Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

Group 1		
Sl. No	**Course Code**	**Course Name**
1	16SCE151	Computer Systems Performance Analysis
2	16MCA442	Data Warehousing & Data Mining
3	16SCE152	Distributed Operating System
4	16MCA453	Software Quality Management

Group-2		
Sl. No	**Course Code**	**Course Name**
1	16MCA544	Storage Area Networks
2	16SCS23	Advanced Algorithms
3	16SCE252	Pattern Recognition
4	16SSE24	Software Metrics & Quality Assurance

Group-3		
Sl. No	**Course Code**	**Course Name**
1	16SCS13	Advances in Data Base Management System
2	16SCS11	Advances in Operating Systems
3	16SCE22	Wireless Networks & Mobile Computing
4	16SCE151	Advances in Digital Image Processing

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

Group-4		
Sl. No	**Course Code**	**Course Name**
1	16SIT424	Machine Learning Techniques
2	16MCA542	Cloud Computing
3	16SCN424	Web Mining
4	16MCA441	Advances in Computer Networks

Group-5		
Sl. No	**Course Code**	**Course Name**
1	16MCA543	Artificial Intelligence
2	16MCA452	Big Data Analytics
3	16MCA353	MIS & E-Commerce
4	16MCA354	Cyber Security

Group-6		
Sl. No	**Course Code**	**Course Name**
1	16MCA541	Web2.0 and Rich Internet Applications
2	16MCA551	Software Defined Networks
3	16SCE14	Probability Statistics and Queuing Theory
4	16MCA444	Cryptography and Network security

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

01	16SCE151	Group-1	COMPUTER SYSTEMS PERFORMANCE ANALYSIS

Exam Hours:03 | **Exam Marks:100**

Module1.

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

Module2.

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

Module3.

Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

Module4.

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE; Limitations of RTEs. Experimental Design and Analysis: Introduction: Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.

Module5.

Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws:

Utilization Law; Forced Flow Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.
Text Books: 1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013. **Reference Books:** 1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003. 2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

02	16MCA442	Group-1	DATA WAREHOUSING AND DATA MINING

Exam Hours:03 | **Exam Marks:100**

Module1.
Data warehousing and OLAP
Data Warehouse basic concepts, Data Warehouse Modeling, Data Cube and OLAP: Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Software.

Module2.
Data Mining and its Applications Introduction, What is Data Mining, Motivating Challenges, Data Mining Tasks, Which technologies are used for data mining, Kinds of pattern that can be mined, Data Mining Applications, Data Preprocessing, Data cleaning, data integration, data reduction and data transformation.

Module3.
Association Analysis: Basic Concepts and Algorithms Frequent Item set Generation, Rule Generation, Compact Representation of Frequent Item sets, Alternative methods for generating Frequent Item sets, FP Growth Algorithm, Evaluation of Association Patterns

Module4.
Classification : Methods, Improving accuracy of classification Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers. Bayesian Classifiers, Estimating Predictive accuracy of classification methods, Improving accuracy of classification methods, Evaluation criteria for classification methods, Multiclass Problem.

Module5.
Clustering Techniques
Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Jiawei Han and MichelineKamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2006.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison- Wesley, 2005.

Reference Books:

1. Arun K Pujari: Data Mining Techniques University Press, 2nd Edition, 2009.
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.
3. Alex Berson and Stephen J.Smith: Data Warehousing, Data Mining, and OLAP Computing McGrawHill Publisher, 1997.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

03	16SCE152	Group-1	DISTRIBUTED OPERATING SYSTEM
Exam Hours:03		**Exam Marks:100**	

Module1.
Fundamentals: What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment (DCE). Message Passing: Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

Module2.
Remote Procedure Calls: Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC.

Module3.
Distributed Shared Memory: Introduction, General Architecture of DSM Systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms.

Module4.
Resource Management: Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach Process Management: Introduction, Process Migration, Threads.

Module5.
Distributed File Systems: Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:
1. Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI, 2007.
Reference Books:
1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education, 2013.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

04	16MCA453	Group-1	SOFTWARE QUALITY MANAGEMENT
Exam Hours:03		**Exam Marks:100**	

Module1.
INTRODUCTION TO SOFTWARE QUALITY
Software Quality - Hierarchical models of Boehm and McCall – Quality measurement – Metrics measurement – Metrics measurement and analysis – Gilb's approach – GQM Model

Module2.
SOFTWARE QUALITY ASSURANCE
Quality tasks – SQA plan – Teams – Characteristics Implementation – Documentation– Reviews and Audits.

Module3.
QUALITY CONTROL AND RELIABILITY
Tools for Quality – Ishikawa's basic tools – CASE tools Defect prevention and removal – Reliability models, Rayleigh model – Reliability growth models for quality assessment.

Module4.
QUALITY MANAGEMENT SYSTEM
Elements of QMS – Rayleigh model framework Reliability Growth models for QMS – Complexity metrics and models Customer satisfaction analysis.

Module5.
QUALITY STANDARDS
Need for standards – ISO 9000 Series – ISO 9000 3 for software development – CMM and CMMI – Six Sigma concepts.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Allan C. Gillies, "Software Quality: Theory and Management", Thomson Learning, 2003.
2. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", PearsonEducation (Singapore) Pte Ltd., 2002.

Reference Books:

1. Norman E. Fenton and Shari Lawrence Pfleeger, "Software Metrics" Thomson,2003
2. Mordechai Ben Menachem and Garry S.Marliss, "Software Quality", Thomson Asia Pvt Ltd, 2003
3. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI ", Pearson Education(Singapore) Pvt Ltd, 2003

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

01	16MCA544	Group-2	STORAGE AREA NETWORKS
Exam Hours:03		**Exam Marks:100**	

Module1.
Concepts of Storage Networking
The Data Storage and Data Access Problem, The Battle for Size and Access Decoupling the Storage Component: Putting Storage on the Network, Decoupling the Storage Component: Creating a Network for Storage

Module2.
Storage Fundamentals
Storage Architectures, Device Overviews, Connectivity Options, Data Organizational Methods

Module3.
Network Attached Storage
Putting Storage on the Network, NAS Hardware Devices, NAS Software Components, NAS Connectivity Options

Module4.
Storage Area Networks
Architecture Overview, Hardware Devices, Software Components, Configuration Options for SANs.

Module5.
Application
Defining the I/O Workload, Applying the SAN Solution, Applying the NAS Solution Considerations When Integrating SAN and NAS Management Planning Business Continuity, Managing Availability, Maintaining Serviceability, Capacity Planning and Security Considerations
Case Studies
NAS Case Study, SAN Case Study, SAN/NAS Management Case Study

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. The Complete Reference “Storage networks” , Robert Spalding, McGraw Hill Education (India) 2003

Reference Books:

1. Information Storage and Management (Misl-Wiley) : 2nd Edition, Emc Education Services, Wiley;Second edition (29 August 2012), ISBN-13: 978-8126537501
2. Storage Are networks Essentials : A complete guide to understanding and Implementing SANs, RichardBarker, Paul Massiglia, Wiley

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

02	16SCS23	Group-2	ADVANCED ALGORITHMS
Exam Hours:03		**Exam Marks:100**	

Module1.
Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

Module2.
Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

Module3.
Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization

Module4.
String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

Module5.
Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rdEdition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2ndEdition, Universities press, 2007

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

03	16SCE252	Group-2	PATTERN RECOGNITION
Exam Hours:03		**Exam Marks:100**	

Module1.
Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems

Module2.
Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation

Module3.
Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network

Module4.
Naive Bayes classifier, Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over fitting & Pruning, Examples, Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM

Module5.
Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, 2011Universities Press, ISBN 978-81-7371-725-3

2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHISBN-81-203-1484-0, 1996.

Reference Books:

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

04	16SSE24	Group-2	SOFTWARE METRICS AND QUALITY ASSURANCE
Exam Hours:03		**Exam Marks:100**	

Module1.
What Is Software Quality: Quality: Popular Views, Quality Professional Views, Software Quality, Total Quality Management and Summary. Fundamentals Of Measurement Theory: Definition, Operational Definition, And Measurement, Level Of Measurement, Some Basic Measures, Reliability And Validity, Measurement Errors, Be Careful With Correlation, Criteria For Causality, Summary. Software Quality Metrics Overview: Product Quality Metrics, In Process Quality Metrics, Metrics for Software Maintenance, Examples For Metrics Programs, Collecting Software Engineering Data.

Module2.
Applying The Seven Basic Quality Tools In Software Development: Ishikawa's Seven Basic Tools, Checklist, Pareo Diagram, Histogram, Run Charts, Scatter Diagram, Control Chart, Cause And Effect Diagram. The Rayleigh Model: Reliability Models, The Rayleigh Model Basic Assumptions, Implementation, Reliability And Predictive Validity.

Module3.
Complexity Metrics And Models: Lines Of Code, Halstead's Software Science, Cyclomatic Complexity Syntactic Metrics, An Example Of Module Design Metrics In Practice. Metric And Lessons Learned For Object Oriented Projects: Object Oriented Concepts And Constructs, Design And Complexity Metrics, Productivity Metrics, Quality And Quality Management Metrics, Lessons Learned For object-oriented Projects.

Module4.
Availability Metrics: Definition And Measurement Of System Availability, Reliability Availability And Defect Rate, Collecting Customer Outage Data For Quality Improvement, In Process Metrics For Outage And Availability. Conducting Software Project Assessment: Audit Ad Assessment, Software Process Maturity Assessment And Software Project Assessment , Software Process Assessment A Proponed Software Project Assessment Method.

Module5.
Dos And Don'ts Of Software Process Improvement: Measuring Process Maturity, Measuring Process Capability, Staged Versus Continuous Debating Religion, Measuring Levels Is Not Enough, Establishing The Alignment Principle, Take Time Getting Faster, Keep it Simple Or Face Decomplexification, Measuring The Value Of Process Improvement , Measuring Process Compliance , Celebrate The Journey Not Just The Destination. Using Function Point Metrics to Measure Software Process Improvement: Software Process Improvement Sequences, Process Improvement Economies, Measuring Process Improvement at Activity Levels

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Stephen H Khan: Metrics and Models in Software Quality Engineering, Pearson 2nd edition2013.

Reference Books:

1. Norman E-Fentor and Share Lawrence Pflieger." Software Metrics". InternationalThomson Computer Press, 1997.
2. S.A.Kelkar,"Software quality and Testing, PHI Learing, Pvt, Ltd., New Delhi 2012.
3. Watts S Humphrey, "Managing the Software Process", Pearson Education Inc, 2008.
4. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI", PearsonEducation (Singapore) Pte Ltd, 2003
5. Philip B Crosby, " Quality is Free: The Art of Making Quality Certain ", MassMarket, 1992.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

01	16SCS13	Group-3	ADVANCES IN DATA BASE MANAGEMENT SYSTEMS
Exam Hours:03		**Exam Marks:100**	

Module1.
Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations. Overview of Object-Oriented Concepts – Objects, Basic properties. Advantages, examples, Abstract data types, Encapsulation, class hierarchies, polymorphism, examples.

Module2.
Object and Object-Relational Databases: Overview of OOP; Complex objects; Identity, structure etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems; syntax and demo examples, The nested relational model. Overview of C++ language binding

Module3.
Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

Module4.
Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; ROC and CMC Curves; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.

Module5.
Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, ar Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographic Information Systems; Genome data management

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

02	16SCS11	Group-3	ADVANCES IN OPERATING SYSTEMS
Exam Hours:03		**Exam Marks:100**	

Module1.
Operating System Overview, Process description & Control: Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, What is a Process? Process States, Process Description, Process Control, Execution of the Operating System, Security Issues.

Module2.
Threads, SMP, and Microkernel, Virtual Memory: Processes and Threads, Symmetric Multiprocessing (SMP), Micro Kernels, Windows Vista Thread and SMP Hours Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX Memory Management, Windows Vista Memory Management, Summary

Module3.
Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSl) Scheduling, Windows Vista Hours Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock

Module4.
Embedded Operating Systems: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.

Module5.
Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine, Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management, Running Process Manager, Creating a new Task, IPC and Synchronization, The Scheduler, Memory Manager, The Virtual Address Space, The Page Fault Handler, File Management. The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects, Threads, Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive, Object Manager, Process and Thread Manager, Virtual Memory Manager, I/o Manager, The cache Manager Kernel local procedure calls and IPC, The native API, subsystems.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

03	16SCE22	Group-3	WIRELESS NETWORKS AND MOBILE COMPUTING

Exam Hours:03 | **Exam Marks:100**

Module1.
Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

Module2.
Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6.

Module3.
Mobile OS and Computing Environment : Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators

Module4.
Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

Module5.
J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.

2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.

2. ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

04	16SCS151	Group-3	ADVANCES IN DIGITAL IMAGE PROCESSING
Exam Hours:03		**Exam Marks:100**	

Module1.
Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

Module2.
Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.

Module3.
Image Restoration: A 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, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter.

Module4.
Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. Wavelets and Multiresolution Processing: Image Pyramids, Subband coding, The Haar Transform, Multiresolution Expansions, Wavelet Transforms in one Dimension, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. Image Compression: Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression

Module5.
Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005.

Reference Books:

1. S. Sridhar, Digital Image Processing, Oxford University Press India, 2011.
2. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
3. Scott E. Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
4. S. Jayaraman, S. Esakkirajan, T. Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.
5. Anthony Scime, “Web Mining Applications and Techniques”, Idea Group Publishing,2005.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

01	16SIT424	Group-4	MACHINE LEARNING TECHNIQUES
Exam Hours:03		**Exam Marks:100**	

Module1. Module -1
INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search

Module2.
NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.

Module3.
BAYESIAN AND COMPUTATIONAL LEARNINGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

Module4.
INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case- Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution

Module5.
ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

Reference Books:

1. EthemAlpaydin, “Introduction to Machine Learning”, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

02	16MCA542	Group-4	CLOUD COMPUTING
Exam Hours:03		**Exam Marks:100**	

Module1. Distributed System Models and Enabling Technologies Scalable Computing Service over the Internet, System Models for Distributed and Cloud Computing

Module2. Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency

Module3.
Virtual Machines and Virtualization of Clusters and Data Centers Implementation Levels of Virtualization, Virtualization Structures /Tools and Mechanisms, Virtual Cluster and Resource Management, Virtualization for Data- Center Automation.

Module4. Cloud Platform Architecture over Virtualized Data Centers Cloud Computing and Service Models, Data-Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS, and Azure, Cloud Security and Trust Management

Module5. Cloud Programming and Software Environments Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things",Kai Hwang, Geoffrey C. Fox. Jack J Dongarra, MK Publishers, 2012.

Reference Books:

1. "Moving to the Cloud, Developing Apps in the New World of Cloud Computing", DinakarSitaram, Geetha Manjunath, Elsevier Publication, 2012.
2. "Cloud Computing, A Practical Approach", Anthony T. Volte, Toby J. Volte and Robert Elsenpeter, McGraw Hill, 2010.
3. "Cloud Computing for Dummies", J. Hurwitz, ISBN 978-0-470-484-8
4. "Web-Based Applications that Change the Way You Work and Collaborate Online", Michael Miller, Pearson Publication, 2012.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

03	16SCN424	Group-4	WEB MINING
Exam Hours:03		**Exam Marks:100**	

Module1.
INTRODUCTION: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink Analysis, Resource Discovery and Vertical Portals, Structured vs. Unstructured Data Mining . INFRASTRUCTURE and WEB SEARCH – Crawling the web – HTML and HTTP Basics – Crawling Basics – Engineering Large Scale Crawlers- Putting together a Crawler- Boolean Queries and the Inverted Index –Relevance Ranking – Similarity Search.

Module2.
INFORMATION RETRIEVAL: Information Retrieval and Text Mining – Keyword Search - Nearest-Neighbor Methods -Measuring Similarity - Web-Based Document Search - Document–Matching - Inverted Lists -Evaluation of Performance - Structure in a Document Collection - Clustering Documents by Similarity- Evaluation of Performance - Information Extraction - Patterns and Entities from Text- Co reference and Relationship Extraction - Template Filling and Database Construction

Module3.
LEARNING I: Similarity and Clustering – Formulations and approaches- Bottom up and Top down Partitioning Paradigms – Clustering and Visualization via Embedding's – Probabilistic Approaches to clustering – Collaborative Filtering, SUPERVISED LEARNING: The Supervised Learning Scenario, Overview of Classification Strategies, Evaluating Text Classifiers, Nearest Neighbor Learners, Feature Selection.

Module4. LEARNING II: SUPERVISED LEARNING – Bayesian Learners, Exploiting Hierarchy among Topics, Maximum Entropy Learners, Discriminative Classification, Hypertext Classification, SEMI SUPERVISEDLEARNING- - Expectation Maximization, Labeling Hypertext Graphs and Co- training.

Module5.
APPLICATIONS: Social Network Analysis- Social Sciences and Bibliometry – Page Rank and HITS – Shortcomings of coarse Grained Graph model- Enhanced Models and Techniques- Evaluation of Topic Distillation- Measuring and Modeling the Web – Resource Discovery – Collecting Important Pages Preferentially – Similarity Search Using Link Topology – Topical Locality and Focused Crawling – Discovering Communities- The Future of Web Mining.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Sholom Weiss, "Text Mining: Predictive Methods for Analyzing Unstructured Information",Springer, 2005
2. Soumen Chakrabarti, "Mining the Web: Discovery Knowledge from Hypertext Data," ElsevierScience 2003

Reference Books:

1. Min Song, Yi-fang Brrok Wu, "Handbook of Research on Text and Web Mining Technologies",Vol I & II,Information Science Reference (IGI), 2009
2. K.P.Soman, ShyamDiwakar, V.Ajay, "Insight into Data Mining Theory and Practice ," PrenticeHall of India Private Ltd 2006
3. Anthony Scime, "Web Mining Applications and Techniques", Idea Group Publishing,2005
4. Margret H.Dunham "DATA MINING - Introductory and Advanced Concepts",PearsonEducation,2003.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

04	16MCA441	Group-4	ADVANCES IN COMPUTER NETWORKS
Exam Hours:03		**Exam Marks:100**	

Module1. Introduction to Computer Networks

History of TCP/IP, TCP Applications and Services, Performance Study of TCP/IP, learning of TCP Performance? TCP, TCP Services , Header Format, Encapsulation in IP, Acknowledgment Mechanism, Retransmission Mechanism, Connection Establishment and Termination, Control and Sliding Window, Congestion Control ,UDP ,UDP Services, Header Format ,Encapsulation in IP,IP Services, Fragmentation and Reassembly , Header Format and IP Version 6, Reasons for Network Measurement, Measurement Tasks, Classification of Measurement Tools, Popular Measurement Tools and Their Applications, Tcpdump, Tcpstat, Ttcp&Netperf. Distributed Benchmark System.

Module2.

TCP/IP Network Simulation and TCP Modeling

The Role of Simulation, Steps of a Systematic Simulation Study, Types of Simulations, Continuous versus Discrete Event, Terminating versus Steady State, Synthetic versus Trace Driven Simulation, Simulation Validation and Verification, Confidence Level of Simulation Results, Confidence Level Formula, Terminating Simulation, Steady-State Simulation, Common Simulation Mistakes, Simulation with Self-Similar Traffic Network Simulators: Model Construction and Parameter Setting Data Collection, Simulation Execution, Presentation of Results and Examples of TCP/IP Simulation. Motivation for Mathematical. Modeling of TCP, Essentials of TCP Modeling, Window Dynamics Packet-Loss Process, Gallery of TCP Models, Periodic Model, Detailed Packet Loss Model, Stochastic Model with General Loss Process, Control System Model and Network System Model.

Module3.

TCP/IP Performance over Wireless Networks & TCP/IP Performance over Mobile Networks & Optical Networks Layer Wireless Networks: Generic Characteristics, Wireless Local Area Networks and Cellular Communications Networks. TCP Performance Issues over Wireless Links, Inappropriate Reduction of Congestion Window, Throughput Loss in WLANs and Throughput Loss in Cellular Communication Systems. Improving TCP Performance over Wireless Links: Splitting TCP Connections, Snooping TCP at Base Stations, Notifying the Causes of Packet Loss, Adding Selective Acknowledgments to TCP and Comparison of Enhancement Schemes. Wireless System Evolution and TCP/IP: Trends in Cellular Communication Systems, Trends in Wireless LAN Systems, TCP/IP over Heterogeneous Wireless systems. Cellular and Ad Hoc Networks: TCP Performance in Cellular Networks, Mobile IP, Impact of Mobility on TCP Performance, Approaches to Improve TCP Performance, TCP Performance in Ad Hoc Networks, Dynamic Source Routing, Impact of Mobility on TCP Performance, Approaches to Improve TCP Performance. Evolution of Optical Networks, IP over DWDM, Multiprotocol Label Switching, Multiprotocol Lambda Switching, Optical Burst Switching, Optical Packet Switching: Optical Packet Format, Congestion Resolution in Optical Packet Switches, Performance of TCP/IP over Optical Networks, Optical Packet Network End-to-End Performance, Mapping of TCP in Optical Packets, Optical Packet Design in the TCP/IP Environment.

Module4.

TCP/IP Performance over Satellite Networks & TCP/IP Performance over Asymmetric Networks A Brief History of Data Satellites, Motivations for Using Satellites, Types of Satellites Satellite Internet Architectures, Satellite Characteristics Affecting TCP: Long Feedback Loop, Link Impairment, Bandwidth-Delay Product, Bandwidth Asymmetry, Variable Delays, LEO Handoff Spectral Congestion, Security. TCP Enhancements for Satellite Networks: Path MTU Discovery, TCP for Transactions, Window Scaling, Large Initial Window, Byte Counting, Delayed ACKs after Slow Start, Explicit Congestion Notification, Multiple Connections, Pacing TCP Segments, TCP/IP Header Compression, and Security Issues Conclusions for TCP Enhancements. Advanced Enhancements and New Versions of TCP: Quick-Start TCP, High Speed TCP ,TCP Peach, Explicit Transport Error Notification TCP Westwood and XCP .New Transport Protocols for Satellite Links: Satellite Transport Protocol, Space Communications Protocol Specifications-Transport Protocol. Types of Network Asymmetry: Bandwidth Asymmetry, Media-Access Asymmetry, Loss Rate. Asymmetry Impact of Asymmetry on TCP performance: Bandwidth Asymmetry, Media Access Asymmetry. Improving TCP Performance over Asymmetric Networks: Uplink Bandwidth Management Handling Infrequent ACK. Experimental Evaluation Of Performance Improvement Techniques Experiments with Bandwidth Asymmetry, Experiments with Media Access Asymmetry

Module5.

TCP/IP Performance over Asymmetric Networks & New TCP Standards and Flavors Types of Network Asymmetry: Bandwidth Asymmetry, Media-Access Asymmetry, Loss Rate. Asymmetry Impact of Asymmetry on TCP Performance: Bandwidth Asymmetry, Media Access Asymmetry. Improving TCP Performance over Asymmetric Networks: KS: Uplink Bandwidth Management Handling Infrequent ACK. Experimental Evaluation of Performance Improvement Techniques Experiments with Bandwidth Asymmetry, Experiments with Media Access Asymmetry. Duplicate Acknowledgments and Fast Retransmit, Fast Recovery and TCP Reno, TCP New Reno, TCP with Selective Acknowledgments, Forward Acknowledgments, TCP Vegas ,Overview of Other Features and Options and Performance Comparison of TCP Flavors

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. High Performance TCP/IP: Networking Concepts, Issues, and Solutions, Mahbub Hassan and Raj Jain, IST Edition, 2009 PHI Learning Chapters 1,2,3,4,5,6,7,8,9,10,11,12,13 (excluding those topics which are not in the syllabus)

Reference Books:

1. TCP/IP Illustrated (Volume I, Volume II and Volume III), W. Richard Stevens, Addison-Wesley

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

01	16MCA543	Group-5	ARTIFICIAL INTELLIGENCE
Exam Hours:03		**Exam Marks:100**	

Module1.
What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond. Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics,

Module2.
Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis. Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem.

Module 3.
Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction Symbolic Reasoning Under Uncertainty: Introduction to non-monotonic reasoning, Logic for non-monotonic reasoning.

Module4.
Implementation: Depth-first search, Implementation: Breadth-first search. Statistical Reasoning: Probability and Bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Fuzzy logic.

Module5.
Weak Slot-and-filter structures: Semantic Nets Frames, Strong slot-and –filler structures: Conceptual dependency, scripts, CYC.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Elaine Rich, Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013

Reference Books:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
2. Nils J. Nilsson: “Principles of Artificial Intelligence”, Elsevier, ISBN-13: 9780934613101

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

02	16MCA452	Group-5	BIG DATA ANALYTICS
Exam Hours:03		**Exam Marks:100**	

Module1.
Big Data and Analytics
Example Applications, Basic Nomenclature, Analysis Process Model, Analytical Model Requirements, types of Data Sources, Sampling, Types of data elements, data explorations, exploratory statistical analysis, missing values, outlier detection and Treatment, standardizing data labels, categorization.

Module2.
Big Data Technology
Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data – Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans-Firewall Analytics.

Module 3.
Meet Hadoop
Data, Data Storage and Analysis, Comparison with Other Systems, RDBMS, Grid Computing Volunteer Computing, A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem Hadoop Releases Response

Module4.
The Hadoop Distributed File system
The Design of HDFS, HDFS Concepts, Blocks, Name nodes and Data nodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic File system Operations, Hadoop File systems Interfaces ,The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the File System API, Writing Data, Directories, Querying the File system, Deleting Data, Data Flow Anatomy of a File Read ,Anatomy of a File Write, Coherency Model, Parallel Copying with distcp Keeping an HDFS Cluster Balanced, Hadoop Archives

Module5.
Map Reduce
A Weather Dataset ,Data Format, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop, Map and Reduce, Java MapReduce, Scaling Out, Data Flow, Combiner functions, Running a Distributed MapReduce Job, Hadoop Streaming, Hadoop Pipes, Compiling and Running, Developing a MapReduce Application, The Configuration API, Combining Resources, Variable Expansion, Configuring the Development Environment, Managing Configuration, GenericOptionsParser, Tool and ToolRunner, Writing a Unit Test, Mapper, Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging, Launching a Job, The MapReduce Web UI, Retrieving the Results, Debugging a Job, Hadoop Logs, Remote Debugging.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Bart Baesens, " Analytics in a Big Data World : The Essential Guide to Data Science and itsApplications" Wiley
2. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence andAnalytic Trends for Today's Businesses", 1st Edition, Michael Minelli, Michele Chambers, AmbigaDhiraj,Wiley CIO Series, 2013.
3. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012

Reference Books:

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN:9788126551071, 2015.
2. Chris Eaton, Dirk derooset al. , "Understanding Big data ", McGraw Hill, 2012.
3. VigneshPrajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.

4. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, 2014.

03	16MCA353	Group-5	MIS & E-Commerce
Exam Hours:03		**Exam Marks:100**	

Module1.
Introduction to MIS
MIS: Concept, Definition, Role of the Management Information System, Impact of the Management Information System, MIS and User, Management as Control System, A support to the Management, Management effectiveness and Organization Effectiveness.
Strategic Management of Business Performance:
The Concept of Corporate Planning, Essentiality of Strategic Planning, Development of the Business Strategies, Types of Strategies, Tools of Planning, Balance Score Card, Score card and Dash Board.

Module2.
Decision-Making: Decision-Making Concepts, Decision-Making Process, Decision Analysis by Analytical Modeling, Behavioural Concepts in Decision-Making, Organizational Decision- Making, MIS and Decision-Modeling. (Case study)
Information, Knowledge, Business Intelligence:
Information Concepts, Information: A Quality Product, Classification of the Information, Methods of Data and Information Collection, Value of the information, Business intelligence.

Module 3.
Technology of Information Systems: Introduction, Data Processing, Transaction Processing, Application Processing, Information System Processing, OLAP(on-line analytical Processing) for Analytical Information, TQM(Total Quality Management) of Information System. Human Factors and User Interface, Evaluation and feasibility of IT Solutions.

Module4.
E-Business Technology: Introduction to E-Business, Models of E-Business: Business to Business(B2B),Business to Customer(B2C), Customer to Business(C2B), Customer to Customer (C2C), Internet and World Wide Web(WWW), Internet/Extranet, Security in E-Business, Electronic Payment Systems, Impact of Web on Strategic Management.

Module5.
E-commerce: Introduction to E-Commerce Technologies: Client-side programming: Important factors in client side, Web page design and production, Overview of HTML, Basic text formatting, Links, Images , Tables, Frames, form server side programming-I: Servlet fundamentals, Server-side Programming II: Database connectivity: Relational database systems, JDBC perspectives and JDBC program example. Business-oriented e-commerce: Feature of B2B e-Commerce, Business models, Integration E-services: Categories of e-services, Web-enabled services, Matchmaking services.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Waman S Jawadekar: Management Information System, 4th Edition, Tata McGraw Hill. (Chapters: 1,3,6,7,16,20)
2. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, E Commerce, Fundamentals & Applications, John Wiley & Sons, 2003. Part I & Part II. (chapters: 3 , 4, 5, 12, 13)

Reference Books:

1 Ralph M Stair and George W Reynolds: Principles of Information Systems, 7th Edition, Thomson, 2010.
2 Steven Alter: Information Systems - The Foundation of E-Business, 4th Edition, Pearson Education, 2001

3 Rahul De, Managing Information Systems in Business, Government and Society, , Wiley India.

04	16MCA354	Group-5	CYBER SECURITY
Exam Hours:03		**Exam Marks:100**	

Module1.
Introduction to Cybercrime and Laws
Introduction, Cybercrime: Definition and Origins of the word, Cybercrime And information Security, Who are Cybercriminals? Classifications of Cybercrimes. How Criminals Plan Them – Introduction, How Criminals Plan the Attacks, Cyber café and Cybercrimes, Botnets, Attack Vector, The Indian IT ACT 2000.

Module2.
Tools and Methods used in Cybercrime
Introduction, Proxy Server and Anonymizers, Password Cracking, Keyloggers and Spyware,Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQLinjection, Buffer Overflow.

Module 3.
Phishing and Identity Theft
Introduction, Phishing – Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft – PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.

Module4.
Unix Command Lines, Backtrack Linux, Mac Ports, Cygwin, Windows Power Shell, Net Cat Commands, NetCat Uses, SSH, Data Pipe, Fpipe

Module5.
Network Defense tools
Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless VsStateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill. (Chapters: 2, 7, 8, 11)
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by NinaGodbole and SunitBelpure, Publication Wiley. (Chapters: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.5, 2.6, 2.7, 6.4,5.2.1, 5.2.2, 5.2.5, 5.3.1, 5.3.2, 5.3.3, 4.2,4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11)

Reference Books:

1. Marjie T. Britz - Computer Forensics and Cyber Crime: An Introduction - Pearson
2. Chwan-Hwa (John) Wu,J. David Irwin - Introduction to Computer Networks and Cyber security – CRCPress
3. Bill Nelson, Amelia Phillips, Christopher Steuart - Guide to Computer Forensics and Investigations -Cengage Learning

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

01	16MCA541	Group-6	WEB 2.0 AND RICH INTERNET APPLICATIONS
Exam Hours:03		**Exam Marks:100**	

Module1.

What is Web 2.0? Folksonomies and Web 2.0, Software As a Service (SaaS), Data and Web 2.0, Convergence, Iterative development, Rich User experience, Multiple Delivery Channels, Social Networking. Web Services: SOAP, RPC Style SOAP, Document style SOAP. WSDL, REST services, JSON format, What is JSON? Array literals, Object literals, Mixing literals, JSON Syntax, JSON Encoding and Decoding, JSON versus XML.

Module2.

Rich Internet Applications With Ajax: Limitations of Classic Web application model, AJAX principles, Technologies behind AJAX, Examples of usage of AJAX; Asynchronous communication and AJAX application model. Ajax with XMLHTTP object: Part 1

Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creating and opening the XMLHttpRequest object, Data download, Displaying the fetched data, Connecting to the server, Adding Server-side programming, Sending data to the server using GET and POST**.**

Module 3.

Ajax with XMLHTTP object: Part 2

Handling multiple XMLHttpRequest objects in the same page, Using two XMLHttpRequest objects, Using an array of XMLHttpRequest objects, Using inner functions, Downloading JavaScript, connecting to Google Suggest, Creating google.php, Downloading from other domains with Ajax, HTML header request and Ajax, Defeating caching, Examples.

Module4.

Working with XML DOM in Ajax Building XML and working with XML in JavaScript, Getting the document element, Accessing any XML element, Handling whitespace in Firefox, Handling cross-browser whitespace, Accessing XML data directly, Validating XML, Further examples of Rich Internet Applications with Ajax.

Working with PHP and Ajax

Working with PHP server variables, Getting the data in to array format, Wrapping applications in to a single PHP page, Validating input from the user, Validating integers and text, DOM, Appending new elements to a web page using the DOM and Ajax, Replacing elements using the DOM, Handling timeouts in Ajax, Downloading images with Ajax, Example programs.

Module5.

Introduction to Bootstrap: What Is Bootstrap? Bootstrap File Structure, Basic HTML Template, Global Styles, Default Grid System, Basic Grid HTML, Offsetting Columns, Nesting Columns, Fluid Grid System, Container Layouts, Responsive Design. Typography, Emphasis Classes, Lists, Code, Tables, Optional Table Classes, Table Row Classes, Forms, Buttons, Images, Icons.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Professional AJAX – Nicholas C Zakas et al, Wrox publications, 2008.
2. Steven Holzner: Ajax: A Beginner's Guide, Tata McGraw Hill, 2014.
3. Jake Spurlock: "Bootstrap: Responsive Web Development", O'Reilly Media, 2014.

Reference Books:

1. Thomas A. Powel: Ajax The Complete reference, McGraw Hill,2008.
2. AravindShenoy, Ulrich Sossou: Learning Bootstrap, Packt, Dec 2014.
3. Dana Moore, Raymond Budd, Edward Benson: Professional Rich Internet Applications: AJAX and Beyond, Wiley 2012.

02	16MCA551	Group-6	SOFTWARE DEFINED NETWORKS
Exam Hours:03		**Exam Marks:100**	

Module1.
Introduction to SDN
Understanding the SDN, Understanding the SDN technology, Control Plane, Data Plane, Moving information between planes, separation of the control and data planes, Distributed control planes, Load Balancing, Creating the MPLS Overlay, Centralized control planes.

Module2.
Working of SDN
Evaluation of Switches and Control planes, SDN Implications, Data centre Needs, Forerunner of SDN, SoftwareDefines Networks is Born, Sustain SDN interoperability, Open source contribution, Fundamental Characteristics of SDN, SDN Operations, SDN Devices, SDN Controllers, SDN Applications, Alternate SDN methods

Module 3.
The Open Flow Specifications
Open Flow Overview, Open Flow Basics, Open Flow 1.0 additions, Open Flow 1.1 additions, Open Flow 1.2 additions, Open Flow 1.3 additions, Open Flow limitations.

Module4.
SDN via APIS, SDN via Hypervisor-Based Overlays, SDN via Opening up the device, Network function virtualization, Alternative Overlap and Ranking.

Module5.
Data centres definition, Data centres demand, tunnelling technologies for Data centres Path technologies in data centres, Ethernet fabrics in Data centres, SDN use case in Data centres

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Software Defined Networking by Thomas D Nadeau and Ken Gray.
2. Software Define Networks, A Comprehensive Approach, Paul Goransson, Chuck Black. MK Publications.

Reference Books:

1. Software Defined Networking for Dummies brought you by cisco, Brian Underdahl and Gary Kinghorn.

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PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

03	16SCE14	Group-6	PROBABILITY STATISTICS AND QUEUING THEORY
Exam Hours:03		**Exam Marks:100**	

Module1.
Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables, Joint pdf / cdf and their properties

Module2.
Probability Distributions / Discrete distributions: Binomial, Poisson Geometric and Hyper-geometric distributions and their properties. Continuous distributions: Uniform, Normal, exponential distributions and their properties.

Module 3.
Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Autocorrelation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.

Module4.
Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution, its properties and uses, $\chi 2$ – test for goodness of fit, $\chi 2$ test for Independence

Module5.
Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern Economy Edition, PHI Learning Pvt. Ltd, 2009.

Reference Books:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishor. S. Trivedi , Prentice Hall of India ,2004.
2. Probability, Statistics and Random Processes, 1st Edition by P Kausalya, Pearson Education, 2013.

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PhD Coursework Courses – 2018 (Master of Computer Applications)
As per 2017 Regulation

04	16MCA444	Group-6	CRYPTOGRAPHY AND NETWORK SECURITY
Exam Hours:03		**Exam Marks:100**	

Module1.
Introduction to Cryptography
Introduction: OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, model for Network Security. Classical Encryption Technique: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

Module2.
Data Encryption and advanced encryption techniques
Block Ciphers, Data Encryption Standard and Advanced Encryption Standard Block Cipher Principles, The Data Encryption Standard, Block Cipher Design Principles and Modes of operation, Evaluation Criteria for AES, AES Cipher-Encryption and Decryption, Data Structure, Encryption Round. Public Key Cryptography and Key Management
Principles of Public Key Cryptosystem, RSA algorithm, Key management, Diffie Hellman Key exchange.

Module 3.
CRYPTOGRAPHY techniques, Message Authentication and Hash Function: Authentication Requirement, Authentication Functions, Message Authentication Code, Hash Functions, Digital Signatures, Digital Signature Standard. Authentication Applications: Kerberos, X.509 Authentication Service

Module4.
E-MAIL AND IP SECURITY: Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME, IP Security: IP Security Overview;IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

Module5.
WEB AND SYSTEM SECURITY
Web Security: Web security Considerations; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET). System Security :Intruders, Intrusion Detection, Firewall Design Principles-Characteristics, Types of Firewall and Firewall Configuration.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", 4th Edition,Pearson Education, 2009. (Chapters: 1, 2.1-2.3, 3.1,3.2,3.5, 5.1,5.2, 6.2, 9.1,9.2, 10.1,10.2, 11.1-11.4, 13.1, 13.3, 14.1, 4.2, 15.1, 15.2, 16.1-16.6, 17.1-17.3, 18.1, 18.2, 20.1; Exclude the topic notmentioned in the syllabus)

Reference Books:

1. Behrouz A. Forouzan and Debdeep Mukhopadhyay: "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill, 2010.
2. AtulKahate, "Cryptography and Network Security" 2nd Edition TMH.