Scheme and Syllabus

for

PhD course work

offered

at

University School of Information, Communication & Technology
Guru Gobind Singh Indraprastha University, Delhi
From
AY 2018-19

Rules of Course work as mentioned in PhD ordinance 2017, Clause 7

Credit requirements, number duration, syllabus, minimum standards for completion etc.

7.1 The credit assigned to the PhD course work shall be minimum of 08 credits and a maximum of 16 credits

7.2 In the course work, a minimum of four credits shall be assigned to one or more courses on research methodology which could cover areas such as quantitative methods, computer application, research ethics and review of published research in the relevant field, training field work etc, other course shall be advanced level course preparing the student for PhD degree

7.3 The detailed course work for PhD shall be designed and recommended by concerned SRC and approved by the concerned BoS.

7.4-75 M.Phil related

7.6 The SRC governing the discipline in which the scholar pursue his/her research shall prescribe the course(s) to him/her based on the recommendation of the RAC of the research scholar.

7.7 All candidates admitted to PhD programmes shall be required to complete the coursework prescribe by the SRC during the initial one or two semesters. The maximum period for completion of the course work shall be two years from the academic session in which the scholar is admitted. If a scholar fail in any course/paper, the scholar shall reappear as and when the course/paper examination is scheduled subsequently.

7.8-7.9 M.Phil related

7.10. The grading system and divisions for the course work shall be as specified in the ordinance 11 of the university. Each paper/course of the course work shall be of maximum of 100 marks. The teacher's continuous evaluation component shall be of 25 marks and end-term semester examination component shall be of 75 marks. Attendance requirement in the course work shall be of minimum 75% of the classes held, the SRC may condone up to 5% of the attendance in specific instances, with reasons recorded in writing. Under no circumstances, a scholar with less than 70% attendance in the course shall be allowed it to appear in the end-tem semester examination by the SRC . The list of detained scholars shall be notified at least 5 working days before the commencement of end-term examination, by the chairperson of the SRC with a copy to the controller of examination for non-issuance of admit card.

7.11 The teacher's continues evaluation of 25 marks, for every course shall be conducted by the concerned faculty who is allocated the responsibility of teaching the course by the SRC. The concerned faculty shall communicate their marks to the controller of examination through the Dean, within a week of the completion of the semester.

For the rest 75 marks, the Controller of examination shall conduct the examination. The panel of paper setter, as approved by the BoS shall be communicated to the controller of Examination. The controller of Examinations shall declare the result combining the teacher's continuation evaluation and the end-term semester examination. The duration of the semester shall be of 15 weeks.

7.12 A PhD scholar has to obtain a minimum of B+ grade in the course work in order to be eligible to continue in the programme and submit the thesis. If, a scholar does not obtain the minimum grade, the scholar may reappear in one or more course work paper/course to improve the grad. The reappear fee applicable shall be as notified for other examination of the university. If the minimum grade required is not obtained in the maximum of duration for the course work as specified the registration/admission of the scholar shall be automatically cancelled.

Paper Code	Particulars	Paper ID	Credits
COMPULSORY PAPER			
CWICT-101	Research Methodology	900101	4
ELECTIVE PAPERS			
MEEC-701	Adhoc Sensor Network	42701	4
MECS-601	Advanced Data Structure	48601	4
MECS-701	Advanced Data Warehousing & Data Mining	48701	4
MERF-601	Advanced Electromagnetic Engineering	06601	4
MEEC-707	Artificial Neural Networks	42707	4
MECS-705	Cloud Computing	48705	4
MECS-717	Cyber Crime Investigations & Cyber Forensics	48717	4
MEVS-601	Digital System Design with Verilog	52601	4
MERA-603	Robotics Engineering	187603	4
MEVS-603	VLSI Technology	52603	4
MEVS-613	Wireless Networks	52613	4
MECS-606	Advanced algorithm Analysis & Design	48606	4
MEDC-602	Advanced Information Theory & Coding	07602	4
MEIT-602	Advanced Mobile Computing	53602	4
MEEC-604	Advanced Signal Processing	42604	4
MEIT-604	Advanced Software Project Management	53604	4
MEEC-606	Advanced VLSI Design	42606	4
MERA-608	Image Processing	187608	4
MEEC-626	Fuzzy Logic & Design	42626	4
MEEC-610	Microwave Integrated Circuits	42610	4
MECS-602	Object Oriented Analysis & Design	48602	4
MERA-618	Optimization Techniques	187618	4
MECS-612	Soft Computing	48612	4

MECS-616	Software Metrics	48616	4
MECS-608	Software Requirement & Estimation	48608	4
MERA-606	Artificial Intelligence	187606	4
MERA-721	Machine Learning	187721	4
MECS-703	Advanced Software Testing	48703	4
MECS-711	Software Quality Management	48711	4
MERA-602	Mobile Robots	187602	4
PHDICT-102	Statistical Computing	900102	4
PHDICT-103	Data Science	900103	4
PHDICT-104	Deep learning	900104	4
PHDICT-106	Advanced Semantic Web	900106	4

Paper Code: CWICT-101	**L**	**T**	**C**
Subject: Research Methodology	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks

Unit I

Descriptive statistic: Data measurements, Data graph: Line graph, Bar Graph, pie chart, histograms, Measure of central tendency: Mean, Median and Mode. Measure of variability: Range, Quartile deviation, standard deviation, average deviation and coefficient of variation. Measure of relative position: percentile ranks, standards scores and T-score.

Probabilities Set Theory: Applying Set Theory to Probability, Probability Axioms,Some Consequences of the Axioms , Conditional Probability Independence. **Correlation:** Karl Pearson's Product Moment Correlation Coefficient (r), Spearman's Rank order correlation coefficient (rho).

[T1,R1]

Unit II

Random Variables: Introduction to discrete and continuous random variables, probability Mass Function Cumulative Distribution Function (CDF), Functions of a Random Variable, Expected Value of a Derived Random Variable ,Variance and Standard Deviation ,Conditional Probability Mass Function. Continuous random variables: The Cumulative Distribution Function (CDF), Probability Density Function (PDF).

Statistical Distributions: Properties and applications of Normal, log-normal and t-distributions, Chi-Square and F distributions, properties of normal curve, applications of normal curve. Measure of shape: skewness and Kurtosis. [T1,T2, R1]

Unit III

Statistical Inference: Concept of standard error and its uses. The significances of statistical measures, Test of the significance difference between two means: Z-Test, T-Test, Analysis of variance and analysis of covariance: Assumptions of ANOVA, one way ANOVA, two way ANOVA. Post Hoc tests: Duncan's multiple range test, Tukey's test. Non-parametric tests: chi-square test, medium test, Friedman test, Wilcoxon test, Nemenyi test. [T1,T2]

Unit IV

Regression: The Simple Regression Model, Multiple Regression Analysis: Estimation, Multiple Regression Analysis: Inference, Multiple Regression Analysis: OLS Asymptotics.. Multiple Regression Analysis with Qualitative Information: Binary (or Dummy) Variables. Heteroskedasticity. [T1,R2]

Text Books:

[T1]. Ken Black: Business Statistics for contemporary decision making, Wiley India, 5th edition,2009

[T2]. Montgomery, D. C., G.C. Runger, Applied Statistics and Probability for Engineers. 5th ed.New Delhi: Wiley-India, 2011.

Reference Books:

[R1]. Roy D. Yates, David J. Goodman, Probability and Stochastic Processes : A Friendly Introduction for Electrical and Computer Engineers, Second edition, John Wiley and Sons,2005

[R2]. Jeffery M. Wooldridge, Introductory Econometrics, New York, South Western, 4th edition, 2002

Paper Code: MEEC-701	**L**	**T**	**C**
Subject Adhoc Sensor Networks		**4**	**- 4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction to Mobile Ad Hoc Networks, Technologies for Ad Hoc Network, Issues in Ad hoc wireless Networks, Ad Hoc network applications, Fundamentals of WLANs, IEEE 802.11 Architecture , protocols ,performance and open issues. Introduction to IEEE 802.15.4, MAC Protocols for Ad Hoc Wireless Networks: Issues, design goals and classification of MAC protocol, MACA and MACAW, Routing Protocols for Ad hoc wireless networks: Issues and classifications of routing protocols, AODV, DSR, DSDV, Multicasting Routing: Issues, Architecture reference model, and classifications of multicasting routing protocols.

UNIT II

Transport layer & Security protocols

Issues and design goals in designing transport layer protocols, TCP over Ad Hoc Wireless Networks: Traditional TCP, Feedback-Based TCP, TCP-BuS, Ad Hoc and Split TCP, Security in Ad hoc wireless networks: Network security requirements, Issues and challenges, Types of Network Security Attacks, and Key management, Secure routing in Ad hoc wireless networks.

UNIT III

Wire Sensor Networks: Introduction and overview of WSN, Applications of Sensor Networks, Sensor network architecture, Architecture of WSNsHardware components, Energy consumption of sensor nodes, Operating systems and execution environments, some examples of sensor nodes, Network Architecture: Sensor networks scenarios, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.

UNIT IV

Communication Protocols:

Physical Layer and Transceiver design considerations in WSNs, Fundamentals of (wireless) MAC protocol:Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol, Address and name management in wireless sensor networks, Localization and positioning, Routing protocols: Data Dissemination and Gathering, Routing Challenges and Design Issues in WSN, QoS in wireless sensor networks, Coverage and deployment, Advanced Application Support.

Text Book(s):

[T1] Ad HOC Wireless Networks: Architectures & Protocols , By C Siva Ram Murty & BS Manoj 2nd Ed, Pearson Education.

[T2]Protocols and Architectures for Wireless Sensor Networks, By Holger Karl and Andreas Willig Wiley Publisher (2014).

Reference Book(s):

[R1 Wireless Sensor Networks Technology, Protocols, and applications by Kazem Sohraby, Daniel Minoli, Taieb Znati, John Wiley & Sons.

[R2] Handbook of Ad Hoc Wireless Network, By Mohmad Illayas, CRC press

Paper Code: MECS-601	**L**	**T**	**C**
Paper: Advanced Data Structure	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT I

Elementary Data Structure: Arrays, Sparse Matrices, strings, stack, queues, Evaluation of Expressions , Linked list, Polynomials: Representation and Operations binary Trees and operations, Binary search tress: Operation and Characteristics.

UNIT II

Binary Heaps, Amortized analysis of Data structures, Balanced Search Trees, AVL trees, augmented data structure, Red Black Trees and properties.

UNIT III

Graph representation and implementation, searching of a graph, application of BFS and DFS
Data structure for Sets, Disjoint Set and Union – find problem and implementation, Basic Hash function and collision resolution Hash Tables (Universal Hashing, Perfect Hashing) implementation and Applications

UNIT IV

External sorting, Multiway search trees, B and B + Trees implementation, Digital Search Trees, Multiway Tries, Suffix Trees and applications

Text Book(s):

[T1] T. H. Cormen, C. E. Leiserson, R.L. Rivest, C. Stein, "Introduction to Algorithms", 3nd Edition, PHI.
[T2] Horowitz, Ellis, Sahni, Sartaj & Anderson-Freed, "Fundamentals of Data Structures in C (Second Edition)", Universities Press

Reference Book(s):

[R1] Mark Allen Weiss (Second Edition) "Data Structures and Algorithm Analysis in C", Pearson
[R2] Robert L. Kruse, Bruce P. Leung, "Data Structures and Program Design in C (Second Edition)", Pearson
[R3] M. Goodrich, R. Tamassia, and D. Mount "Data Structures and Algorithms in C++", Wiley 2004

Paper Code: MECS-701	**L**	**T**	**C**
Subject: Advanced Data Warehousing & Data Mining	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Review of Data Warehousing:

Introduction to Data Warehousing: Evolution of Data Warehousing, Data Warehousing concepts, Benefits of Data Warehousing, Comparison of OLTP and Data Warehousing, Why Have a Separate Data Warehouse, Problems of Data Warehousing.

Data Warehousing Architecture

Architecture: Operational Data and Data store, Load Manager, Warehouse Manager, Query Manager, Detailed Data, Lightly and Highlysummarised Data, Archive/Backup Data, Meta-Data, 2-tier, 3-tier and 4-tier data warehouse architecture

UNIT II

Multidimensional Data Modeling

Principles of dimensional modeling: From Tables and Spreadsheets to Data Cubes, the STAR schema, STAR Schema Keys, Advantages of the STAR Schema Dimensional Modeling: Updates to the Dimension tables, miscellaneous dimensions, the snowflake schema, Fact Constellations, aggregate fact tables, families of STARS, Measures: Their Categorization and Computation, Concept Hierarchies, OLAP Operations in the Multidimensional Data Model, A Starnet Query Model for Querying Multidimensional Databases

UNIT III

Data Warehouse Implementation,

Efficient Computation of Data Cubes, Indexing OLAP Data, Efficient Processing of OLAP Queries, Metadata repository, Data warehouse back-end tools and utilities

Data Preprocessing

Why preprocess the data? Data cleaning, Missing values, Noisy data, Inconsistent data, Data integration and transformation, Data reduction: Data cube aggregation,

Dimensionality reduction, Data compression, Numerosity reduction

Discretization and concept hierarchy generation for numeric data and categorical data

UNIT IV

Data Mining Basics: What is Data Mining, The knowledge discovery process, OLAP versus data mining, data mining and the data warehouse, Major Data Mining Techniques, Cluster detection, decision trees, memory-based reasoning, link analysis, neural networks, genetic algorithms, moving into data mining, Data Mining Applications, Benefits of data mining, applications in retail industry, applications in telecommunications industry, applications in banking and finance.

Text Books:

1. Morgan Kaufmann - Data Mining - Concepts and Technique
2. Paul Raj Poonia, “Fundamentals of Data Warehousing”, John Wiley & Sons, 2003.

Reference Books:

1. W. H. Inmon, “Building the operational data store”, 2nd Ed., John Wiley, 1999
2. Sam Anahony, “Data Warehousing in the real world: A practical guide for building decision support systems”, John Wiley, 2004

Paper Code: MERF-601	**L**	**T**	**C**
Subject: Advanced Electromagnetic Engineering	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

The Source Concept, Duality, Uniqueness, Image Theory, The Equivalence Principal, Fields in Half-space, The Induction Theorem, Reciprocity, Green's Function

UNIT II

The Wave Function, Plane Waves, The Rectangular Waveguide, Alternative Mode Sets
The Rectangular Cavity, Partially Filled Waveguide, The Dielectric-Slab Waveguide, Surface-Guided Waves, Modal Expansion of Fields, Current in Waveguides

UNIT III

The Wave Function, The Circular Waveguide, Radial Waveguides, The Circular Cavity
Other Guided Waves, Source of Cylindrical Waves, Two-dimensional Radiation, Waves Transformations, Scattering by Cylinders, Scattering by Wedges, Three-dimensional Radiation

UNIT IV

The Wave Function, The Spherical Cavity, Orthogonality Relationships, Space as a Waveguide, Other Radial waveguide, Other resonators

Text Book(s):

[T1] Introduction to Electrodynamics By David J. Griffith, John Wiley & Sons, 3rd Edition.

Reference Book(s):

[R1] Time Harmonic Electromagnetic Fields By R. F. Harrington, McGraw Hill, 1961.
[R2] Electromagnetic Waves and Radiating Systems By Jordan and Balmain, Pretice Hall, 2nd Edition.

Paper Code: MEEC-707	**L**	**T**	**C**
Subject: Artificial Neural Networks	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Biological analogy, Architecture classification, Neural Models, Learning Paradigm and Rule, single unit mapping and the perception.

Unit-II

Feed forward networks – Review of optimization methods, back propagation, variation on Backpropagation, FFANN mapping capability, properties of FFANN's Generalization.

Unit-III

PCA, SOM, LVQ, Adaptive Resonance Networks.

Unit-IV

Hopfield Networks, Associative Memories, RBF Networks.

Applications of Artificial Neural Networks: Regression, applications to function approximation, Classification, Blind Source Separation.

Text Book(s):

[T1] Haykin S., "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.

Reference Book(s):

[R1] Anderson J.A., "An Introduction to Neural Networks", PHI, 1999.
[R2] Hertz J, Krogh A, R.G. Palmer, "Introduction to the Theory of Neural Computation",
[R3] Addison-Wesley, California, 1991.
[R4] Hertz J, Krogh A, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.
[R5] Freeman J.A., D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison-Wesley, Reading, Mass, (1992).
[R6] Golden R.M., "Mathematical Methods for Neural Network Analysis and Design", MIT Press, Cambridge, MA, 1996.

Paper Code: MECS-705	**L**	**T**	**C**
Subject: Cloud Computing	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering &Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS, Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure.

UNIT II

Introduction to Cloud Technologies, Study of Hypervisors, SOAP, REST, Compare SOAP and REST, Webservices, AJAX and mashups-Web services, Mashups: user interface services, Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Multi-entity support, Multi-schema approach, Multi-tenance using cloud data stores, Data access control for enterprise applications.

UNIT III

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo, Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Introduction to cloud development, Monitoring in Cloud, A grid of clouds, Mobile Cloud Computing, Sky computing, Utility Computing, Elastic Computing.

UNIT IV

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture, Cloud computing security challenges, Issues in cloud computing, Implementing real time application over cloud platform, Issues in Intercloud environments, QoS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment, Inter Cloud issues, load balancing, resource optimization.

Text Book(s):

[T1] Cloud Computing: A Practical Approach, Antohy T Velte, et.al McGraw Hill,
[T2] Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
[T3] Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY)

Reference Book(s):

[R1] Cloud Computing Bible by Barrie Sosinsky, Wiley India
[R2] Cloud Applications by George Reese, O'REILLY Publication
[R3] Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

Paper Code: MECS-717	**L**	**T**	**C**
Subject: Cyber Crime Investigations & Cyber Forensics	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction :Introduction to Cyber World, Types of cyber-attacks, Cyber Crime and Digital Fraud, Cyber-attacks and cyber security , Information warfare and cyber terrorism,

Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations)

UNIT II

Under Standing Computer Investigations Preparing a Computer Investigations, Taking a systematic approach, Understanding Data recovery workstations and software, Conducting an Investigation, Completing the case. Processing Crime and Incident Response: Identifying Digital evidences, Collecting evidence, Preparing for a search, Seizing and Storing Digital evidences, Digital Hashing.

UNIT III

Windows and DOS systems based Investigations: File Systems, Examining File systems, Disk Encryption, Windows registry, startup tasks, Linux Boot processes and File systems, Digital signature and time stamping, cryptography, cell phone and mobile device forensics, Email investigations, Network Forensics, SQL Injections, Steganography.

UNIT IV

Computer Forensics Tools and Software: Helix, DTsearch, S-tools, Camouflage, Recovery of Deleted files in windows and Unix , Hardware forensic tools like Port scanning and vulnerability assessment tools like *Nmap* , *Netscan*etc . Password recovery e.g. Passware, Mobile forensic tools , DOS file systems and Forensic tools, Password encryption analyzer

Text Book(s):

[T1] Computer Forensics and Investigations, 2nd edition, Nelson, Phillips, Enfinger, Steuart, Cenage Learning 2008

[T2] Incident Response & Computer Forensics. Mandia, K., Prosise, C., Pepe, M. 2nd Edition. Tata-Mcgraw Hill, 2003.

Reference Book(s):

[R1] Digital Evidence and Computer Crime, 2nd Edition, Eoghan Casey, academic Press File System Forensic Analysis by Brian Carrier , addition Wesley

[R2] Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Harlan Carvey, syngress Publication

[R3] EnCE: The Official EnCase Certified Examiner Study Guide, 2nd Edition, Steve Bunting, sybex Publication

Paper Code: MEVS-601	**L**	**T**	**C**
Subject: Digital System Design with Verilog	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

ASIC Design Flow, Architecture and configuration of (Xilinx)Virtex series FPGA, Principles Hardware Description Languages, Y-Chart, Review of Synchronous and Asynchronous Design, Types of HDLs, Introduction to Verilog, Language Constructs ,Modeling style, Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators,

UNIT II

Design of Adder, Subtractor, Decoders, Encoders, Multiplexer, code Converter. Behavioral Modeling: Functional Bifurcation, Initial & Always Construct, multiple always blocks, Program flow control and looping, Parallel blocks, force-release construct, design of sequential circuits using verilog: Register, Counters, Timing and Delays model, path delay modeling, timing check

UNIT III

Introduction of behavioral modelling, functional bifurcation, initial & always construct, procedural assignment statement, Delay in Procedural statements, Timing Control Statements, If and If-else, case statement assign-deassign, repeat construct, loop construct: repeat, for, while & forever, sequential and parallel blocks, force-release construct, design of flip flop, shift register and counters using Verilog

UNIT IV

Data Subsystems, Storage Modules, Functional Modules, Data paths, Control Subsystems, Micro programmed Controller, Structure of a micro programmed controller, Micro instruction Format, Micro instruction sequencing, Micro instruction Timing, Basic component of a micro system, memory subsystem design.

Text Book(s):

[T1] Verilog HDL by Samir Palnitkar, Pearson Pub.
[T2] M. Ercegovac, T. Lang and L.J. Moreno, "Introduction to Digital Systems", Wiley,2000

Reference Book(s):

[R1] Digital Design by Frank Vahid, Wiley, 20063.
[R2] Introduction to Digital Systems by M. Ercegovac, T. Lang and L.J. Moreno, Wiley, 2000.
[R3] Fundamental of digital Logic with Verilog design by S. Brown & Z. Vransesic, TMH.
[R4] Design through Verilog HDL by T.R. Padmanabhan & B. Bala Tripura Sundari, Wiley Pub. 2007

Paper Code: MERA-603	**L**	**T**	**C**
Subject: Robotics Engineering	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I-Introduction

History of robots, Classification of robots, Present status and future trends. Basic components of robotic system. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Mechanisms and transmission, End effectors, Grippers-different methods of gripping, Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, Cam type gripper, Magnetic grippers, Vacuum grippers, Air operated grippers; Specifications of robot.

UNIT II- Drive systems and Sensors

Drive system- hydraulic, pneumatic and electric systems

Sensors in robot – Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.

UNIT II- Kinematics and Dynamics of Robots

2D, 3D Transformation, Scaling, Rotation, Translation, Homogeneous coordinates, multiple transformation, Simple problems.

Matrix representation, Forward and Reverse Kinematics Of Three Degree of Freedom, Homogeneious Transformations, Inverse kinematics of Robot,Robot Arm dynamics, D-H representationof robots, Basics of Trajectory Planning.

UNIT IV-Robot Control, Programming and Applications

Robot controls-Point to point control, Continuous path control, Intelligent robot, Control system for robot joint, Control actions, Feedback devices, Encoder, Resolver, LVDT,Motion Interpolations, Adaptive control.

Introduction to Robotic Programming, On-line and off-line programming, programming examples.

Robot applications-Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting.

References:

[1.] S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009.
[2.] Mikell P Groover& Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
[3.] Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
[4.] Francis N. Nagy, AndrasSiegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.
[5.] P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995.
[6.] Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.
[7.] Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics control,sensing, vision and intelligence", McGraw Hill Book co, 1987
[8.] Craig. J. J. "Introduction to Robotics mechanics and control", Addison- Wesley, 1999.
[9.] Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons Inc.,1985.
[10.] Bharat Bhushan., "Springer Handbook of Nanotechnology", Springer, 2004.
[11.] Julian W. Gardner., "Micro sensor MEMS and Smart Devices", John Wiley & Sons, 2001

Paper Code: MEVS-603	**L**	**T**	**C**
Subject: VLSI Technology	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Clean room technology - Clean room concept – Growth of single crystal Si, surface contamination, Chemical Mechanical Polishing, wafer preparation, DI water, RCA and Chemical Cleaning. Processing considerations: Chemical cleaning, getting the thermal Stress factors etc.

Epitaxy: Physical Vapour Deposition, Vapors phase Epitaxy Basic Transport processes & reaction kinetics, doping & auto doping, equipments, & safety considerations, epitaxial defects, molecular beam epitaxy, equipment used, film characteristics, SOI structure.

UNIT II

Oxidation: Growth mechanism & kinetics, Silicon oxidation model, interface considerations, orientation dependence of oxidation rates thin oxides. Oxidation technique & systems dry & wet oxidation. Masking properties of SiO_2.

Diffusion: Diffusion from a chemical source in vapor form at high temperature, diffusion from doped oxide source, Ion Implantation, Annealing and diffusion from an ion implanted layer.

UNIT III

Lithography

Optical Lithography: optical resists, contact & proximity printing, projection printing, electron lithography: resists, mask generation. Electron optics: roster scans & vector scans, variable beam shape. X-ray lithography: resists & printing, X ray sources & masks. Ion lithography.

UNIT IV

Etching

Reactive plasma etching, AC & DC plasma excitation, plasma properties, chemistry & surface interactions, feature size control & apostrophic etching, ion enhanced & induced etching, properties of etch processing. Reactive Ion Beam etching, Specific etches processes: poly/polycide. Trench etching.

Metallisation - Different types of metallization, uses & desired properties

Text Book(s):

[T1] S.M. Sze, “VLSI Technology”, John Wiley & Sons, 2000.

Reference Book(s):

[R1] B.G. Streetman, “SolidState Electronics Devices”, Prentice Hall, 2002.
[R2] Wai-KaiChen,“VLSI Technology” Wiley, March 2003

Paper Code: MEVS-613	**L**	**T**	**C**
Subject: Wireless Networks	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction to Personal Communication Services (PCS): PCS architecture, Mobility management, Networks signaling.

Global system for Mobile Communication (GSM) system overview: GSM Architecture, Mobility Management, Network signaling.

UNIT II

General Packet Radio Services (GPRS): GPRS architecture, GPRS Network nodes. Enhanced Data rates for GSM Evolution (EDGE), Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, Wireless Markup Languages (WML).

UNIT III

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G. Fourth Generation (4G) Mobile services: Introduction to Long Term Evaluation (LTE), Orthogonal Frequency Division Multiple Access (OFDMA), Multi-In Multi-Out Antenna system (MIMO), LTE-Advanced

Wireless local Loop (WLL): Introduction to WLL architecture, WLL technologies, WMAN (Wireless MAN), IEEE802.16 standard, WiMAX

UNIT IV

Global Mobile Satellite Systems: Case studies of IRIDIUM and GLOBALSTAR systems.

Bluetooth technology. Wireless Sensor Networks: Introduction, Architecture, ZigBee protocol, Applications.

Text Book(s):

[T1] Yi –Bing Lin & Imrich Chlamatac, “Wireless and mobile Networks Architecture,” John Wiley & Sons Publication, 2001.
[T2] Raj Pandya, “Mobile & Personnel communication Systems and Services”, Prentice Hall India, 2001.
[T3] Theodore S. Rappaport, “Wireless Communication- Principles and practices,” 2nd Ed. Pearson Education Pvt. Ltd, 2003.
[T4] Jochen Schiller, “Mobile communications,” Pearson Education Pvt. Ltd., 2002.
[T5] Singhal & Bridgman, “The Wireless Application Protocol,” Pearson Education, 2004.

References Book(s):

[R1] Hensmann, Merk, & Stober, “Principles of Mobile Computing,” 2nd Ed., Springer International Edition, 2003.
[R2] Talukdar & Yaragal, “Mobile Computing,” TMH, 2005.
[R3] Smith & Collins, “3G Wireless Networks,” TMH, 2007.

Paper Code: MECS-606	**L**	**T**	**C**
Subject: Advanced Algorithm Analysis & Design	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Review of various Design and Analysis Techniques and their comparisons: Overview of Divide-and-Conquer, Dynamic Programming and Greedy Algorithms, Comparison of dynamic programming and Greedy algorithm with Knapsack as case study Theoretical foundation of greedy algorithm, Matroids and Greedy methods, A Task Scheduling problem as a Matroid. Comparisons of all techniques with reference to their time complexity, space complexity, guaranteed optimization and Stability.

UNIT II

Review of Graph Theory, Internal Representations, Traversal algorithms, Tree, Spanning tree generation.
Maximum Flow: Flow networks, The ford-fulkerson method, Maximum bipartite matching, Push-Rebel Algorithms, The relable-to-front algorithms.
Computational Geometry: Line segments properties, determining whether any pair of segment intersects, Finding a convex hull, finding the closest pair of points

UNIT III

Matrix Operations: Solving system of linear equation, Inverting Matrices, Symmetric positive-definite matrices and least square approximation
Polynomial and FFT: Representation of polynomials, The DFT and FFT, efficient FFT implementation
Number–Theoretic Algorithm: Elementary number-theoretic notion, Greatest common divisor, modular arithmetic, solving modular linear equation, the Chinese remainder theorem, Power of an element, The RSA public-key cryptosystem, Primality testing, Integer Factorization.

UNIT IV

NP-Completeness, Polynomial time, Polynomial time verification, NP completeness and reducibility, NP-Completeness proofs. Few examples NP complete problems.
Approximation Algorithms- the vertex-cover problem, The Traveling-Salesman Problem, The set covering problem, Randomization and linear programming, Subset-sum problem.

Text Book(s):

[T1] T. H. Cormen, C. E. Leiserson, R.L. Rivest, C. Stein, "Introduction to Algorithms", 2nd Edition, PHI.

Reference Book(s):

[R1] A.V. Aho, J. E. Hopcroft, J.D. Ulman, "The Design & Analysis of Computer Algorithms", Addison Wesley.
[R2] V. Manber, "Introduction to Algorithms – A Creative Approach", Addison Wesley.
[R3] Ellis Harwitz and SartazSahani, "Fundamentals of Computer Algorithms", Galgotia.

Paper Code: MEDC-602	**L**	**T**	**C**
Subject: Advanced Information Theory & Coding	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Measure of Information, Information contents of discrete memoryless sources, Entropy & Mutual Information, Source coding theorem: Huffman coding, Shannon-Fano coding, Lempel-Ziv algorithm, Prefix codes,

UNIT II

Channel Coding theorem, Channel capacity theorem, Channel models, BSC, DMC, Lossless, Noiseless channels, Linear Block codes, Systematic & Non-Systematic codes, Repitition codes, Hamming codes, Cyclic codes, Cyclic Redundancy check (CRC) codes, Golay codes, BCH Codes, Read-Solomon codes.

UNIT III

Convolutional codes, Polynomial representation of Convolutional codes, Tree, State and Trellis diagrams, Maximum-likelihood/ Viterbi Decoding of Convolutional codes, Concept of Interleaving, Turbo Codes, Turbo decoding,

UNIT IV

Combined coding and Modulation, Trellis Coded Modulation (TCM), Mapping by set partitioning, TCM decoder, TCM for fading channels, Concept of Space time Trellis Codes.

Text Book(s):

[T1] Information Theory, Coding and Cryptography By Ranjan Bose, Tata McGraw Hill, 2002.
[T2] Introduction to Error Control Codes by Salvatore Gravano, Oxford University Press

Reference Book(s):

[R1] Information Theory, Inference, and Learning Algorithms By David J.C. MacKay, Cambridge University Press, 2003.
[R2] Entropy & Information Theory by Robert M Gray, Springer-Verlag, Newyork, INC, 1990.

Paper Code: MEIT-602	**L**	**T**	**C**
Subject: Advanced Mobile Computing	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

3. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
4. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction: Short history of wireless communication, Applications, Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread Spectrum, Cellular systems (DSSS & FHSS).
Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access
Mobile Computing Architecture: Three Tier Architecture for mobile computing, Design considerations, Mobile Computing through Internet. File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Mobile File System, Mobile databases.

UNIT II

Wireless LAN and Blue tooth(IEEE 802.11,802.15)Wireless LAN: Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks : System architecture, Protocol architecture, Physical layer, Medium Access Control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control sub layer, Medium Access Control sub layer, Information bases and Networking.
Bluetooth: User Scenarios, Physical Layer, MAC layer, networking. Security, link management, Enterprise PCS: Office Level , Local Area Wireless: An Example of WPBX, Capacity Planning for WPBX, IrDA ZigBee, RFID, Wireless Broadband (WiMax)

UNIT III

Mobile Network and Transport Layers Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol, Dynamic Host Configuration Protocol - Routing – DSDV – DSR – Alternative Metrics.
Mobile Transport Layer: Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.

UNITIV

Support for Mobility: Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, WAPUAProf and Caching , User Agent Profile , Caching Model , Wireless Bearers for WAP , WAP Developer Toolkits and application environment, Wireless telephony application, Mobileagents, Application Server, Gateways, Portals, Service Discovery, Device Management Language Support: Hypertext markup language (XHTML)-MP, Wireless mark-up language; WML script, Mobile Application Languages-XML, Voice XML. Java, J2ME and JavaCard.
Wireless devices and their Operating System: Palm OS; Windows CE; EPOC; Symbian OS; Linux for Mobile Devices. Mobile Agents
Synchronization: Synchronization Software for Mobile Devices, Synchronization Protocols,
SyncML-Synchronization Language for Mobile Computing. Introduction to Threats and Security Issues in Mobile Computing

Text Book(s):

1. Jochen Schiller, "Mobile communications", Addison wisely, Pearson Education.
2. Yi Bang Lin and Imrich Chlamtech , “Wireless and Mobile Network Architecture”, Wiley.
3. Raj Kamal, “Mobile Computing”, Oxford.

Reference Book(s):

1. Rappaort, "Wireless Communications Principals and Practices”.
2. P. Nicopolitidis, "Wireless Networks”, John Wiley.
3. K. Pahlavan, P. Krishnamurthy, "Principles of Wireless Networks".
4. Reza B’Far, “Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML”, Cambridge University Press, 2005.
5. Uwe Hansmann, Lothar Merk, Martin S. Nicklous, Thomas Stober, “Principles of Mobile Computing”, Springer.
6. Evaggelia Pitoura and George Samaras, “Data Management for Mobile Computing”, Kluwer Academic Publishers, 1998.

Paper Code: MEEC-604	**L**	**T**	**C**
Subject: Advanced Signal Processing	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Discrete Time Signals and Systems, Frequency Domain Representation, Z-Transforms, Discrete Fourier Transforms, Impulse Response and Transfer functions, Convolution and Correlation.

UNIT II

IIR Filter Design: Filter Approximation, Impulse Invariant Method, Bi-linear Transformation method filter structures, Finite word length effects, limitations of IIR filters. FIR Filter Design: Linear phase response, Windowing technique, Gibb's Phenomenon, Frequency Sampling Method, FIR Filter structures.

UNIT III

Frequency Domain Realization of Digital Filters, Radix-2 FFT Algorithm. Introduction to Multirate digital signal processing

UNIT IV

Power Spectrum Estimation, Classical Spectral Estimation, Parametric Modeling - AR, MA, ARMA methods, Minimum variance spectral estimations. Principles of DSP Architecture.

Text Book(s):

[T1] G. J. Proakis and D. G. Manolakis, "Digital Signal Processing, Principles, algorithms and applications", 4th ed. Pearson Education.
[T2] S. K. Mitra, " Digital Signal Processing" 3rd ed. TMH.

References Book(s):

[R1] A.V. Oppenheim and R.W. Schafer "Discrete Time Signal Processing", PHI 1992.
[R2] Steven M. Kay "Modern Spectral Estimation", PHI 1988.
[R3] Clark Cory.L, "Lab view DSP and Digital comm.", TMH 2005.
[R4] Roman Kuc "Introduction to Digital Signal Processing", McGraw Hill 1988

Paper Code: MEIT-604	**L**	**T**	**C**
Subject: Advanced Software Project Management	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction to Software Project Management: Software development as a project; Stakeholders in software project; Software product, process, resources, quality, and cost; Objectives, issues, and problems relating to software projects. Overview of Project Planning: Steps in project planning; Defining scope and objectives; work breakdown structure; Deliverables and other products; time, cost, and resource estimation; Alternatives in planning, Project Evaluation: Strategic assessment; Technical assessment; Cost-benefit analysis; Cash flow forecasting; Cost-benefit evaluation techniques; Break-even analysis; Risk evaluation Selection of Appropriate Project Approach: Choosing development technology and methodology; choice of process model; Rapid application development; Waterfall model; V-process model; Spiral model; Prototyping,; Incremental delivery.

UNIT II

Software Effort Estimation : Problem in software estimation; Effort estimation techniques; Expert judgement; Estimation by analogy; Delphi technique; Algorithmic methods; Top-down and bottom-up estimation; Function point analysis; Object points; COCOMO model.

Activity Planning : Network planning model; Activity-on-arrow network; Precedence network; Forward pass; Backward pass; Critical path; Slack and float. Risk Analysis and Management : Nature and categories of risk in software development; risk Identification; Risk assessment; Risk mitigation, monitoring, and management; Evaluating schedule risk using PERT.

UNIT III

Recourse Allocation : Nature of project resources; Identifying resource requirement of activities; Allocating and scheduling resources; cost of resources; Standard, planned, and actual cost; Cost variance; time-cost trade-off. Project Tracking and Control: Measurement of physical and financial progress; Earned value analysis; Status reports; Milestone reports; Change control. Contact Management: Outsourcing of products and services; Types of contracts; Stages in contract placement; Terms of contract; Contract monitoring; Acceptance testing

UNIT IV

Managing People and Organizing Teams: Organizational behaviour; Recruitment and placement; Motivation; Group behaviour; Individual and group decision making; Leadership and leadership styles; forms of organizational structures. Software Quality Assurance: Planning for quality; Product versus process quality management; Procedural and quantitative approaches; Defect analysis and prevention; Statistical process control; Pareto analysis; Causal analysis; Quality standards; ISO 9000; Capability Maturity Model; Quality audit. Configuration Management: Configuration management process; Software configuration items; Version control; change control; Configuration audit; Status reporting.

Text Books:

[T1] Bob Hughes and Mike Cotterell, “Software Project Management”, Third Edition 2002, McGraw-Hill

[T2] PankajJalote, “Software Project Management in Practice”, 2002, Pearson Education Asia.

Reference Books:

[R1] Roger S. Pressman, “Software Engineering: A practitioner’s Approach”, Fifth Edition 2001 McGraw-Hill

[R2] Robert T. Futrell, Donald F. Shafer, and Linda I.. Shafer, “Quality Software Project Management”, 2002, Pearson Education Asia.

[R3] Ramesh Gopalaswamy, “Managing Global Software Projects”, 2003, Tata McGraw-Hill

Paper Code: MEEC-606	**L**	**T**	**C**
Subject : Advanced VLSI Design	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction: Basic principle of MOS transistor, Introduction to large signal MOS models (long channel) for digital design.

MOS Circuit Layout & Simulation and manufacturing: scaling, MOS SPICE model and simulation, CMOS layout: design rules, Transistor layout, Inverter layout, NMOS and CMOS basic manufacturing steps.

UNIT II

The MOS Inverter : Inverter principle, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, switching characteristics, Propagation Delay, Power Consumption.

Combinational MOS Logic Design : Static MOS design, Ratioed logic, Pass Transistor logic, complex logic circuits.

UNIT III

Sequential MOS Logic Design

Static latches, Flip flops & Registers, Dynamic Latches & Registers, CMOS Schmitt trigger, Astable Circuits. Memory Design: ROM & RAM cells design **Dynamic MOS design:** Dynamic logic families and performances. **Clock Distribution** Clock Distribution. Input and Output Interface circuits.

UNIT IV

Subsystem design

Design styles, design concepts: Hierarchy, Regularity, Modularity, Locality. CMOS Sub system design: Adders, Multipliers.

Text Book(s):

[T1] S. Kang & Y. Leblebici, "CMOS Digital IC Circuit Analysis & Design", McGraw Hill, 2003.
[T2] J. Rabaey, "Digital Integrated Circuits Design", Pearson Education, Second Edition, 2003.

Reference Books

[R1] Neil Weste and David Harris: "CMOS VLSI design" Pearson Education 2009.

Paper Code: MERA-608	**L**	**T**	**C**
Subject: Image Processing	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction & Digital Image Fundamentals: Fundamentals Steps in Digital Image Processing, Components of Digital Image Processing Systems, Applications of Digital Image Processing, Image Sampling and Quantization, Some basic relationships like Neighborhood, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations, stereo imaging and camera calibration.

UNIT II

Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Equalization, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Method, Image Negation.

Image Enhancement in the Frequency Domain:

Introduction to Fourier Transform and its properties, Fast Fourier Transform, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering.

UNIT III

Image Restoration: Model of the Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

Image Compression:

Coding, Inter-pixel and Psycho-visual Redundancy, Image Compression models, Elements of Information Theory, Error free compression, Lossy compression, Image compression standards, Introduction to Video Coding.

UNIT IV

Image Segmentation: Detection of Discontinuities - point, lines and edge segmentation, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation.

Representation and Description:

Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description,

Morphological Image Processing: Erosion and dilation, Some basic Morphological Algorithms.

Refernces:

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2009
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI, 2003.
3. William K. Pratt, "Digital Image Processing", Wiley, 2007.
4. Milan Sonka,VaclavHlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision" 3rd Edition, Cengage Learning, 2008.

Paper Code: MEEC-626	**L**	**T**	**C**
Subject: Fuzzy Logic & Design	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT II

Fuzzy Relations: Crisp & Fuzzy Relations, Projections & Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on single set, Equivalence, Compatibility & Ordering Relations, Morphisms, Fuzzy Relation Equations.

Unit-III

Possibility Theory: Fuzzy Measures, Evidence & Possibility Theory, Possibility versus Probability Theory.

Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Unit-IV

Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp sets, Fuzziness of Fuzzy Sets.

Applications of Fuzzy Logic:

Text Book(s):

[T1] G. J. Klir, Yuan, "Fuzzy Sets and fuzzy logic, Theory and applications", Prentice Hall India, 1995.

Reference Book(s):

[R1] John Yen, Reza Langari, "Fuzzy Logic Intelligence, Control and Information", Pearson Education, 2006.
[R2] Ross, "Fuzzy Logic with Engineering Applications", 2nd Edition, John Wiley, 2004.
[R2] H. Zimmermann, "Fuzzy Set Theory and its application

Paper Code: MEEC-610	**L**	**T**	**C**
Subject : Microwave Integrated Circuits	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Classification of transmission lines: Planar, quasiplanar and 3-D structures, their basic properties, field distribution and range of applications. Types of MICs and their technology, Propagating models, Analysis of MIC by conformal transformation Numerical analysis, Hybrid mode analysis, Substrate materials and fabrication steps in MIC

UNIT II

Introduction to microstrip line, slot line and coplanar wave guide

Microstrip circuit design: Introduction, Impedance transformers, Directional couplers, branch line couplers, filters, resonators. Design and Fabrication of Lumped elements for MICs, Comparison with distributed circuits

UNIT III

Non-reciprocal components and active devices for MICs: Ferromagnetic substrates and inserts, Microstrip circulators, Phase shifters, Microwave transistors, Parametric diodes and Amplifiers, PIN diodes, Transferred electron devices, IMPATT, BARITT, Avalanche diodes

UNIT IV

MMIC technology: Fabrication process of MMIC, Hybrid MICs, Configuration, Dielectric substances, thick and thin film technology, Testing methods, Encapsulation and mounting of Devices.

Text Book(s):

[T1] Microwave Engineering using Microstrip Circuits – E H Fooks, R A Zakarevicius-prentice Hall
[T2] Microwave Microwave Engineering By D.M.Pozar,

Reference Books:

[R1] G. Gonzalez, Microwave Transistor Amplifiers: Analysis and Design, 2nd ed., Prentice Hall, 1996. Reference
[R2] Liao S.Y.: Microwave Circuits & Devices. PHI
[R3] Hoffman R.K."HandBook of Microwave Intergrated Circuits", Artech House, Boston,1987
[R4] B.Bhat and Stripline-like transmission lines for MICs, John Wiley, 1989.

Paper Code: MECS-602	**L**	**T**	**C**
Subject ; Object Oriented Analysis & Design	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Object Oriented Design Fundamentals: The object model - Classes and Objects, Complexity ,Classification, Notation, Process - Pragmatics - Binary and entity relationship, Object types - Object state, OOSD life cycle

UNIT II

Object Oriented Analysis: Overview of Object Oriented Analysis, Shaler/Mellor, Coad/Yourdon, Rumbagh, Booch's Approach towards the analysis, UML ,Usecase, Conceptual model, Behaviour ,Class, Analysis patterns, Overview, Diagrams, Aggregation.

UNIT III

Object Oriented Design Methods: Unified Modeling Language : UML –static view, Dynamic view, Model Management View, UML Diagrams, Collaboration - Sequence - Class - Design patterns and frameworks - Comparison with other Design methods

UNIT IV

Managing Object Oriented Development Managing analysis and design - Evaluation testing - Coding - Maintenance Metrics, case Studies In Object Oriented Development Design of foundation class libraries - Object Oriented databases - Client/Server computing - Middleware.

Text Book(s):

[T1] Craig Larmen, Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development, Prentice Hall (2004)

[T2] Booch G., Rambaugh J., Jacobson Ivar, The Unified Modeling Language User Guide, Pearson Education (2003)

Reference Books:

[R1] Yogesh Singh, RuchikaMalhotra , Object oriented software engineering, PHI 2012

[R2] Booch G, Maksimchuk, Engel, Young, Conallen and Housten, Object Oriented Analysis and Design with Applications, Addison Wesley Professional (2007)

[R3] Booch G., Object Oriented Analysis and Design, Addision Wesley (1994)

Paper Code: MERA-618	**L**	**T**	**C**
Subject: Optimization Techniques		**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction: Statement of an Optimization problem, Classification of Optimization problems

Classical Optimization Techniques: Single variable optimization, Multivariable optimization with no constraints– Hessian matrix, Multivariable saddle point, Optimization with equality constraints – Lagrange multiplier method, Multivariable optimization with inequality constrains – Kuhn-Tucker conditions.

UNIT II

One-Dimensional Minimization Methods: Elimination Methods, UnrestrMEed Search Method, Fibonacci Methods, Interpolation Methods – Quadratic and Cubic Interpolation Methods

Integer Programming: Gomory's Cutting Plane Method for Integer Linear Programming, Formulation and Solution of Integer Polynomial and Non-linear problems.

UNIT III

Unconstrained Minimization Methods: Univariate and pattern search method, steepest descent method, Newton method, Powell method.

Constrained Minimization Methods: Characteristics of a constrained problem, Direct Methods of feasible directions, Indirect Methods of interior and exterior penalty functions

UNIT IV

Genetic Algorithm: Introduction to GA, fitness function, GA operators, Unconstrained and constrained optimization using Genetic algorithm, Global optimization using GA.

Text Books

[T1] "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.

[T2] Optimization Concepts and Applications in Engineering – Ashok D.Belegundu and Tirupathi R Chandrupatla — Pearson Education.

References Book(s):

[R1] "Operations Research: An Introduction" – by H.A. Taha, PHI Pvt. Ltd., 6th edition

[R2] "Optimization for Engineering Design: Algorithms and Examples", Kalyanmoy deb, PHI publication

[R3] "Genetic Algorithm in Search Optimization and Machine Learning", D.E. Goldberg, Addision-Wesley Publication, 1989

Paper Code: MECS-612	**L**	**T**	**C**
Subject: Soft Computing	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction: Introduction to Soft Computing Concepts, Importance of tolerance in imprecision and uncertainty, Soft Computing Constituents and Conventional Artificial Intelligence, From Conventional AI to Computational Intelligence, Fuzzy Set Theory, Neural Networks and Evolutionary Computation

Neural Networks: Overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

UNIT II

Introduction to Fuzzy Sets: Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations,
Aggregation Operations.

Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets, Defuzzyfication.

UNIT III

Evolutionary Computation: Genetic Algorithms and Genetic Programming, Evolutionary Programming, Evolutionary Strategies and Differential Evolution Coevolution, Different operators of Genetic Algorithms, Analysis of Selection Operations, Convergence of Genetic Algorithms

UNIT IV

Rough Sets: Introduction, Imprecise categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.

Hybrid Systems: Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks. Fuzzy Logic bases Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

Text Book(s):

[T1] Anderson J.A, "An Introduction to Neural Networks", PHI, 1999.
[T2] Hertz J. Krogh, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.

Reference Book(s):

[R1] "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey,1999.
[R2] Freeman J.A. & D.M. Skapura. "Neural Networks: Algorithms, Applications and Programming Techniques", Addison Wesley, Reading, Mass, (1992).
[R3] G.J. Klir& B. Yuan, "Fuzzy Sets & Fuzzy Logic", PHI, 1995.
[R4] Melanie Mitchell, "An Introduction to Genetic Algorithm", PHI, 1998.

Paper Code: MECS-616	**L**	**T**	**C**
Subject: Software Metrics	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT I

Introduction:

What is measurement and why do it? Measurement in software engineering, scope of software metrics.

The Basics of Measurement:

Representational theory, Measurement & Models, Measurement Scales and Scale Types, Meaningfulness in Measurement

UNIT II

A Goal Framework for Software Measurement:

Classifying software measures, Determining what to measure, Applying the framework Empirical Investigation & Data Collection:

Four Principles of Investigation, Planning formal experiments, What is good data, How to define the data, How to collect data, When to collect data.

UNIT III

Analyzing Software Measurement Data:

Analyzing the results of experiments, Analysis Techniques, Overview of statistical tests.Measuring Internal Product Attributes, Size and Structure:

Aspects of Software Size, Length, Reuse, Functionality, Complexity, Types of Structural Measures, Modularity and information flow attributes, Object Oriented Metrics

UNIT IV

Measuring External Product Attributes:

Modeling Software Quality, Measuring aspects of quality

Measurement and Management:

Planning a measurement program, Measurement in practice, empirical research in software engineering.

Text Book(s):

[T1] Norman E. Fenton & Shari Lawrence Pfeiffer, "Software Metrics", Thomson Computer Press, 1996.

Reference Books:

[R1] Norman E. Fenton, "Software Metrics: A Rigorous and Practical Approach", International Thomson Computer Press, 1996.

[R2] B. Henderson-Sellers, "Object-Oriented Metrics, Measures of Complexity", Prentice Hall, 1996.

[R3] Kishore, Swapna, "Software Requirement and Estimation", Tata McGraw Hill, 2001

Paper Code: MECS – 608	**L**	**T**	**C**
Subject: Software Requirements& Estimation	**4**	**0**	**4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 75**

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.

Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks

UNIT I

Introduction to software life cycle, Management activities in a software project,

Requirements engineering: Requirements Elicitation, Requirement Elicitation techniques, Requirement Analysis, Requirement Analysis Models, Requirement Documentation, Requirement Management

UNIT II

Size Estimation: Function Point Analysis from DFD's, ER diagram, Function Point Analysis from Use Case Diagram & Class Diagram, Mask II FPA, LOC estimation, Conversion between size measures

UNIT III

Effort, schedule & cost estimation: Estimation factors, COCOMO-II, Estimation by Analogy, Validating Software Estimates

Tools: Software Estimation Tools

UNIT IV

Industry Resources; IFPUG, UQAM-SEMRL, COSMIC, IEEE, Two latest Research papers to be covered

Text Books:

1. Kishore, Swapna, “Software Requirements and Estimation”, Tata McGraw Hill, 2001

Reference Books:

1. Norman E. Fenton, “Software Metrics: A Rigorous and Practical Approach”, International Thomson Computer Press, 1996.
2. B. Henderson-Sellers, “Object-Oriented Metrics, Measures of Complexity”, Prentice Hall, 1996.

Paper Code: MERA-606	**L**	**T**	**C**
Paper: Artificial Intelligence	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

Unit-I

Introduction:

Introduction to artificial intelligence and intelligent agents, categorization of AI

Problem solving:

Production systems and rules for some AI problems: water jug problem, missionaries-cannibals problem etc.

Solving problems by searching: state space formulation, depth first and breadth first search, iterative deepening

Unit-II

Intelligent search methods:

A* and its memory restricted variants

Heuristic search:

Hill climbing, best-first search, problem reduction, constraint satisfaction.

Game Playing:

Minimax, alpha-beta pruning

Unit-III

Knowledge and reasoning:

Propositional and first order logic, semantic networks, building a knowledge base,
inference in first order logic, logical reasoning systems

Planning:

Components of a planning system, goal stack planning, non-linear planning strategies, probabilistic reasoning systems, Baysian networks

Unit-IV

Learning:

Overview of different forms of learning, Inductive learning, learning decision trees, computational learning theory,

Artificial neural networks.

Evolutionary computation: Genetic algorithms, swarm intelligence, particle swarm optimization.

Applications:

Robotics, Natural language processing etc.

Text Book:

1. Rich and Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2014

Reference book:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, 2011.
2. Deepak Khemani, "A First Course in Artificial Intelligence", Tata McGraw Hill, 2013.
3. S. Russel and P.Norvig,"AI: A modern approach", 3rd Edition, Pearson Education, 2009.

Paper Code: MERA-721	**L**	**T**	**C**
Paper: Machine Learning	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT-I

Introduction: well posed learning problem, designing a learning system: training experience, target function, final design. Issues in machine learning

Concept, Learning and General to specific ordering: concept learning task, concept learning as search, version spaces and candidate elimination, inductive bias

UNIT-II

Decision Tree learning (DTL): introduction, decision tree representation, problems for DTL, DTL algorithm, hypothesis space search, inductive bias in DTL, issues in DTL.

Bayesian Learning: Introduction, Bayes Theorem, concept learning, least square hypothesis, predicting probabilities, Bayes optimal classifiers, EM algorithm

UNIT-III

Instance Based Learning: introduction, K-nearest neighbor learning, locally weighted regression, case based reasoning.

Learning set of rule: introduction, sequential covering algorithm, learning rule sets, first order rules

UNIT-IV

Analytical learning: introduction, perfect domain theory, explanation based learning. Inductive analytical approaches to learning.

Text Book:

1. Machine learning by Tom M. Mitchell, McGraw Hill 1997

References:

1. Introduction to machine learning: EthemAlpaydin PHI learning, 2008
2. Pattern Recognition by RajjanShinghal, Oxford Press, 2006
3. Pattern Classification - Duda, Hart and Stork, 2000
4. The Elements of Statistical Learning - Hastie, Tibshirani, Friedman, Springer 2001

Paper Code: MECS – 703	**L**	**T**	**C**
Subject: Advanced Software Testing	**4**	**0**	**4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 75**

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.

Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks

UNIT I

Introduction: Testing Process, Terminologies: Error, Fault, Failure, Test Cases, Testing Process, Limitations of Testing, Graph Theory: Graph, Matrix representation, Paths and Independent paths, Generation of graph from program, Identification of independent paths.

Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

Unit - II

Structural Testing: Control flow testing, Path testing, Data Flow Testing, Slice based testing, Mutation Testing

Software Verification: Verification methods, SRS verification, SDD verification, Source code reviews, User documentation verification, Software project audit,

Unit- III

Creating Test Cases from Requirements and use cases:

Use case diagram and use cases, Generation of Test cases from use cases, Guidelines for generating validity checks, Strategies for data validating, Database testing, Regression Testing: What is Regression Testing?, Regression test cases selection, Reducing the number of test cases, Risk analysis, Code coverage prioritization technique

Software Testing Activities: Levels of Testing, Debugging, Software Testing Tools, and Software test Plan

Unit- IV

Object oriented Testing: What is Object orientation?, What is Object Oriented testing?, Path Testing, State Based Testing, Class Testing, Testing Web Applications: What is Web testing?, Functional Testing, User interface Testing, Usability Testing, Configuration and Compatibility Testing, Security Testing, Performance Testing, Database testing, Post Deployment Testing , Web Metrics

Automated Test Data Generation: What is automated test data generation? Approaches to test data generation, Test data generation, using genetic algorithm, Test Data Generation Tools.

Text Books:

1. Yogesh Singh, "Software Testing", Cambridge University Press, New York, 2012
2. CemKaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993.

Reference Books:

1. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 1995.
2. K.K. Aggarwal&Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2005
3. Louise Tamres, "Software Testing", Pearson Education Asia, 2002
4. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
5. Boris Beizer, "Black-Box Testing – Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc., New York, 1995.
6. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.
7. Gordon Schulmeyer, "Zero Defect Software", McGraw-Hill, New York, 1990.
8. Watts Humphrey, "Managing the Software Process", Addison Wesley Pub. Co. Inc., Massachusetts, 1989.
9. Boris Beizer, "Software System Testing and Quality Assurance", Van Nostrand Reinhold, New York, 1984.
10. Glenford Myers, "The Art of Software Testing", John Wiley & Sons Inc., New York, 1979.
11. Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
12. Louise Tamres, "Software Testing", Pearson Education Asia, 2002

Paper Code: MECS – 711 **L T C**
Subject: Software Quality Management **4 0 4**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 75
Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks

UNIT I
Concepts and Overview: Concepts of Software Quality, Quality Attributes, Software Quality Control and Software Quality Assurance, Evolution of SQA, Major SQA activities, Major SQA issues, Zero defect Software.
Software Quality Assurance: The Philosophy of Assurance, The Meaning of Quality, The Relationship of Assurance to the Software Life-Cycle, SQA Techniques.

UNIT II
Tailoring the Software Quality Assurance Program: Reviews, Walkthrough, Inspection, and Configuration Audits.
Evaluation: Software Requirements, Preliminary design, Detailed design, Coding and Unit Test, Integration and Testing, System Testing, types of Evaluations.
Configuration Management: Maintaining Product Integrity, Change Management, Version Control, Metrics, Configuration Management Planning.

UNIT III
Error Reporting: Identification of Defect, Analysis of Defect, Correction of Defect, Implementation of Correction, Regression Testing, Categorization of Defect, Relationship of Development Phases.
Trend Analysis: Error Quality, Error Frequency, Program Unit Complexity, Compilation Frequency.

UNIT IV
Corrective Action as to Cause: Identifying the Requirement for Corrective Action, Determining the Action to be Taken, Implementing the Correcting the corrective Action, Periodic Review of Actions Taken.
Traceability, Records, Software Quality Program Planning, Social Factors: Accuracy, Authority, Benefit, Communication, Consistency, and Retaliation.

Text Books:
1. Robert Dunn, “Software Quality Concepts and Plans”, Prentice-Hall, 2003.
2. Alan Gillies, “Software Quality, Theory and Management”, Chapman and Hall, 2004.

Reference Books:
1. Michael Dyer, “The Cleanroom approach to Quality Software Engineering”, Wiley & Sons, 1992.
2. Daniel Freedman, Gerald Weinberg, “Handbook of Walkthroughts, Inspections and Technical Reviews”, Dorset House Publishing, 1990.
3. Tom Gilb, “Principles of Software Engineering Management”, Addison-Wesley, 1988.
4. Tom Gilb, Dorothy Graham, “Software Inspection” Addison-Wesley, 1993.
5. Watts Humphrey, “Managing the Software Process”, Addison-Wesley, 1990.
6. Watts Humphrey, “A Discipline for Software Engineering”, Addison-Wesley, 1995.
7. Arthur Lowell, “Improving Software Quality An Insider’s guide to TQM”, 1993, Wiley & Sons

Paper code: MERA-602	**L**	**T**	**C**
Subject: Mobile Robots	**4**	**0**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.

Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT-I Introduction of Mobile Robotics, Mechanics and Locomotion: A brief history of mobile robotics, applications and market. Recent advances in the mobile robotics for RISE (Risky Intervention and Surveillance Environment) applications, Locomotion, Key issues in locomotion, legged, wheeled and aerial mobile robots.

Mobile Robot Kinematics: Introduction, kinematic models and constrains, mobile robot workspace, beyond basic kinematics, motion control (kinematic control). [T1, T2, T3]

UNIT-II Perception, robotics Architectures and Robot Learning: Sensors Classification, sensor characterization, wheel/motor encoders, heading/orientation sensors, ground based beacons, active ranging, motion/speed sensors, vision based sensors. Low level control, Control architectures, software frameworks, Robot Learning, case studies of learning robots. [T1, T2, T3]

UNIT-III Mobile Robot Localization: Introduction, the challenge of localization: Noise and aliasing, to localize or not to localize: localization based navigation versus programmed solutions, map representation, probabilistic map, map based localization, autonomous map building. Planning and navigation: Planning and reaction, obstacle avoidance, D* algorithm, Navigation architecture, case studies. [T1, T2, T3, R2]

UNIT-IV Introduction to image processing: Introduction to computer vision, Image processing: Point operators, Linear Filters, More neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations. Camera Systems in Machine : Camera Technology, History in Brief, Machine Vision versus closed Circuit Television (CCTV), Sensor Technologies, spatial Differentiation: 1D and 2D, CCD Technology, Full Frame Principle, Frame Transfer Principle, Interline Tranfer, Interlaced Scan Interline Transfer, Frame Readout. [T1, T2, T3, R1]

Text Books:

[T1] Roland Siegwart & Illah R. Nourbakhsh, “Introduction to autonomous mobile robots”, Prentice Hall of India, 2004.

[T2] George A. Bekey “Autonomous Robots” MIT Press.

[T3] Howie Choset, Kevin M. Lynch, Seth Hutchinson, George A. Kantor, Wolfram Burgard, Lydia E. Kavrakiand Sebastian Thrun, "Principles of Robot motion: Theory, Algorithm and Implementations", MIT Press.

Reference Books:

[R1] Richard Szeliski: “Computer Vision : Algorithms and Applications”, 2010 Springer.

[R2] Alexander Hornberg: “Handbook of Machine Vision”, Wiley-VCH

Paper code: PhDICT-102 **L T C**
Subject: STATISTICAL COMPUTING **4 0 4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

Unit-I

Probability Theory: Sample Spaces- Events - Axioms – Counting - Conditional Probability and Bayes' Theorem – The Binomial Theorem – Random variable and distributions : Mean and Variance of a Random variable-Binomial-Poisson-Exponential and Normal distributions. Curve Fitting and Principles of Least Squares- Regression and correlation.

Unit-II

Sampling Distributions & Descriptive Statistics: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Sampling distributions (Chi-Square, t, F, z). Test of Hypothesis- Testing for Attributes – Mean of Normal Population – One-tailed and two-tailed tests, F-test and Chi-Square test - - Analysis of variance ANOVA – One way and two way classifications. Tabular data- Power and the computation of sample size-

Unit-III

Advanced data handlingMultiple regression- Linear models- Logistic regression- Rates and Poisson regressionNonlinear curve fitting. Density Estimation- Recursive Partitioning- Smoothers and Generalised Additive Models - Survivals Analysis- Analysing Longitudinal Data- Simultaneous Inference and Multiple Comparisons- Meta-Analysis- Principal Component Analysis- Multidimensional Scaling Cluster Analysis.

Unit-IV

Introduction to R- Packages- Scientific Calculator- Inspecting Variables- Vectors Matrices and Arrays- Lists and Data Frames- Functions- Strings and Factors- Flow Control and Loops- Advanced Looping- Date and Times. Introduction to PythonPackages- Fundamentals of Python- Inserting and Exporting Data- Data CleansingChecking and Filling Missing Data- Merging Data- Operations- Joins.

References:

1. Richard Cotton, "Learning R", O'Reilly, 2013.
2. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
3. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, LLC, 2014.
4. Samir Madhavan, "Mastering Python for Data Science", Packt, 2015.
5. Sheldon M. Ross,"Introduction to Probability and Statistics for Engineers and Scientists", 4 th edition, Academic Press; 2009.
6. Paul Teetor, "R Cookbook, O'Reilly, 2011. 7. Mark Lutz ,"Learning Python", O'Reilly,5th Edition,2013

Paper Code: PHDICT-103	**L**	**T**	**C**
Subject: Data Science	**4**	**-**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

Unit -I

Introduction to Data Science:- Big Data and Data Science, Datafication - Current landscape of perspectives, Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R, Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA –

Unit –II

The Data Science Process - Case Study: RealDirect (online real estate firm), Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means, Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web

Unit-III

Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation

Unit -IV

Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs, Data Visualization - Basic principles, ideas and tools for data visualization, Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science

Text Book:

1. Cathy O'Neil and Rachel Schutt, " Doing Data Science, Straight Talk From The Frontline", O'Reilly. 2014.

Reference Books:

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)
5. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
6. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.
7. Carl Shan, Henry Wang, Max Song, and William Chen, The Data Science Handbook, Data Science Bookshelf, 2015

Paper code: PhDICT-104	**L**	**T**	**C**
Subject: Deep Learning	**4**	**0**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

3. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
4. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

Unit-I

Introduction, DL successes, Gradient descent, logistic regression, Probability, continuous and discrete distributors, maximum likelihood, cost function hypothesis and tasks, training data, max. likelihood cost, cross entropy, MSE cost, feed-forward networks, MLP, Sigmoidal units, neuroscience inspiration, outpu vs hidden layers; linear vs non-linear networks, learning via gradient descent; recursive chain rule (backpropagation); if time: bias-variance tradeoff, regularization; output units: linear, softmax; hidden units: tanh, RELU; GPU training, regularization,etc;

Unit-II

RLUs, dropout, batch normalization, How to use the SCC cluster; introduction to Tensorflow..Convolutional neural networks; Convolutional nets continued; case studies; probabilistic methods Applications of Deep Belief Nets and related models recurrent neural networks; sequence modeling; backpropagation through time; vanishing/exploding gradient problem; gradient clipping, long-short term memory (LSTM) more intuition about RNNs, LSTMs; toy addition problem; language modeling; bi-directional RNN

Unit-III

Autoencoders Gated recurrent unit; bi-directional RNN; encoder-decoder RNN; neural machine translation Attention; neural Turing machines; Reading: Neural Turing Machines paper; Neural Machine Translation by Jointly Learning to Align and Translate paper;

Generative Adversarial Networks, Reading: Andrew Ng's reinforcement learning lecture; Andrej Karpathy's blog post on policy gradient; Deep Mind's Playing Atari with Deep Reinforcement Learning paper. image and video captioning vision for autonomous driving

Parsing, Recursive Neural Networks ResNets and WaveNet Gender prediction using character level language models

Unit-IV

Deep reinforcement learning for playing atari games, Deep learning for video multi-classification, Image compression using deep learning, Classifying and recovering for different category images, Efficient deep generative models for unsupervised learning, Single image super-resolution using a generative adversarial network, Conditional video generation with generative adversarial networks, Lung cancer detection, Transfer reinforcement learning using actor-mimic, Data science bowl lung cancer detection, Deep learning for inverse problems, Image-to-image translation with conditional adversarial networks, Popular Approaches to Deep Reinforcement Learning, Discrete neural networks/very low precision weights, Using deep reinforcement learning to play chess

Text book:

1. Deep Learning, by Ian Goodfellow, Yoshua Bengio, Aaron Courville. MIT press

References:

[1.] Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Interscience. 2nd Edition. 2001.
[2.] Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.
[3.] Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.
[4.] Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.
[5.] Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.
[6.] Koller, D. and Friedman, N. Probabilistic Graphical Models. MIT Press. 2009.

Paper code: PhDICT-106 **L T C**
Subject: Advanced Semantic Web **4 0 4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**
Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 23 marks.
Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 13 marks.

UNIT – I
Web and Semantic web origins , basic concepts of web & semantic web, Semantic Web roadmap, it's vision and objectives , from today's web to semantic web, various concerns, Need and possibilities, applications, W3C, contributions of Sir Tim Berner's LEE, myths/hypes/fallacies of semantic web.

UNIT – II
Architecture of Semantic Web (various versions), Gerber's evaluation criteria, various semantic web technologies and tools. XML, XMLS, XML Query Language, RDF as a data model of semantic model, RDFS, RDF/XML, URI, Cryptography concerns and issues.

UNIT – III
Ontology and its operations, Ontology Engineering along with Ontology design and development concerns, Querying the semantic web , SPARQL Query processing, optimization and execution along with implementation illustrations for filtering RDF using Jena and twinkle tool, Linked Open Data and 5-star LOD scheme by Tim Berner's Lee.

UNIT – IV
Significant research concerns of Semantic Web, Semantic Web Services, Software agents, Search Engines, Information Extraction and Retrieval key concerns, Semantic Annotation, NLP, Web usage mining, Social Networks for Network Analysis and visualization using centrality measures, Sentiment Analysis, Semantic browsers, Knowledge Engineering, IOT & SWOT. Key aspects of semantic web programming.

TEXT BOOKS:

[T1] Hebeler, J., and Fisher, A., "Semantic Web Programming" John Wiley & Sons, 2012
[T2] Biffl, Stefan, and Marta Sabou, eds. "Semantic Web Technologies for intelligent engineering applications" Springer, 2016.
[T3] Badr, Youakim, Richard Chbeir, Ajith Abraham, and Aboul-Ella Hassanien, eds. "Emergent web intelligence: Advanced Semantic technologies" Springer, 2010.
[T4] Sikos, Leslie. "Mastering structured data on the Semantic Web: From HTML5 microdata to Linked Open Data" Apress, 2015.
[T5] Akerkar, Rajendra, "Foundations of the semantic Web: XML, RDF & Ontology", Alpha Science International, Ltd, 2009.
[T6] Grigoris Antoniou and Paul Groth, "A Semantic Web Primer", 2012

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[R2] Geroimenko and Chen, "Visualizing the Semantic Web", Springer, 2004.
[R3] Passin, "Explorer's guide to the Semantic Web", Manning, 2004.
[R4] Pascal, Krotzsch and Rudolph, "Foundations of Semantic Web Technologies", SRC Press, 2009.
[R5] Smiraglia R. "Domain analysis for knowledge organization: tools for ontology extraction. Chandos Publishing", 2015
[R6] Diana Maynard, Kalina Bontcheva, Isabelle Augenstein, "Natural Language Processing for the Semantic Web", Morgan & Claypool , 2017.