

Deccan Education Society's
FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY

Academic Year 2017-2018

Syllabus for M.Sc. (Industrial Mathematics with Computer Applications)

SEMESTER - III

Semester-III

Subject Code	Subject Title	Paper	Credits
MTS5301	Probability and Statistics	Compulsory	5
MTS5302	Cryptography	Elective	5
MTS5303	Topology	Elective	5
MTS5304	Object Oriented Software Engineering	Compulsory	5
MTS5305	Operating Systems	Compulsory	5
MTS5306	JAVA Programming	Compulsory	5
MTS5307	Laboratory Course III (Based on Operating systems and JAVA programming)	Compulsory	4
VI	Cyber Security III	Compulsory	1
VII	Skill Development	Compulsory	1

Semester-IV

Subject Code	Subject Title	Paper	Credits
MTS5401	Ordinary Differential Equations	Compulsory	5
MTS5402	Statistical Inference	Compulsory	5
MTS5403	Computer Networks	Compulsory	5
MTS5404	DAA	Compulsory	5
MTS5405	Android Programming	Elective	5
MTS5406	Python	Elective	5
MTS5407	Web UI design	Elective	5
MTS5408	Laboratory Course IV (Based on Elective(MTS5405/ MST5406/MST5407))	Compulsory	4
	Cyber Security IV	Compulsory	1
	Skill Development	Compulsory	1

MTS5301 Probability and Statistics

Unit 1	Introduction to Probability: -Classical definition, Empirical definition and Axiomatic definition ,Addition theorem for Probabilities and related problems, Mutually Exclusive Events and related problems, Independent Events, Conditional Probability and related problems, Theorem of Inverse Probabilities (known as Baye’s Theorem) and related problems.	(5 Lectures)
Unit 2	Random Variables: -What is a Random Variable, Probability distribution of a Discrete Random Variable & related problems, Probability distribution of a Continuous Random Variable & related problems, Distribution Function and related problems, Moments, Inequalities regarding Moments , Moments of a Symmetric Probability Distribution , Factorial Moments and related problems. Markov’s Inequality and Chebychev’s Inequality	(7 Lectures)
Unit 3	Generating Functions :- Probability Generating Function, Moment Generating Function , Factorial Moment Generating Function , Cumulant Generating Function ,Characteristic Function	(8 Lectures)
Unit 4	Expectation and Variances: -Definition of Expectation, Theorems on Expectation and its related problems. Variance in terms of Expectation and related problems. Covariance in terms of Expectation and related problems. Variance of a Linear Combination. Introduction to Joint and Marginal Probability Distributions.	(6Lectures)
Unit 5	Discrete Probability Distributions:- Binomial Distribution and related Problems Poison Distribution and related Problems. Geometric Distribution, Loss of Memory Property and related problems. Discrete Uniform Distribution, Mean, Variance and related Properties. Negative Binomial Distribution and related problems. Hypergeometric Distribution (Positive and Negative) and related problems	(10 Lectures)
Unit 6	Continuous Probability Distributions :- Continuous Uniform Distribution and related problems .Exponential Distribution, Loss of Memory Property and related problems .Normal Distribution, Standard Normal Variate and its related problems .Introduction to Gamma Distribution .Introduction to Chi-Square distribution, some properties and related problems .Introduction to Student t distribution and related problems .Introduction to Snedecor’s F distribution and related problems.	(12 Lectures)
Unit 7	Correlation and Regression Analysis: - Introduction and Scatter Diagrams ,Karl Pearson’s Coefficient of Correlation, Properties and Problems ,Spearmen’s Rank Correlation Coefficient. Method of Concurrent Deviations, Interpretation of r and Probable Error. Linear Regression, Lines of Regression , Theorems on Regression Coefficients, Problems based on it.Yule’s Rule, Order of Regression Coefficients Partial Regression Coefficients’ and its various properties ,Equation of Regression planes in 3	(12 Lectures)

	variable case and Generalization to n variables ,Variance of the Residual and the standard error of the estimate ,Introduction to Coefficient of Multiple Correlation ,Introduction to Coefficient of Partial correlation, Relation between the Multiple and Partial Correlation Coefficient.	
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Note: Some assignments like Fitting of Distributions, Correlation and Regression Analysis to be implemented using R Statistical Programming Language.

References:

- Probability and Statistics for Scientists and Engineers: Walpole Myers & Ye
- Mathematical Statistics: Parimal Mukhopadhyay
- Probability & Statistics with Reliability, Queuing and Computer Science Applications: Agarwal
- Probabaility and Statistics for Engineers: Richard Gupta , C B Gupta

MTS5302 General Topology (Elective)

Unit 1	Topological Spaces and Continuous Functions: Topological Spaces and Basis of Topology (Sections 12 and 13), Ordered, Product, Metric and Subspace Topologies (Sections 14, 15, 16 and 20), Closed Sets, Limit Points and Hausdroff Spaces (Section 17) , Continuous Functions, Homeomorphisms, Rules of Constructing Continuous Functions and Pasting Lemma (Proof and Examples) (Section 18) ,Introduction to Box Topology, Comparison of Product and Box Topologies (Section 19)	20 lectures
Unit 2	Connected Spaces: Introduction to Separation and Connected Spaces, Results and Examples (Section 23), Connected Spaces, Intermediate value theorem, Path connected spaces and Examples (Section 24), Components and Local Connectedness (Section 25)	12 lectures
Unit 3	Compact Spaces: Introduction to Compact Spaces, Tube Lemma, Finite Intersection Property and Examples (Section 26), Compact Subspaces of Real Line, Extreme Value theorem (Section 27.1 to 27.4), Limit Point Compactness (Section 28), Local Compactness (Section 29) One point Compactification	15 lectures
Unit 4	Countable and Separation Axioms: First and Second Countable Axiom, Lindelof Spaces with Example (Section 30), Separation by Open sets (Regular and Normal Spaces) with Examples (Section 31 and 32), Urysohn Lemma which is separation by Continuous Function (Theorem 33.1 Statement only)	10 lectures
Unit 5	The Tychonoff Theorem: Tychonoff theorem with Proof (Section 37)	3 lectures

Textbook:

James .R. Munkres (Second Edition) Topology

References

- 1) K.D. Joshi Introduction to General Topology
- 2) G.F. Simmons Topology and Modern Analysis
- 3) Armstrong Springer Verlag (Indian Edition) Basic Topology
- 4) Kelley General Topology
- 5) James Dugundji Topology

MTS5303 Cryptography (Elective)

Unit 1	Basic Number Theory Divisibility and Euclidean ,algorithm Congruence's and Chinese remainder theorem , Some applications to factoring	5 lectures
Unit 2	Introduction to Finite Fields :- Polynomial rings , Structure of finite fields , Construction of finite fields	5 lectures
Unit 3	Introduction to cryptography: - Cryptography in Modern world. Substitution cipher, Ceaser, Monoalphabetic, Transposition Cipher, Polyalphabetic substitution ciphers, Vigenere Cipher, Introduction to polygraphic substitution ciphers	10 lectures
Unit 4	Symmetric key cryptography :- Introduction and overview ,Stream Cipher, one time Pad, Block cipher ,Modes of operation Electronic code book, cipher block chaining, Cipher feedback ,Algorithms: Data Encryption Standard, Advanced Encryption Standard, IDEA (International Data Encryption Algorithm) ,Attacks against DES, AES, IDEA	15 lectures
Unit 5	Public key Cryptography :- Introduction and Overview ,The RSA algorithm ,Generation of keys ,Exchange messages ,Diffie Hellman Key Agreement protocol ,ElGamal Encryption, Algorithms: Discrete Logarithm, MD5,Attacks against RSA, Discrete Logarithm, Elliptic Curves, Menezes Vanstone Encryption	15 lectures
Unit 6	Applications of Cryptography :- Digital Signature, Kerberos, Pretty Good privacy Internet protocol security Note: All the topics based on Ciphers can be implemented using C, C++ or python as Programming Exercises or Assignments	10 lectures

Reference Books:

1. Neil Koblitz: Number theory and Cryptography
2. Adam J. Elbirt (CRC press): Understanding and Applying cryptography and Data security.
3. Robert Lewand: Cryptological Mathematics (Mathematical Association of America).
4. Bruce Schneier: Applied Cryptography (Wiley India Edition)
5. Atul Kahate: Cryptography and Network security (Tata Mcgraw Hill)

MTS5304 Object Oriented Software Engineering (OOSE)

Unit 1	Introduction :- Software, attributes of good software Software Engineering Software process, Software process models -Linear Sequential Model (LSM) ,The Prototype Model (PRM),The Rapid Application Development Model (RAD)(Agile , Extreme Programming) ,The Incremental Model (INS) ,The Boehm Spiral Model (BMS)	(7 Lectures)
Unit 2	Socio-technical systems and Software Requirements :- System, System properties , System Engineering ,Critical systems, System dependability, availability, reliability, safety and security ,Functional and non-functional requirements ,User requirements ,Software requirements document Requirements engineering , Feasibility studies, elicitation and analysis Requirements validation	(5 Lectures)
Unit 3	System Models :- Introduction to : Context models, Behavioral models (Data Flow Diagrams),Data models Example solving with Data Flow Diagrams.	(4Lectures)
Unit 4	Unified Modeling Language :- Introduction to UML, Basic Structural Modeling ,Classes , Relationship, Common mechanism, Diagrams, Class diagram ,Packages, Object Diagram ,Basic Behavioral Modeling ,Interactions ,Use cases, Use Case Diagram ,Interaction Diagram ,Activity Diagram ,State chart Diagram ,Architectural Modeling ,Component , Components Diagram ,Deployment Diagram, Collaboration diagram ,Object Oriented Design ,An object oriented design process ,Case studies with UML	(13 Lectures)
Unit 5	Introduction to Distributed Systems Architectures :- Client server architectures ,Distributed object architectures.	(2 Lectures)
Unit 6	Verification and validation :- Verification and validation ,Software Inspections ,Automated static analysis ,Verification and formal methods	(3 Lectures)
Unit 7	Introduction to Project Management :- What is Project? What is Project management?, Project phases and project life cycle, organizational structure, Qualities of Project Manager	(5 Lectures)
	Software Metrics:- The scope of software metrics, software metrics data collection, analyzing software data, measuring size, structure, external attributes.	(6 Lectures)
	Quality Standards:- CMM, PSP/TSP	(3 Lectures)

Reference Books:

1. Software Engineering (7th Edition) by Ian Sommerville Pearson education
2. Software Engineering A Practitioners Approach 6th, 7th Edition Roger S. Pressman [McGraw Hill International Edition]
3. The Unified Modeling Language User Guide By Grady Booch, James Rumbaugh and Ivar Jacobson
4. Information Technology Project Management By -Kathy Schwalbe

MTS5305 Operating Systems

Unit 1	1. Operating System Functions 1.1. What is Operating System? 1.2. Different Services of the Operating System. 1.3. Uses of the system call 1.4. User view of the Operating system 1.5. Graphical User Interface 1.6. The Kernel 1.7. Booting	(4 Lectures)
Unit 2	Information Management 1.1. Introduction 1.2. Disk Basics 1.2.1. Basics 1.2.2. Seek 1.2.3. Rotational delay 1.3. Direct Memory Access 1.4. Device Driver 1.4.1. The basics 1.4.2. Path Management 1.4.3. The submodules of DD 1.4.4. I/o procedure 1.4.5. I/o scheduler 1.4.6. Scheduling policies 1.4.6.1. FCFS 1.4.6.2. SSTF 1.4.6.3. SCAN 1.4.6.4. N-step SCAN 1.4.6.5. C-SCAN	(10 Lectures)
Unit 3	Process Description and Control 1.1. What is process? 1.2. Process states 1.3. Process Description 1.4. Process Control 1.5. Process scheduling algorithm 1.5.1. FCFS 1.5.2. SJF 1.5.3. Preemptive SJF 1.5.4. Priority 1.5.5. priority with preemptive 1.5.6. round robin 1.6. Execution of the Operating System 1.7. Security Issues	(9 Lectures)
Unit 4	Thread, SMP and Microkernels 1.1. Process and threads 1.1.1. Multithreading 1.1.2. Thread Functionality 1.1.3. User-Level and Kernel-Level thread 1.2. Symmetric Multiprocessing 1.2.1. SMP Architecture 1.2.2. SMP Organization	(7 Lectures)

	1.2.3. Multiprocessor Operating System Design Consideration 1.3. Microkernels 1.3.1. Microkernel Architecture 1.3.2. Benefits of Microkernel Organization Performance and Design	
Unit 5	Concurrency 1.1. Principles of Concurrency 1.2. Mutual Exclusion 1.3. Semaphores 1.4. Monitors 1.5. Message passing 1.6. Readers/Writers Problems	(6 Lectures)
Unit 6	Dead Lock and Starvation 1.1. Principle of Deadlock 1.2. Deadlock Prevention 1.3. Deadlock Avoidance 1.4. Deadlock Detection 1.5. An Integrated deadlock strategy 1.6. Dining philosophers problem	(5 Lectures)
Unit 7	Memory Management (MM) 1.1. Background 1.2. Logical Vs Physical address space 1.3. Swapping 1.4. Contiguous allocation 1.5. Paging 1.6. Segmentation 1.7. Segmentation with paging Combined system 1.8. Virtual memory concept Overlays, Demand paging, Page replacement algorithms	(9 Lectures)
Unit 8	File System 1.1. File Concept : File types, File operations 1.2. Access methods 1.3. Directory structure : Device directory contents ,Operations 1.4. Protection 1.5. File system structure 1.6. Allocation methods 1.7. NFS	(7 Lectures)
References: <ul style="list-style-type: none"> • Operating Systems, A.S. Godbole, Tata McGraw Hill Publications • Operating Systems, internal and Design Principal, William Stallings, Pearsons • Operating System Concepts, Silberschatz, Galvin, Gagne, Wiley India Pvt Ltd. 		

MTS5306 Java Programming

Unit 1	Introduction to Object Oriented Concepts :- Object, Class, Encapsulation, Abstraction, Data Hiding, Inheritance, Polymorphism Message Passing, Dynamic Binding, History of Object Oriented Languages, Comparison with Structured Programming	(2 Lectures)
Unit 2	Introduction to the Java Technology The Java Platform, Java Buzzwords, API, JVM, Java Compiler, Byte Code, Java Editions, Internal Details of JVM, Difference between JDK, JRE & JVM	(3 Lectures)
Unit 3	Main Features of Java language Introduction to Java, Writing & Compiling Java Programs- The main Method, Command Line Arguments, String Class, Primitive Data Types, Variables, and Assignment, javadoc Comments, UNICODE System, Naming Convention, Expressions, Data Conversion, Interactive Programs, Boolean Data Type and Expressions { if, switch } Statements, { for, while, do } Statements, Creating & Calling Methods, Parameter Passing, Returning Values, Overloading Methods, Scope of Variables	(3 Lectures)
Unit 4	Arrays Defining and Initializing Arrays, new Operator, Using Arrays , Passing Arrays to Methods, Returning Arrays from Methods, Command-Line Arguments, Dimensional Arrays	(2 Lectures)
Unit 5	Objects and Classes Defining Class, Creating Object, Reference Variables, Packages (Concept of package, package and import keywords, Use of predefined packages), Visibility Modifiers(public, private, protected, default), Object, Members and Class Members (static), Arrays of Objects, this Keyword, Wrapper Classes, Types of Classes(Inner Class, Anonymous Class), Static block , Instance Block, Scanner Class	(7 Lectures)
Unit 6	String Handling What is a String? , Immutable Strings, Substring, Methods of String Class, toString() Method, StringBuffer Class, StringBuilder Class, StringBuffer vs StringBuilder	(4 Lectures)
Unit 7	Inheritance and Polymorphism Inheritance (IS-A), Aggregation/Composition (HAS-A), Superclass and Subclass – extends Keyword, super Keyword, Overriding Members, Protected Data Members- Object Class and its toString() Method, Final Classes, Methods and Variables, instanceof Operator, Dynamic Binding , Casting Objects	(3 Lectures)
Unit 8	Abstract Classes & Interfaces Concept of Interfaces, Implementing Interfaces	(2 Lectures)
Unit 9	Exceptions and Exception handling Exception Handling: What and Why?, try and catch Block, Multiple catch Block ,Nested try, finally Block, throw Keyword, Exception Propagation, throws Keyword , Checked & Unchecked Exceptions, Custom Exception , final vs finally vs finalize()	(4 Lectures)
Unit 10	File Handling FileOutputStream & FileInputStream , BufferedOutputStream & BufferedInputStream, FileWriter & FileReader, Using Scanner Class to Read from File, PrintWriter, StreamTokenizer, ObjectInputStream & ObjectOutputStream, , Serialization & Deserialization, transient	(6 Lectures)

	Keyword	
Unit 11	Multithreading Multithreading : What and Why? , Life Cycle of a Thread, Creating Thread(Extending Thread Class/ Implementing Runnable Interface) , Thread Priority, What is a Daemon Thread? , Thread synchronization	(5 Lectures)
Unit 12	Introduction to Collection Collection Framework, ArrayList Class, LinkedList Class, HashSet Class, TreeSet Class, Hashtable Class, HashMap Class, TreeMap Class, Comparable and Comparator Interfaces	(8 Lectures)
Unit 13	JDBC JDBC Drivers, Connectivity with MySQL, DriverManager, Connection interface, Statement interface, ResultSet interface, PreparedStatement, ResultSetMetaData, DatabaseMetaData	(6 Lectures)
Unit 14	JAVA Other Features For-each loop, Varargs, Static import, Annotations	(2 Lectures)
Unit 15	Introduction to Web Application What is a web application? HTTP Request, HTTP Response, Client UI (HTML/CSS, JavaScript) & Server (Servlet/JSP), Tomcat Web Server, "Hello World" Web App Demo using Servlet & JSP	(3 Lectures)
Reference Books: 1.Java : How to Program, Deitel & Deitel, Prentice Hall 2.Core Java 2: Volume I – Fundamentals, Cay S. Horstmann and Gary Cornell; Prentice-Hall 2002. ISBN 0130471771 3.Core Java 2: Volume II – Advanced Features, Cay S. Horstmann and Gary Cornell; Prentice-Hall 2001. ISBN 0130927384 4.Java: The Complete Reference, Herbert Schildt. Fifth Edition 5.Introduction to Java Programming, Daniel Liang Important URLs : http://java.sun.com/reference/docs/		

MTS5307

Laboratory Course III (Based on Operating systems and JAVA programming)

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Academic Year 2017-2018

Syllabus for M.Sc. (Industrial Mathematics with Computer Applications)

SEMESTER - IV

MTS5401 Ordinary Differential Equations

Unit 1	Introduction: Degree and Order of a Differential Equation, Formulation and First Order Equations of Variable Separable Type, Homogeneous and Linear Differential Equation. Orthogonal Trajectories	(2 Lectures)
Unit 2	Second Order Linear Equations 1. The General Solutions of Homogeneous Equations 2. The Use of One Solution to find another 3. The Homogeneous Equation with Constant Coefficients 4. The Method of Undetermined Coefficients 5. The Method of Variation of Parameters	(8 Lectures)
Unit 3	Qualitative Properties of Solutions 1. Oscillations and the Sturm Separation Theorem 2. The Sturm Comparison Theorem	(5 Lectures)
Unit 4	Power Series Solutions 1. Second Order Equations: Ordinary Points 2. Regular Singular Points and Forbenius Series Solution 3. Gauss Hyper geometric Equation and Point at Infinity	(8 Lectures)
Unit 5	System of First Order Equations 1. General System and its Formulations 2. Linear Systems 3. Homogeneous Linear Systems with Constant Coefficients	(8 Lectures)
Unit 6	Non Linear Equations 1. Autonomous Systems, The Phase Plane 2. The types of Critical Points and its Stability 3. Critical Points and Stability for Linear Systems 4. Stability by Liapunov's Direct Method 5. Simple Critical Points for Non-Linear Systems	(10 Lectures)
Unit 7	The Calculus of Variations 1. The Method of Undetermined Coefficients 2. Euler's Differential Equation for an Extremal 3. Isoperimetric Problems	(9 Lectures)
Unit 8	The Existence and Uniqueness Theorem 1. Picard's Method of Successive Approximations 2. Lipschitz Continuity and its related Problems 3. Various Versions of Existence and Uniqueness theorem (Statements Only)	(6 Lectures)

Note

- Various topics like regarding Applications can be done as a part of Seminars
- Solving of the differential Equations to be coded using various Languages like C, C++, Python, Scilab, Octave, Euler and JAVA

Reference Books

1. Differential Equations with Applications with Historical Notes: GF Simmons
2. Differential Equations, Dynamical Systems and Linear Algebra: Morris Hirsch and Stephen Smale
3. Differential Equations: Earl Coddington
4. Differential Equations: Rainville, Bedient
5. A First Course on Differential Equations and its Applications: Derrick and Grossman

MTS5402 Statistical Inference

Unit 1	Parametric Tests <ol style="list-style-type: none">1. Statistical Hypothesis: Simple and Composite2. Null Hypothesis and Alternative hypothesis3. Types of Errors in Testing of hypothesis4. Level of Significance, Critical Regions,5. One Tailed and Two tailed tests6. P value or Probability value of a Test Statistic7. Procedure of Testing of hypothesis and problems related to it8. Procedure of P-Value Estimation and problems related to it9. Size and Power of a test.10. Most Powerful (M.P.) level α test of simple null hypothesis against a simple Alternative11. Statement of Neyman Pearson Lemma for constructing the M.P.12. Power function of a test, power curve, definition of uniformly most powerful (UMP) level α test for one side alternative and related example.	(12 Lectures)
Unit 2	Large Sample Tests <ol style="list-style-type: none">1. Introduction to concept of Sampling Distribution of a Statistic2. Sampling of Attributes<ul style="list-style-type: none">• Test for Single Proportion and related problems• Test of Significance for Difference of Proportions and related problems3. Sampling of Means<ul style="list-style-type: none">• Test of Significance for a Single Mean and related problems• Test of Significance for Difference of Means and related problems• Test of Significance for the difference of Standard deviations an related problems	(8 Lectures)
Unit 3	Chi square distribution <ol style="list-style-type: none">1. Applications of Chi-square Distribution2. Chi-square test for Goodness of Fit and its conditions for validity3. Chi-Square Test for Independence of Attributes4. Introduction to Degrees of Freedom5. Its use in 2×2 and $2 \times k$ contingency tables6. Test for equality of several Proportions7. Chi-square test for Population Variance	(6 Lectures)
Unit 4	Small Sample Tests <ol style="list-style-type: none">1. Critical Values and Applications of t distribution2. Test for a Single Mean3. Confidence Interval for difference of two means4. Paired t test for difference of two Means5. T-test for significance of an Observed Sample Correlation Coefficient.6. Fisher's Z Transform7. F Statistic and Critical Values of F distribution8. Applications of F distributions and its Applications9. F-test for Equality of Population Variances10. Relation between t, F and Chi-square Distributions	(10 Lectures)

Unit 5	<p>Non Parametric Methods</p> <ol style="list-style-type: none"> 1. Introduction to Non Parametric Tests, Advantages and Limitations 2. Concept of Distribution Free Statistic 3. Sign Test <ul style="list-style-type: none"> • Single Sample Sign Test • Single Sample Sign Test (Large Sample) • Single Sample Sign Test (Small Samples) • Paired Sample Sign Test 4. Wilcoxon Signed Rank Test <ul style="list-style-type: none"> • Signed Ranks • Single Sample Wilcoxon Signed Rank Test (Small Sample $n \leq 30$) • Wilcoxon Signed Rank Test for Matched Pairs • Wilcoxon Signed Rank Test (Large Samples) 5. Mann Whitney Test <ul style="list-style-type: none"> • U Statistics • Mann Whitney Test for Independent Samples (Small Samples) • Mann Whitney Test for Independent Samples (Large Samples) 	(8 Lectures)
Unit 6	<p>Likelihood Ratio Tests</p> <ol style="list-style-type: none"> 1. Notion of Likelihood Ratio Test (LRT) 2. Construction of LRT for means of normal distribution (one and two sided) <ul style="list-style-type: none"> • When variance is known • When variance is unknown 3. Construction of LRT for variance of normal distribution (one and two sided) <ul style="list-style-type: none"> • When mean is known • When mean is unknown 4. LRT for parameters of Binomial and Exponential distribution for two sided alternatives only. 5. LRT as a function sufficient statistics 6. Statement of Asymptotic Distribution of $-2 \log \lambda(x)$ 	(10 Lectures)
Unit 7	<p>Analysis of Variance (ANNOVA)</p> <ol style="list-style-type: none"> 1. One Way Classification <ul style="list-style-type: none"> • Mathematical Model • Statistical Analysis of the above model • Hypothesis Testing for more than Two Means and related problems 2. Two Way Classification <ul style="list-style-type: none"> • Mathematical Model and Underlying Assumptions • Statistical Analysis of the Above Model • Problem Based on it 	(8 Lectures)
<p>Note: 1 More Emphasis to be given on Problem Solving.</p>		

MTS5403 Computer Networks

Unit 1	Introduction to Computer Networks <ul style="list-style-type: none">1.1. Data Communication<ul style="list-style-type: none">1.1.1. characteristics of data communication,1.1.2. components,1.1.3. data representation1.1.4. data flow1.2. Computer Networks :· goals and applications1.3. Network Hardware: · broadcast and point-to-point1.4. Network Topologies: · mesh, star, bus, ring, hybrid1.5. Network Types: · LAN, MAN, WAN, Wireless Networks, Home Networks,1.6. Protocols and Standards1.7. Network Software<ul style="list-style-type: none">1.7.1. Protocol Hierarchies1.7.2. layers, protocols, peers, interfaces, network architecture, protocol stack1.7.3. design issues of the layers – addressing, error control, flow control, multiplexing and de-multiplexing, routing1.7.4. Connection-oriented and connectionless service	(6 Lectures)
Unit 2	Network Models <ul style="list-style-type: none">2.1. Reference Models<ul style="list-style-type: none">2.1.1. The OSI Reference Model2.1.2. TCP/IP Reference Model2.1.3. Comparison of the OSI and TCP/IP reference models	(3 Lectures)
Unit 3	Physical Layer <ul style="list-style-type: none">3.1.Tasks Performed3.2.Signals<ul style="list-style-type: none">3.2.1. Analog and Digital3.2.2. Analog signals3.2.3. Digital signals3.3.Digital Transmission<ul style="list-style-type: none">3.3.1. Line coding<ul style="list-style-type: none">3.3.1.1. Some characteristics of Line coding3.3.1.2. Line coding scheme3.4.Sampling<ul style="list-style-type: none">3.4.1. PAM3.4.2. PCM3.5.Transmission Mode<ul style="list-style-type: none">3.5.1. Parallel Transmission3.5.2. Serial Transmission3.6.Transmission Media<ul style="list-style-type: none">3.6.1. Guided Media3.6.2. Unguided Media (Wireless)3.7.The Public Switched Telephone Network<ul style="list-style-type: none">3.7.1. Structure of the telephone Network3.7.2. Switching Circuit, Message and Packet	(10 Lectures)
Unit 4	Data Link Layer <ul style="list-style-type: none">4.1.Data Link Layer Design Issues<ul style="list-style-type: none">4.1.1. Services provided to the network layer4.1.2. Framing4.1.3. Error control4.1.4. Flow control4.2.Error Detection and Correction<ul style="list-style-type: none">4.2.1. Types of Errors Single bit and burst errors	(8 Lectures)

	<ul style="list-style-type: none"> 4.2.2. Detection 4.2.3. Error Correction 4.3.Elementary Data Link Protocols <ul style="list-style-type: none"> 4.3.1. Unrestricted Simplex protocol 4.3.2. A simplex stop-and wait protocol 4.3.3. A simplex protocol for a noisy channel 4.4.Sliding Window protocols <ul style="list-style-type: none"> 4.4.1. One-bit sliding window protocol 4.4.2. A protocol using Go Back N 4.4.3. A protocol using Selective Repeat 	
Unit 5	<p>The Medium Access Sublayer</p> <ul style="list-style-type: none"> 5.1.The Channel Allocation Problem <ul style="list-style-type: none"> 5.1.1. Static Channel Allocation in LANs and MANs 5.1.2. Dynamic channel allocation in LANs and MANs. 5.2.Multiple Access <ul style="list-style-type: none"> 5.2.1. Random Access 5.2.2. Controlled Access 5.2.3. Channelization FDMA, TDMA, CDMA concepts 5.3.Local Area Networks : Ethernet <ul style="list-style-type: none"> 5.3.1. Traditional Ethernet 5.3.2. Fast Ethernet 5.3.3. Gigabit Ethernet 5.4.Data Link Layer Switching <ul style="list-style-type: none"> 5.4.1. Bridges from 802.x to 802.y 5.4.2. Local Internetworking 5.4.3. Spanning tree Bridges 5.4.4. Remote Bridges 5.4.5. Repeaters, Hubs, Bridges, Switches, Routers and Gateways 5.4.6. Virtual LANs. 5.5.1. IEEE 802.11 Architecture: BSS and ESS, Station types 5.5.2. Bluetooth Architecture : Piconets and scatternet 	(8 Lectures)
Unit 6	<p>Network Layer</p> <ul style="list-style-type: none"> 6.1.Network Layer Design Issues <ul style="list-style-type: none"> 6.1.1. Store and Forward Packet Switching 6.1.2. Services Provided to the Transport Layer 6.1.3. Implementation of Connectionless Services 6.1.4. Implementation of Connection oriented services 6.1.5. Comparison of Virtual Circuit and Datagram Subnets 6.2.Addressing <ul style="list-style-type: none"> 6.2.1. Internet Address 6.2.2. Classful Address 6.2.3. Subnetting 6.2.4. Classless Addressing 6.2.5. Dynamic Address Configuration 6.3.Routing Algorithms <ul style="list-style-type: none"> 6.3.1. Optimality Principle 6.3.2. Shortest Path Routing 6.3.3. Flooding 6.3.4. Distance Vector Routing 6.3.5. Link State Routing 6.3.6. Routing Techniques Routing Table <ul style="list-style-type: none"> 6.3.6.1. Next hop Routing 6.3.6.2. Network specific Routing 6.3.6.3. Host specific routing 	(12 Lectures)

	<ul style="list-style-type: none"> 6.3.6.4. Default Routing 6.3.7. Static versus Dynamic Routing Table 6.3.8. Routing Table for Classful Addressing 6.4. Congestion Control <ul style="list-style-type: none"> 6.4.1. Concept 6.4.2. General Principles of Congestion Control 6.4.3. Congestion Control Prevention Policies 6.5. Internetworking <ul style="list-style-type: none"> 6.5.1. How networks Differ 6.6. Network Layer Protocols <ul style="list-style-type: none"> 6.6.1. ARP 6.6.2. IP 6.6.3. ICMP 	
Unit 7	<p>Transport Layer</p> <ul style="list-style-type: none"> 7.1. The Transport Service <ul style="list-style-type: none"> 7.1.1. Services provided to the Upper layers 7.1.2. Transport Service primitives 7.2. Elements of Transport Protocols <ul style="list-style-type: none"> 7.2.1. Addressing 7.2.2. Connection Establishment 7.2.3. Connection Release 7.2.4. Flow Control and Buffering 7.2.5. Multiplexing 7.2.6. Crash Recovery 7.3. The Internet Transport Protocols : UDP <ul style="list-style-type: none"> 7.3.1. Introduction to UDP 7.3.2. Remote Procedure Call 7.4. The Internet Transport Protocols : TCP <ul style="list-style-type: none"> 7.4.1. Introduction to TCP 7.4.2. The TCP Protocol 7.4.3. The TCP Segment Header 	(12 Lectures)
Unit 8	<p>Upper Layer Protocols</p> <p>8.1 SMTP, FTP, Telnet, HTTP (functionality and applications only)</p>	(2 lectures)

Reference Books

1. Computer Networks , A. S. Tanenbaum, 4th Edition
2. Data Communication and Networking, Behrouz Forouzan, 3rd Edition
3. An Introduction to Computer Networks, S. A. M. Rizvi and V. K. Sharma

MTS5404 Design and Analysis of Algorithms

Unit 1	Growth of Functions <ol style="list-style-type: none">1. Asymptotic Notations2. Standard Notations and Common Functions	(2 Lectures)
Unit 2	Recurrences <ol style="list-style-type: none">1. The substitution Method2. The Recursion Tree Method3. The Master Theorem	(6 Lectures)
Unit 3	Sorting an Order Statistics <ol style="list-style-type: none">1. Heap Sort (Heaps, Heap Property and the algorithm)2. Quicksort (Description, Algorithm and Performance Analysis)3. Sorting in Linear Time (Radix, Counting and Bucket Sort)4. Median and Order Statistics (Maximum and Minimum, Selection in expected linear time and worst case linear time)	(12 Lectures)
Unit 4	Dynamic Programming <ol style="list-style-type: none">1. Matrix chain multiplication Problem2. Longest common Subsequence.3. Optimal Binary Search Trees	(8 Lectures)
Unit 5	Greedy Algorithms <ol style="list-style-type: none">1. An activity selection problem2. Elements of Greedy Strategy3. Huffman Codes	(6 Lectures)
Unit 6	Graph Theoretic algorithms <ol style="list-style-type: none">1. Revision of BFS, DFS algorithms of Data Structures2. Topological Sort3. Revision of algorithms of Kruskal and Prim4. Bellman Ford's Algorithm5. Dijkstra's Algorithm	(6 Lectures)
Unit 7	Hash Tables <ol style="list-style-type: none">1. Direct Address Tables2. Hash Tables3. Hash Functions4. Open Addressing5. Perfect Hashing	(6 Lectures)
Unit 8	String Matching <ol style="list-style-type: none">1. The Naïve String Matching Algorithm2. The Rabin Krap Algorithm3. String Matching with Finite Automata4. The Knuth Morris Pratt Algorithm	(6 lectures)
Unit 9	NP Completeness <ol style="list-style-type: none">1. Informal concepts of deterministic and non deterministic algorithms2. P and NP , NP Completeness3. Statements of Cooks Theorem4. Discussion with Vertex Cover Problem5. Discussion with Travelling Salesman Problem.	(8 Lectures)

Note:

- Any programming assignment with any of the algorithms mentioned above can be considered as a part of Assignments.
- Certain Topics covered in Data Structures and Graph Theory can also be considered as a part of Assignments.

References:

- Introduction to Algorithms: H.Cormen, Rivest, Stien anf Leiserson
- Fundamentals of Computer Algorithms: Horowiitz, Sahani and Rajasekaran
- Mathematics for Analysis of Algorithms: D.Knuth and H.Green
- The Art of Computer Programming (Volume I and II) : Donald Knuth
- An introduction to Analysis of Algorithms: Micheal Soltys

MTS5405 Android Programming

Unit 1	Android Introduction What is Android? , History and Version, Android Architecture, Core Building Blocks, Android Emulator, Setup Android Studio, Hello Android Example, Understanding Project Structure, ART (Android Runtime), AndroidManifest.xml, R.java, RES (Resources), Understanding Permissions.	(6 Lectures)
Unit 2	Android UI Elements UI Widgets, Working with Button, Toast, Custom Toast, ToggleButton, CheckBox, AlertDialog, Spinner, WebView, SeekBar, DatePicker, TimePicker, ProgressBar, ActionBar(Toolbar) – Creating Actions, Handling Action Selection.	(12 Lectures)
Unit 3	Activity and Intents Activity Life Cycle, Implicit Intent, Explicit Intent, Sharing Data Between Two Activities (Using Intent), startActivityForResult , Android Camera App Example By Using Camera Intent.	(8 Lectures)
Unit 4	Android Fragments Android Fragments Lifecycle, FragmentManager Class, Methods, Android Fragment Example	(6 Lectures)
Unit 5	Android Storage Shared Preferences, Internal Storage, External Storage.	(5 Lectures)
Unit 6	Android SQLite SQLiteOpenHelper Class and Methods, SQLiteDatabase Class & Methods, CRUD Operations (Create,Read,Update,Delete)	(6 Lectures)
Unit 7	Content Providers Concept, Reading Data From Content Provider, Using Telephonic Content Provider.	(4 Lectures)
Unit 8	GPS & Google Maps LocationManager Class, Getting Location Coordinates (Latitude & Longitude), Using Google Maps	(6 lectures)
Unit 9	Android Multimedia Playing audio and video	(3 Lectures)
Unit 10	Connecting to a Web Application Creating Server (PHP/ JAVA), Creating Client (Android), Communication between Client and Server (Passing JSON Data), Parsing JSON Response	(4 Lectures)

Reference Books:

1. Android Programming for Beginners by John Horton
2. Beginning Android Programming with Android Studio(2016) by Jerome F. DiMarzio
3. Head First Android Development(2015) by Dawn Griffith
4. Beginning Android by Mark L. Murphy
5. Professional Android Application Development by Reto Meier

Important URL <https://developer.android.com>

MTS5406 Python Programming

Unit 1	Python Introduction What is Python? , Features, History, Version, Applications, Install Python, Python Path, Python Example, Execute Python, Variables, Keywords, Identifiers, Literals, Operators, Comments	(4 Lectures)
Unit 2	Control Statement if, if-else if, nested if, for loop, while loop, do-while, break, continue, pass.	(4 Lectures)
Unit 3	Python Strings Accessing Strings, Basic Operators, Membership Operators, Relational Operators, Slice Notation, String functions and Methods	(6 Lectures)
Unit 4	Python Data Structures Python List - Accessing Lists, List Operations, Functions and Methods of Lists Python Tuple- Accessing Tuple, Tuple Operations, Functions of Tuples, Why use Tuple?. Python Dictionary- Accessing Values, Functions & Methods.	(8 Lectures)
Unit 5	Python Functions Built-in Functions, User defined Functions, Invoking a Function, return Statement, Argument and Parameter, Positional Argument (Required Argument), Default Argument, Keyword Argument, Anonymous Function, Difference between Normal Functions and Anonymous Function, Scope of a Variable	(4 Lectures)
Unit 6	Python OOPs OOPs Concepts, Object Class, Constructors, Inheritance, Multilevel Inheritance, Multiple Inheritance	(3 Lectures)
Unit 7	Python Files I/O Input from Keyboard, File Handling, Attributes of File, Modes of File, File Handling Methods	(6 Lectures)
Unit 8	Python Modules What is a Module? , Importing a Module, Built in Modules in Python, Package.	(4 lectures)
Unit 9	Exception Handling Hierarchy of Exception, Except with no Exception, Declaring Multiple Exception, Finally Block, Raise an Exception, Custom Exception.	(4 Lectures)
Unit 10	Time & Calendar Retrieve Time, Formatted Time, Time module, Calendar module	(2 Lectures)
Unit 11	Multithreading The Threading Module, Thread class, Creating a New Thread, Starting a New Thread, Thread Class Methods, Thread Synchronization.	(8 Lectures)
Unit 12	Python-MySQL Connectivity Establishing a Connection, CRUD (Create, Read, Update, Delete) Operations.	(3 Lectures)
Unit 13	Python GUI Programming Tkinter module, Tkinter Programming, Tkinter Widgets (Frame, Canvas, Label, Button, Listbox, Radiobutton, Checkbutton, MessageBox).	(4 Lectures)

Reference Books:

1. Beginning-Python, Second Edition by Magnus Lie Hetland
2. The Complete Reference Python by Martin C. Brown
3. Head First Python by Patrick Barry
4. Learning Python, O'Reilly by Mark Lutz
5. Python in a Nutshell, O'Reilly by Alex Martelli

MTS5407 Web UI (User Interface) Design

Unit 1	<p>HTML What is HTML?, Tags, Heading, paragraph, anchor, image, table, Lists (ordered, unordered, description), form, label, input, button, br, hr, script (simple javascript code)</p> <p>HTML5: Audio, Video, Progress, Datalist Tag, Header Tag, Footer Tag, Article Tag, Aside Tag, Canvas, SVG, Local Storage, Geo location</p>	(14 Lectures)
Unit 2	<p>CSS Syntax, Colors, Backgrounds, Borders, Margins, Padding, Height/Width, Box Model, Outline</p> <p>Text, Fonts, Icons, Links, Lists, Tables, Display, Max-width, Position, Overflow, Inline-block, Align, Combinators, Pseudo-class, Pseudo-element, Opacity, Navigation Bar, Dropdowns, Tooltips, Image Gallery, Image Sprites, Attr Selectors, Forms, Counters,</p> <p>CSS3 – Rounded Corners, Border Images, Backgrounds, Colors, Gradients, Shadows, Text, Fonts, 2D Transforms, 3D Transforms, Transitions, Animations, Images, Buttons, Pagination, Multiple Columns, User Interface, Box Sizing, Flexbox, Media Queries, MQ Examples</p>	(12 Lectures)
Unit 3	<p>JavaScript Introduction, Syntax, Statements, Comments, Variables, Operators, Data Types, Functions, Objects, Scope, Events, Strings, String Methods, Numbers, Number Methods, Math, Random, Dates, Date Formats, Date Methods, Arrays, Array Methods, Array Sort, Booleans, Comparisons, Conditions, Switch, for loop, while loop, break, Type Conversion, Bitwise, Debugging, JS Objects, Object Properties, Object Methods, Object Prototypes.</p>	(14 Lectures)
Unit 4	<p>Bootstrap What is Bootstrap, Container, Jumbotron, Button, Grid, Table, Form, Alert, Wells, Badge & Label, Panels, Pagination, Pager, Image, Glyphicon, Carousel, Progress Bar, List Group, Dropdown, Collapse, Tabs/Pills, Navbar, Input Types (check box, radio button), Modals, Popover</p>	(8 Lectures)
Unit 5	<p>jQuery & AJAX Introduction, Syntax, Selectors, Attributes, Effects, hide/show, toggle, fade, slide, animate, delay, callbacks, html(), CSS manipulation, Traversing, DOM, Filtering, Events – (click(), bind(), blur(), focus(), select(), change(), submit(), keydown(), keypress(), keyup(), mouseenter(), mouseleave(), hover(), mousedown(), mouseup(), mouseover(), load(), unload()), AJAX, GET, POST</p>	(12 Lectures)

Reference Books:

1. Beginning HTML5 and CSS3 By Christopher Murphy, Divya Manian, Oliver Studholme and Richard W. Clark (APress)
2. Beginning JavaScript By Jeremy McPeak and Paul Wilton(Wrox)
3. Beginning JQuery By Jack Franklin (APress)
4. Bootstrap By Jake Spurlock (O'Reilly)
5. Head First HTML5 Programming, Building Web Apps with JavaScript By Eric Freeman, Elisabeth Robson (O'Reilly)
6. Head First JavaScript Programming By [Eric T. Freeman, Elisabeth Robson](#) (O'Reilly)
7. Head First Ajax By Rebecca M. Riordan (O'Reilly)
8. Head First jQuery, A Brain-Friendly Guide By Ryan Benedetti, Ronan Cranley (O'Reilly)

Important URLs:

1. <https://www.w3schools.com>
2. [http:// getbootstrap.com](http://getbootstrap.com)

MTS5408

Laboratory Course IV (**Based on
Elective(MTS5405/ MST5406/MST5407)**)