *English For Business*(A functional approach 2nd Edition).DP Publiacations Ltd,London,Great Britian.
Yate Martin,2004,*The Ultimate Job Search Letters Book*.Great Britian
Herta A Murphy 1997 Effective Business Communications (7th Edition)

Approval:

Board of Studies:	**Resolution No.**	**Dated:**
Board of Faculty:	**Resolution No.**	**Dated:**
Academic Council:	**Resolution No.**	**Dated:**

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

Title of Subject	**:**	**Human Computer Interaction (SW-317)**
Discipline	**:**	Software Engineering (5th Semester)
Effective	**:**	17 Batch & onwards
Pre-requisite	**:**	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks:** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Identify various interaction mechanisms and purpose of a variety of interfaces along with their application areas.	C2	1
2	Distinguish modules that cover the entire user-centered design and evaluation process - from understanding user needs, to designing interactive systems that meet those needs.	C4	2

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **INTRODUCTION**

  The Human vision, Human Memory, reasoning and problem solving. Interaction models, frameworks and interaction styles, Contexts for HCI, Psychology of usable things, Processes for User-Centered Design, Metrics and Measures for Evaluation, Usability heuristics and principles of Usability testing, Physical capabilities, Cognitive and social models for interaction design,

- **PARADIGMS FOR INTERACTION**

  Using design rules, Principles of good interaction design, Accessibility, Principles of GUI, Visual design elements, Data gathering, Task analysis, Prototyping, Help and user documentation, Internationalization.

- **USABILITY**

  Usability inspection methods, Usability testing methods, New Interaction Technologies, Usability in practice, Visual Design and Typography, Icon Design, Ubiquitous, Augmented and Virtual Reality.

- **EVALUATION TECHNIQUES AND SOCIAL ISSUES**

  Styles of evaluation, Evaluating the design and implementation, designing user support systems. Non-speech Sound, Handwriting Recognition Gesture recognition, Computer vision and Ubiquitous computing applications research.

Recommended Books:

1. Designing the User Interface: Strategies for Effective Human-Computer Interaction, Ben Shneiderman and Catherine Plaisant, 6th Ed, Pearson Inc, Latest Edition.
2. HUMAN-COMPUTER INTERACTION, Latest Edition Dix, Finlay, Abowd and Beale.
3. User Interface Design and Evaluation Amazon by Debbie Stone, Caroline Jarret, Mark Woodroffe, and Shailey Minocha, Latest Edition.
4. Designing Interfaces: Patterns for Effective Interaction design *By Jennifer Tidwell,* Latest Edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject : **Information Security (SW-316)**
Discipline : Software Engineering (5th Semester)
Effective : 17 Batch & onwards
Pre-requisite : Computer Networks
Assessment : Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours : 03 + 00 **Marks:** 100
Minimum Contact Hours: 45

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain the concept and knowledge of IS and implementation of cryptography and related techniques using information security concepts.	C2	1
2	Analyze enterprise level security by using different hardware and software Security solutions.	C4	2
3	Use Information security solution for an organization in order to cope with their security issues.	C3	1

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- Introduction to Information Security
- Need for security
- Legal, ethical and Professional issues in information security
- Planning for security
- Risk Management
- Security technology: Access control, Firewalls and VPNs
- Intrusion detection and prevention systems
- Cryptography
- Unintentional programming oversights, Malicious code, countermeasures
- Browser attacks, Web attacks, E-mail attacks
- Security in operating systems
- Network security attacks and security counter measures
- Security in databases
- Cloud security tools and techniques

- Physical security

Recommended Books:

1. Corporate Computer and Network Security by Raymond Panko, Prentice Hall, Latest Edition.
2. CISSP, Shon Harris, McGraw-Hill Osborne Media, Latest Edition.
3. Cryptography and Network Security, William Stallings, Prentice Hall, Latest Edition.
4. Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, latest Edition, Cengage Learning.
5. Security in Computing, Pfleeger, C.P., Pfleeger, S.L. & Margulies, J., latest Edition, Prentice Hall.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Software Construction & Development (SW-315)**
Discipline	**:**	Software Engineering (5th Semester)
Effective	**:**	17 Batch & onwards
Pre-requisite	**:**	Software Design and Architecture
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	02 + 01 **Marks:** 50 + 50
Minimum Contact Hours:		30 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Recognize the software engineering process from basic to advanced level.	C4	2
2	Organize the intricacies of software deployment and configuration.	C5	3
3	Use knowledge to develop, deploy and configure variety of softwares.	P4	5

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- Moving from design to implementation code
- Regular expressions and grammars, Parser generators
- Software Construction fundamentals
- Designing specifications
- Mutability and immutability
- Recursion and Abstract data types
- Abstraction functions and rep invariants
- Interfaces, Graphical user interfaces
- Recursive data types
- Concurrency, thread safety, Sockets and networking
- Queues and message passing, Locks and synchronization
- Code refactoring
- Exception handling
- Static checking and testing
- Code review

Practical Work to be carried out:

1	Software Development Methods
2	Class Diagram
3	Sequence Diagram
4	Object Diagram
5	Activity Diagram
6	Requirements gathering strategies
7	Development of SRS document
8	OOP paradigm
9	Agile Frameworks
10	OOAD optimization
11	Unit Testing
12	Integration Testing
13	Software Deployment
14	Configuration Management
15	Case study/Project

Recommended Books:

1. Introduction to Software engineering by Ian Sommerville. (Latest Edition)
2. Software Configuration management by Professor Hossein Saydian
3. Working with effectively with Legacy code by Michael C. Feathers. (Latest Edition)
4. Client-Centered Software Development, Allen B. Tucker, CRC Press, latest edition.
5. Software Essentials: Design and Construction, Adiar Dingle, CRC Press, latest edition.
6. Clean Code: A Handbook of Agile Software Craftsmanship, Robert C. Martin, Prentice Hall, latest edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject **:**		**Statistics and Probability (MTH317)**
Discipline	:	Software Engineering (5th Semester)
Effective	:	17SW & onwards
Pre-requisite	:	None
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	:	03 + 00 Marks: 100
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Describe different statistical methods to obtain the measure of central values of a data and their interpretation	C4	2
2	Apply Probability and its rules. Different probability distributions and their uses	C4	2
3	Analyze Estimations and hypothesis along with regression and correlation analysis	C4	2

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Introduction: Nature and importance of statistics, descriptive and inferential statistics, population and samples.
Descriptive Measures: Measures of central tendency and measures of dispersions.
Probability: Introduction to probability, counting techniques, dependent and independent events, conditional probability, additive rule of probability. Contingency tables, joint and marginal probabilities, the multiplication rule, Bayes's theorem.
Probability Distribution: Concept of random variables, discrete and continuous probability distributions., Mean and variance of a random variables. Binomial and Poisson distributions, mean and variance of Binomial and Poisson distribution. Normal distribution, Standard normal distribution and inverse use of table of areas under the normal curve.
Sampling Distribution: Sampling distribution of means with replacement and without replacement, Central limit theorem.
Estimation of Parameters: Confidence interval of one population mean, estimation a population mean, estimating the difference between two population mean. The Chi-square distribution.
Tests of Hypothesis: Testing a statistical hypothesis, Type I & II error, one tailed and two tailed tests. Test concerning means and variances, testing the difference between two means, Good-ness of fit test.
Simple Regression and Correlation: Regression analysis by least squares method, testing the significance of the slope, simple correlation analysis, coefficient of correlation, testing the significance of coefficient of

correlation.

Books Recommended:

- M. Anwar Solangi; Statistical Methods and Estimations
- Ronald Walpole, Introductory Statistics
- Sher Muhammad Choudhry, Introduction to Statistics vol. I & II
- Iqbal Bhatti, Elements of Statistics
- Douglas C. Montgomery, Applied Statistics and Probability for Engineering.

Approval:

Board of Studies:	**Resolution No. 01**	**Dated: 26-03-2018**
Board of Faculty:	**Resolution No. 3.1**	**Dated: 11-04-2018**
Academic Council:	**Resolution No. 17(ii)**	**Dated: 23-04-2018**

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

Title of Subject	**:**	**Data Science and Analytics (SW-326)**
Discipline	**:**	Software Engineering (6th Semester)
Effective	**:**	17 Batch & onwards
Pre-requisite	**:**	Database Systems, Data Warehousing
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 + 50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Determine fundamental information to get insight into the challenges with big data.	C3	1
2	Evaluate techniques for storing and process large amounts of structured and unstructured data	C6	2,4
3	Plan application of big data to get valuable information on market trends	C5	3
4	Implement and deploy a sample project for extracting useful information from a mid sized dataset.	P3	5

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **Introduction to Big Data Analytics**
  - Data Analytics,
  - Analytics for Business Intelligence
  - Big Data Analytics
  - Big Data Classifications
  - Big Data for Cognitive Mobile Analytics.

- **Big Data Platforms**
  - Introduction to NOSQL databases
  - Comparing NOSQL DBMS to relational DBMS
  - Aggregate Data Model
  - Big Data Model
  - Comparing NOSQL and Relational data models

- Big Data Stores
- Processing Data on Hadoop

- **Big Data Modeling Techniques**
  - Denormalization, Aggregates, Joins
  - General Modelling Techniques (Enumerable Keys, Dimensionality Reduction, Index table)

- **Big Data Analytics using Machine Learning Algorithms**
  - Recommendation,
  - Clustering,
  - Classification,
  -
- **Linked Big Data**
  - Graph Computing
  - Graph Analytics,
  - Graphical Models and Bayesian Networks,
  - Social and Information Networks
  - Basic Network Properties and Graphs
  - Random Networks
  - Small-world and Scale-free Properties
  - Models of Network Formation
  -
- **Big Data Visualization**
  - Data Exploration Components
  - Techniques to Explore Data
  - Tools for Exploratory Data Analysis
  - Extrapolation of Data Analysis to Big Data, Techniques and Tools
  - Data Visualization Techniques

Practical Work to be carried out:

1. Mongo DB for working with NOSQL
2. DDL, DML and Data Retrieval commands in Mongo DB
3. Hadoop File system
4. MapReduce Framework
5. Spark Basics and Running Spark Applications on Hadoop
6. PyCharm IDE for Python
7. Data types, Control structures and Functions in Python
8. Input/Output and Exceptions in Python
9. Python libraries for Data Sciences & Machine Learning (NumPy, SciPy and SciKit)
10. Linear Regression using SciKit
11. Supervised learning: Naïve Bayes and Support Vector Machines using SciKit
12. Unsupervised learning: Clustering using Sci Kit
13. Confusion Matrix and cross validation for Data Evaluation
14. R language, Data Structures, Manipulation, Functions.
15. Case Study: Working with real datasets for prediction and categorization tasks.

Recommended Books:

1. Thomas Erl, Wajid Khattak, Paul Buhler, Big Data Fundamentals: Concepts, Drivers and Techniques, Latest edition, Prentice Hall Publications
2. T. Fawcett and F. Provost , Data Science for Business: What you Need to Know about Data Mining and Data Analytic Thinking, Publisher: O'Reilly Media, Latest Edition

3. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics: Systems for Decision Support, Publisher: Pearson/Prentice Hall, Latest Edition
4. Wes Mc Kinney, “Python for Data Analysis”, O'Reilly Media, Latest Edition

---

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Discrete Structures (SW-325)**
Discipline	**:**	Software Engineering (6th Semester)
Effective	**:**	17 Batch & onwards
Pre-requisite	**:**	Operation Research
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks:** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain the basics of discrete structures along with their properties and applications.	C3	1
2	Solve problems involving Relations, Combinatorics, Graphs, Recurrence Relations, Trees, Mathematical Logic.	C4	2

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Sets and Notation:
Defining sets, Set operations.

Induction:
Introducing induction, Strong induction, why is the induction principle true? Proof Techniques, Proofs by contradiction, direct proofs

Divisibility:
The division algorithm, Remainders, Greatest common divisors

Prime Numbers:
The fundamental theorem of arithmetic, the infinity of primes

Relations and Functions:
Ordered pairs, Relations, Kinds of relations, Creating relations, Functions

Mathematical Logic:
Propositions and predicates, Quantifiers, Negations, Logical connectives, Tautologies and logical inference

Binomial Coefficients:
Basic properties, Binomial theorem

Graphs:
Introduction, Common graphs, Kinds of graphs.

Trees:
Basic properties and spanning trees

Planar Graphs:

Drawing graphs in the plane, Euler's formula, and Coloring planar graphs

Recommended Books:

1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, Latest Edition.
2. Pace G.J.; Mathematics of Discrete Structures for Computer Science, Latest Edition.
3. Susanna S. Epp, Discrete Mathematics with Applications, Latest Edition

---

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Mobile Application Development (SW-327)**
Discipline	**:**	Software Engineering (6th Semester)
Effective	**:**	17 Batch & onwards
Pre-requisite	**:**	Operation Research
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 + 50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain the basic concepts used in various Mobile Application Development Frameworks.	C3	1
2	Use mobile application components and compare the different performance trade-offs	C4	2
3	Create mobile application solutions to real world problems	C5	3
4	Develop mobile applications using current software development environments	P3	5

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **Mobiles Application Development Platform**
  - HTML5 for Mobiles;
- **Android OS Architecture**
  - Framework and Application Development;
- **IOS: Architecture**
  - Framework and Application Development;
- **Windows Mobile Architecture**
  - Framework and Application Development;
- **Calling Built-in Applications using Intents;**
- **Displaying Notifications; Components of a Screen;**
  - Adapting to Display Orientation;
  - Managing Changes to Screen Orientation;
  - Utilizing the Action Bar;
- **Creating the User Interface;**
  - Listening for UI Notifications; Views; User Preferences;

- **Persisting Data; Sharing Data;**
- **Sending SMS Messages; Getting Feedback; Sending Email;**
- **Consuming Web Services Using HTTP;**
    - Web Services: Accessing and Creating;
    - Displaying Maps;
    - Location-aware Applications;
- **Publishing Android Applications; Deployment on App Stores;**
- **Mobile Platform Constraints; Emerging Technologies**

Practical Work to be carried out:

1 Setting up the Development Environment for building Mobile Applications
2 Creating User Interfaces for Mobile Apps
3 Writing programs for Mobile Application
4 Working with Intents
5 Writing programs for reading sensors
6 Using Native google Maps and Geocoding
7 Using Concurrent programming in Mobile Applications
8 Making program to use Bluetooth
9 Working with Broadcast Receivers
10 Using Fragments, fragment lifecycle and fragment transactions
11 Programming Services
12 Writing program for SQLite Database to store and retrieve data
13 Integrating Facebook API with Mobile Apps
14 App packaging and publishing it to an app store
15 Case study/Project

Recommended Books:

1. Reto Meier.; "Professional Android Application Development", Latest Edition, Wrox publishers.
2. TommiMikonen; "Programming Mobile Devices an Introduction for Practitioners", Latest Edition, Wiley publishers, Latest Edition.
3. Professional Android application development, Reto Meier, Wrox
4. Programmer to Programmer, latest edition.
5. iOS Programming: The Big Nerd Ranch Guide, Conway, J., Hillegass, A., & Keur, C., latest Edition.
6. Android Programming: The Big Nerd Ranch Guides, Phillips, B. & Hardy, B., latest Edition

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Software Project Management (SW - 322)**
Discipline	**:**	Software Engineering (6th Semester)
Effective	**:**	17 Batch & onwards
Pre-requisite	**:**	Introduction To Software Engineering
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 0 **Marks:** 100
Minimum Contact Hours:		45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain principles of project lifecycle and how to identify opportunities on relevant and appropriate project scenarios.	C3	1
2	Critically evaluate and discuss the issues around project management and its application in the real world.	C6	2, 4
3	Incorporate project management techniques to initiate, plan, execute and work in teams to create a project plan for a project scenario that includes key tasks, critical paths, dependencies and realistic timeline.	C5	6,9,11

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

Course outline:

- Introduction to Software Project Management
- Project Management concepts
- Project Management Tools
- PMI‘s Knowledge areas, PMI Framework
- PMI Process Groups.
- Understanding Organizations. Project Planning, Project Evaluation
- Selection of an Appropriate Approach in Project
- Software Effort Estimation, Activity Planning
- Risk Management, Evaluating the Risks to the Schedule, Risk Control
- Configuration Management and Maintenance
- Environment for Configuration Control
- Resource Allocation
- Monitoring & Control
- Review and Evaluation
- Challenges of Outsourcing in Project Management

Books Recommended:

1. Software Engineering- A practitioner's Approach by Rogers Pressman Latest Edition.
2. Software Project management, Bob Hughes and Mike Cottere Latest Edition
3. Information Technology Project Management, Schwalbe, K., latest Edition, Cengage Learning.
4. A guide to the project management body of knowledge (PMBOK guide), Project Management Institute Inc, latest Edition.
5. Software Project Management, Bob Hughes and Mike Cotterell, McGraw-Hill Education; latest Edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject : **Technical & Business Writing (ENG302)**
Discipline : Software Engineering (6th Semester)
Effective : 17 Batch & onwards
Pre-requisite : Functional English
Assessment : Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours : 03 + 0 **Marks:** 100
Minimum Contact Hours: 45

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Develop presentation skills; demonstrate professional skills in discussion and offer explanations using examples.	C3	2
2	Draft different types of texts such as Technical Report, letters with different types of messages involving different registers and purposes, CV and Covering letter.	C3	10

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Reading: Text Analysis, critical thinking
Skimming, scanning and detailed reading

Writing: Academic Writing/Technical Report Writing
Drafting letters with different types of messages with different registers and purposes, prepare CV's and covering letters according to job requirement

Listening: Listening Comprehension
Formal and informal lectures and presentations take notes and collect specific information

Speaking: Speaking in real life situations
Conversational strategies, elements of public speaking: Giving lectures and presentation on specific topics
Ask questions and explain point of view in discussions
(Demonstrate turn taking technique)

Recommended Books

Rise B. Axelrod and Charles R. Cooper,1996 *The Concise Guide to Writing technique.*
Chilver.J,1992, *English For Business*(A functional approach 2nd Edition).DP Publications' Ltd,London,Great Britian.
Yate Martin,2004,*The Ultimate Job Search Letters Book*.Great Britian

Approval:

Board of Studies:	**Resolution No. 1**	**Dated: 03-10-2013**
Board of Faculty:	**Resolution No.**	**Dated:**
Academic Council:	**Resolution No.**	**Dated:**

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

Title of Subject : **Formal Methods in Software Engineering (SW-418)**
Discipline : Software Engineering (7th Semester)
Effective : F16 Batch & onwards
Pre-requisite : Discrete Structures
Assessment : Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours : 03 + 0 **Marks:** 100
Minimum Contact Hours: 45

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Identify what can and what cannot be expressed by certain specification/modeling formalisms	C2	1
2	Transform formal specifications of object-oriented system units, using the concepts of method contracts and class invariants.	C4	2
3	Formulate connection between programs and formal specifications that can be represented in a program logic.	C5	3

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

INTRODUCTION TO FORMAL METHODS
Introduction to the use of mathematical models for specification and validation, Finite state machine models, models of concurrent systems, verification of models, and limitations.

MODEL CHECKING
Analyzing well-formedness (e.g. completeness, consistency, robustness, etc.), Analyzing correctness (e.g. static analysis, simulation, model checking, etc.).

FORMAL LANGUAGES
Formal analysis, An introduction to Alloy and Alloy Analyzer, Sets, Sequences, Composite objects, Comparative Formal Methods, Proofs. Introduction to Object Constraint Language (OCL) and use of class variants, pre and post conditions on operations and model verification

FORMAL VERIFICATION METHODS
Unit level specification language for Java programs, a logic for verification of Java programs, verification of Java programs, in the sense that the implementation of a unit fulfills the specification.

Recommended Books:

1. Modern Formal Methods and Applications, Hossam A. Gabbar, Springer-Verlag Latest Edition.
2. Formal Software Development: From VDM to Java, Charatan, Quentin, and Aaron Kans. Palgrave Macmillan, Latest Edition
3. Object Modeling with the OCL: The Rationale behind the Object Constraint Language, edited by Tony Clark, Jos Warmer, Latest Edition

---

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Multimedia Communication (SW-416)**
Discipline	**:**	Software Engineering (7th Semester)
Effective	**:**	F16 Batch & onwards
Pre-requisite	**:**	Discrete Structures
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 + 50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain multimedia systems which incorporate digital audio, graphics and video, pictures, integration of media, multimedia authoring, and delivery of multimedia.	C3	1
2	Discover techniques for data compression and transmission, audio and video compression, 3D modeling, and animation in multimedia.	C4	2
3	Practice the skills in planning, designing, implementing and evaluating multimedia projects. Manage problem solving skills in assigned project related to interactive multimedia application.	P5	5,9

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **INTRODUCTION TO MULTIMEDIA**
  Multimedia applications and requirements, overview of multimedia systems, Characteristics, Challenges and components of multimedia system, Overview of MM software tools, MM authoring tools, their types and features, Organizing MM team.

- **DEVICES FOR MM AND TEXT**
  Input and output devices, Connecting devices (SCSI, MCI, IDE), Compact Disc Technology (CAV and CLV) and Formats, Optical and CD storage media, Font editing and design tools, Hypertext and Hyperlinks, Integrating Text with Graphics and Videos.

- **IMAGES**
  Bitmap and Vector graphics, Image file formats, Digitizing Real world Images, Image Processing software, Color models, Using Light sources and perspective.

- **AUDIO**

Sound, Computer manipulation of Sound, Digital Audio and Analogue Audio, MIDI, Audio file formats and Sampling, Digital audio and MIDI.

- **VIDEO**
  Analogue Video and its standards (PAL, SECAM, NTSC), Digital Video and its standards (AVI, MPEG, QUICKTIME, MOV)

- **VIDEO AND AUDIO COMPRESSION**
  Audio and video compression (e.g., JPEG, MPEG, H.26X, etc.), scalable coding, perceptual audio encoders. Performance comparison of coding algorithms, Algorithms for image and video processing.

- **ANIMATION**
  Animation techniques, file formats and animation process, 3D drawing, modeling and surface rendering and its methods.

Practical Work to be carried out:

1 Introduction to Adobe Photoshop and learn to edit images in Photoshop.
2 Applying different layer styles to design glossy candy text effect using Adobe Photoshop.
3 Learn to design an awesome television icon from scratch using Adobe Photoshop.
4 Learn to design academic posters using Adobe Photoshop
5 Working with Animations in Adobe Photoshop
6 Introduction to Audacity and learn to apply editing operations and special effects on sounds.
7 Working with Text to speech converters
8 Working with Hit films Express
9 To become familiar with special effects in Hit films Express
10 To work with Google Sketch up
11 To work with frame by frame and tweening animation in flash.
12 To work with special effects in flash.
13 To work with scripting in Flash.
14 T work with character animation in Flash.
15 Details about your project consisting of software and tools used with comprehensive procedure.

Recommended Books:

1. Jeff Burger, “The Desktop Multimedia Bible”, Addison Wesley Publishing Company, Latest Edition.
2. Vaughan, “Multimedia Making It work”, Osborne Mc Graw Hill, Latest Edition.
3. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols, and Standards", Latest Edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject : **Software Re-Engineering (SW-415)**
Discipline : Software Engineering (7th Semester)
Effective : F16 Batch & onwards
Pre-requisite : Introduction to Software Engineering, Software requirement Engineering, Software Economics and Management, Software Design And Architecture
Assessment : Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours : 03 + 0 **Marks:** 100
Minimum Contact Hours: 45

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain the concepts and technique of software re- engineering.	C3	1
3	Analyze problems associated with object oriented software systems.	C4	2
2	Use reengineering techniques to maintain and modify software systems	C5	3
4	Perform complex design reengineering and reverse engineering problems.	C6	4

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **SOFTWARE RE-ENGINEERING:**
  The Reuse Process, Describing Reusable Components, Management Issues

- **FUNDAMENTAL RE-ENGINEERING TECHNIQUES:**
  to modernize legacy systems including source code analysis, architecture recovery, and code restructuring, migration to Object Oriented platforms, migration to network-centric environments, and software integration,

- **SOFTWARE REFACTORING STRATEGIES:**
  Forward and Reverse Engineering, program comprehension, source code transformation and refactoring strategies, software maintenance and re-engineering economics.

- **RE-ENGINEERING COST FACTORS:**
  quality of the software, tool support, required data conversion, availability of expert staff for re-engineering

Recommended Books:

1. Re-engineering legacy software, David Lorge Parnas, Chris Birchall, Safari Books, Shelter Island, NY, Latest Edition
2. Reengineering, Priyadarshi Tripathy and Kshirasagar Naik, John Wiley & Sons, Inc. Latest Edition
3. Software Maintenance and Evolution: a Roadmap, K.H.Bennett and V.T Rajlich, The Future of Software Engineering, ACM Press, Latest Edition

---

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Web Engineering (SW-417)**
Discipline	**:**	Software Engineering (7th Semester)
Effective	**:**	F16 Batch & onwards
Pre-requisite	**:**	Programming Fundamentals
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 +50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Outline fundamentals of Web technologies and explain HTML, CSS and Javascript for client-side web interfacing.	C3	1
2	Work with server-side languages to create dynamic web applications.	C5	3
3	Host web applications and create databases to store and process data proficiently	P5	5,9

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **Client Side Technologies & Responsive Web:**
  - **HTML:**

    Text: headings, paragraphs, bold & italic, superscript & subscript, white space, line breaks & horizontal rules, visual editors & their code views, semantic markup, strong & emphasis, quotations, abbreviations & acronyms, citations & definitions, author details,

    Lists & tables: ordered lists, unordered lists, definition lists, nested lists, basic table structure, table headings, spanning columns, spanning rows, long tables

    Links: writing links, linking to other sites, linking to other pages on the same site, directory structure, relative urls, email links, opening links in a new window, linking to a specific part of the same page, linking to a specific part of another page

    Images: choosing images for website, storing images on site, adding images, height & width of images, where to place images in your code, aligning images, image dimensions, cropping images, image resolution, vector images, animated gifs, transparency

    Forms: form controls, form structure, text input, password input, text area, radio button, drop down list box, multiple select box, file input box, submit button, image button, html5: form validation

    HTML5: Semantic elements, multimedia elements, graphic elements, form elements and APIs

- **CSS:** External CSS, Internal CSS, Inline CSS, CSS selectors, Color, Foreground color, Background color, text, Typeface terminology, Size of type, Type scales, Units of type size, Bold, Italic, lowercase, Underline & strike, Letter & word spacing, Alignment, Vertical alignment, Indenting text, Styling links, boxes, Border, margin & padding, White space & vertical margin, Border width, Border style, Border Color, lists, tables and forms, Bullet point styles, Images for bullets, List shorthand, Table properties, images, Controlling sizes of images, Aligning images, Background images, repeating images, CSS selectors, Bootstrap framework.

- **JavaScript:** Variables, Operators, Functions, Document Object Model, Expressions and Control Flow in JavaScript, Looping, JavaScript Events, JavaScript Objects, JavaScript Arrays, Validating User Input with JavaScript, Regular Expressions

- **Server Side Technologies:**
  - Introduction to PHP, Expressions and Control Flow in PHP, Operators, Conditionals, Looping, Implicit and Explicit Casting, PHP Functions and Objects, Including and Requiring Files, PHP Objects, PHP Arrays, Multidimensional Arrays, Array Functions, Date and Time Functions, File Handling, Form handling, Cookies, Sessions and Authentication

  - **Server Side Databases:** MySQL Basics, Accessing MySQL, Indexes, MySQL Functions, Querying a MySQL Database with PHP

  - **Server Side MVC Framework:** MVC Framework, PHP MVC Frameworks, Codeigniter Installation and Configuration, Creating Applications With Custom Codeigniter Controllers, Views and Models.

Practical Work to be carried out:

1. To understand HTML basics for developing web applications
2. To become familiar with HTML5 semantic and multimedia elements
3. To become familiar with Javascript basics for user interaction
4. To become familiar with CSS for styling web applications
5. To become familiar with Bootstrap styling framework
6. To become familiar with PHP basics and installation of web server
7. To become familiar with control structures and arrays in PHP
8. To become familiar with functions and form handling and file handling in PHP
9. To become familiar with AJAX for data fetching
10. To become familiar with sessions and cookie management in PHP
11. To become familiar with database connectivity using PHP
12. To become familiar with web services using PHP
13. To become familiar with Codeigniter PHP MVC Framework
14. To become familiar with Kubernetes environment and understand its basics
15. To understand basics of dockers for developing web applications

Recommended Books:

1. Jon Duckett, "HTML and CSS: Design and build web sites" (Wiley, Latest Edition)
2. Robin Nixon, "Learning PHP, MySQL & Java Script with jQuery, CSS & HTML5" (O'Rielly, Latest Edition).

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Cloud Computing (SW-425)**
Discipline	**:**	Software Engineering (8th Semester)
Effective	**:**	F16 Batch & onwards
Pre-requisite	**:**	Operating Systems
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 +50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain concepts of cloud computing and get familiar with different cloud computing technologies.	C3	1
2	Analyze the role of various technologies and architectures (web services, JSPs, Servlets, Spring Framework) for enterprise level distributed applications	C4	2
3	Devise cloud environment on different platform and deploy applications	C5	3
4	Design and develop cloud applications	P4	5

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Cloud Systems, Cloud Systems Characteristics, Goals and Challenges, Cloud Data, Cloud processing system, Resource brokerage, Resource monitoring, Load balancing Resource clustering, Distributed Data Bases, Distributed Transactions, Connections Pooling, Types of Cloud Computing, SaaS, PaaS and IaaS, Sample Applications, Grid Computing & Parallel Processing, Grid v/s Cluster Computing, Application Servers, Enterprise Technologies, Enterprise Architecture & Platform, Enterprise Development Issues.

THREADS AND PARALLELISM

Storage elements, Flynn's Taxonomy, Levels of Parallelism, Multithreading, Thread Programming Models, Thread synchronization: Event synchronization, Asynchronous v/s Synchronous Operations, Blocking, Deadlocks and Timeouts.

DISTRIBUTED COMPUTING USING RMI

The RMI Architecture: (The Stubs and Skeleton Layers, Remote Reference Layer, Transaction Layer), Locating Remote or Distributed Objects, Passing Method Parameters (Primitive and Object Parameters), Object Parameters and Serialization, Distributed Garbage Collector

Application Development using RMI:
Defining Remote Interface, Implementing Remote Interface, Writing Client Object, Generating Stubs & Skeletons, Running Clients & Server, Registering Distributed Object.

RMI OTHER CONSIDERATIONS AND CORBA
RMI over IIOP, RMI Callbacks, CORBA, CORBA vs. RMI-IIOP

NAMING & DIRECTORY SERVICES
Introduction to Naming & Directory Services, Introduction to Java Naming & Directory Services (JNDI) & LDAP, Storing & Searching the Distributed Objects using JNDI & LDAP.

DISTRIBUTED DEVELOPMENT USING JEE
Spring Framework Architecture and Modules Spring MVC lifecycle, Directory structure, Sample application, Application Development using Spring MVC: Applications using Multiple View Pages, Multiple Controllers, Model Interface, Introduction to Spring JDBC Template and Sample application using CRUD.

VIRTUALIZATION AND PRIVACY IN CLOUD COMPUTING
Implementing virtualization in cloud computing environment. Identifying security and privacy issues in cloud computing

Practical Work to be carried out:

1 To work with Remote Method Invocation (RMI) API
2 To work with Remote Method Invocation (RMI) Object Serialization
3 To work with Remote Method Invocation (RMI) Callbacks
4 To work with RMI-IIOP
5 To implement multithreading
6 To work with MVC architecture for Enterprise level applications
7 To implement preserving user state in distributed applications
8 To work with Spring framework
9 To work with JDBC template of Spring framework
10 To work with cloud computing using Microsoft Azure
11 To work with Amazon web services (AWS)
12 Develop distributed applications using Amazon web services
13 To become familiar with Amazon's AWS Identity Management and Security in the Cloud
14 To make Amazon's RESTFul WebServices
15 Case study

Recommended Books:

1. Cloud Computing: Concepts, Technology & Architecture 2013 (The Prentice Hall Service Technology Series by Thomas Erl), Latest Edition
2. Cloud Computing: From Beginning to End Paperback by Mr. Ray J Rafaels, Latest Edition
3. Distributed systems: Principles and Paradigms by Andrew S. Tanenbaum, Latest Edition

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**

Academic Council: **Resolution No. 96.10** **Dated: 07-10-2019**

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

Title of Subject : **Simulation and Modeling (SW-424)**
Discipline : Software Engineering (8th Semester)
Effective : F16 Batch & onwards
Pre-requisite : Linear Algebra, Statistics and probability
Assessment : Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours : 03 + 0 **Marks:** 100
Minimum Contact Hours: 45

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain the model classification at different levels.	C3	1
2	Incorporate learned knowledge to formulate and predict the effects simulated models.	C5	4
3	Evaluate the simulation results of a medium sized engineering problem.	C6	3

PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **INTRODUCTION**

Introduction, Simulation Modeling and Analysis, Other Types of Simulation Models, Purposes of Simulation, Advantages to Simulation, Disadvantages to Simulation, Basic Simulation Concepts, Additional Basic Simulation Issues

- **SIMULATION EXAMPLES**

Simulation of a Single-Server Queuing System, Simulation of an Inventory System
Problem Statement, Program Organization and Logic, Program, Simulation Output and Discussion,

- **SIMULATION SOFTWARE**

Introduction, Comparison of Simulation Packages with Programming Languages, Classification of Simulation Software, Desirable Software Features, General-Purpose Simulation Packages, Object-Oriented Simulation, Examples of Application-Oriented Simulation Packages.

- **RANDOM NUMBER GENERATION**

Properties of Random Numbers, Generation of Pseudo-Random Numbers, Testing for Randomness, Pitfalls

- **RANDOM VARIATE GENERATION**

General Approaches to Generating Random Variates (Inverse Transform, Direct Transform, Convolution, Accept-Reject), Generating Continuous Random Variates, Generating Discrete Random Variates

- **INPUT MODELING**

Collecting Data, Identifying Distribution, Histograms, Parameter Estimation, Goodness-of-Fit, Selecting Input Model without Data

- **VERIFICATION AND VALIDATION OF SIMULATION MODELS**

Model Building, Verification, and Validation, Verification of Simulation Models, Calibration and Validation of Models

- **OUTPUT ANALYSIS**

Types of Simulations with Respect to Output Analysis, Stochastic Nature of Output Data, Measures of Performance, Output Analysis for Termination Simulations, Output Analysis for Steady-State Simulations

Recommended Books:

1. Averill M Law, Simulation modeling and analysis, Latest Edition.
2. Christopher A Cheng, Simulation Modeling Handbook, A practical approach, CRC press latest edition.
3. Frank L. Severance, "System modeling and simulation", John Wiley and Sons Ltd, Latest Edition.
4. Bungartz, H.-J., Zimmer, S., Buchholz, M., Pflüger, D., Modeling and Simulation, Springer-Verlag, Latest Edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**

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

Title of Subject	**:**	**Software Quality Engineering (SW-426)**
Discipline	**:**	Software Engineering (8th Semester)
Effective	**:**	F16 Batch & onwards
Pre-requisite	**:**	Formal Methods in Software Engineering, Software Re-engineering
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours:		45 + 45

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

CLOs	Description	Taxonomy level	PLO
1	Explain basics of software quality assurance and testing fundamentals	C3	1
2	Analyze different scenarios to grasp working mechanism of various testing techniques	C4	2
3	Construct Test cases and perform testing on various applications using Modern Tools	P4	5

PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- Introduction to Software Quality and Quality Engineering
- Software quality factors and attributes, software quality models
- SQA Process Implementation Activities
- SQA plan and project plan
- Software inspections, Software reviews, Inspection checks and metrics
- Software testing concepts, issues and techniques, Software testing lifecycle
- Software quality metrics, product metrics, process metrics
- Test Planning Process, Testing documentation
- Software testing techniques, Testing philosophies
- Testing strategies, Model based testing,
- Software testing techniques, Testing using models,
- Domain and combinatorial testing,
- Unit and integration testing, Acceptance testing,
- Test automation
- Open issues on software testing

Practical Work to be carried out:

1 Validation and verification
2 Developing test cases
3 Application of Black box testing
4 Applying OO testing strategies
5 Unit testing using JUnit
6 Creating test suites using JUnit
7 Creating Mocks using in Mockito
8 Integration testing
9 Coding and testing cross reference
10 Web Functional Testing using Selenium
11 Application of formal methods
12 Producing log Using Log4J
13 Working with performance testing
14 Working with load testing
15 Case study

Recommended Books:

1. Software Engineering, Practitioners Approach, Roger S. Pressman, Mc.Graw Hill Inc, Latest Edition.
2. Foundation of Software Testing, Dorothy Graham, Cengage Learning EMEA Publishers, Latest Edition.
3. Software Quality: Concepts and Practice, Daniel Galin, John Wiley & Sons, latest edition
4. Introduction to Software Testing, Paul Ammann and Jeff Offutt, latest Edition, Cambridge University Press.
5. Introduction to Software Quality, Gerard O'Regan, Springer International, latest edition.

Approval:

Board of Studies:	**Resolution No. 02**	**Dated: 29-08-2019**
Board of Faculty:	**Resolution No. 01**	**Dated: 07-10-2019**
Academic Council:	**Resolution No. 96.10**	**Dated: 07-10-2019**