COURSE SCHEME
EXAMINATION SCHEME
ABSORPTION SCHEME
&
SYLLABUS

Of

First, Second, Third & Fourth Semester
Choice Base Credit System (CBCS)
Of
Master of Technology (M.Tech)

In
Software System

Of
RASHTRASANT TUKDOJI MAHARAJ
NAGPUR UNIVERSITY, NAGPUR

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology
Choice Base Credit System (CBCS)

I Semester M. Tech. Software System (SS)

Subject Code	Subject	Teaching Scheme			Examination Scheme								
					Theory					Practical			
		Hours per week		No. of Credits	Duration of Paper (Hrs.)	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks
		L	P			University Assessment	College Assessment			University Assessment	College Assessment		
PGSS101T	Advanced Data Structure and Algorithms	4	-	4	3	70	30	100	50	-	-	-	-
PGSS102T	Advances System Software Design	4	-	4	3	70	30	100	50	-	-	-	-
PGSS103T	Software Architecture	4	-	4	3	70	30	100	50	-	-	-	-
PGSS104T	Elective –I (Discipline Specific)	4	-	4	3	70	30	100	50	-	-	-	-
PGOPEN105T	Elective –II (Open)	4	-	4	3	70	30	100	50	-	-	-	-
PGSS106P	Laboratory –I (ADSA)	-	2	1	-	-	-	-	-	50	50	100	50
PGSS107P	Laboratory –II (ASSD)	-	2	1	-	-	-	-	-	50	50	100	50
Total		20	4		-	350	150	500	-	100	100	200	-
Semester Total		24		22	700 Marks								

Elective –I (Discipline Specific) PGSS104/1T- **AI and Expert System Design,** PGSS104/2T- **Network System Design**
Elective –II (Open) PGOPEN105/1T-**Real Time System & Software,** PGOPEN105/2T-**Operation Research**

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology
Choice Base Credit System(CBCS)

II Semester M. Tech. Software System (SS)

Subject Code	Subject	Teaching Scheme			Examination Scheme								
					Theory					Practical			
		Hours per week		No. of Credits	Duration of Paper (Hrs.)	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks
		L	P			University Assessment	College Assessment			University Assessment	College Assessment		
PGSS201T	Automata and Advanced Computability	4	-	4	3	70	30	100	50	-	-	-	-
PGSS202T	Software Design and Construction	4	-	4	3	70	30	100	50	-	-	-	-
PGSS203T	Device Driver Design and Development	4	-	4	3	70	30	100	50	-	-	-	-
PGSS204T	Elective –III (Discipline)	4	-	4	3	70	30	100	50	-	-	-	-
PGFD205T	Foundation Courses -I	4	-	4	3	70	30	100	50	-	-	-	-
PGSS206P	Laboratory –III (AAC)	-	2	1	-	-	-	-	-	50	50	100	50
PGSS207P	Laboratory –IV (SDC)	-	2	1	-	-	-	-	-	50	50	100	50
Total		20	4		-	350	150	500	-	100	100	200	-
Semester Total		24		22	700 Marks								

Elective –III (Discipline Specific) PGSS204/1T-**System Performance and Evaluation,** PGSS204/2T-**Organization Theory and Behavior**
Foundation Courses –I PGFD205T **-Research Methodology**

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology
Choice Base Credit System(CBCS)

III Semester M. Tech. Software System (SS)

Subject Code	Subject	Teaching Scheme			Examination Scheme									
					Theory					Practical				
		Hours per week		No. of Credits	Duration of Paper (Hrs.)	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks
		L	P			University Assessment	College Assessment			University Assessment	College Assessment		
PGOPEN301T	Elective –IV (Open)	4	-	4	3	70	30	100	50	-	-	-	-
PGFD302T	Foundation Courses -II	4	-	4	3	70	30	100	50	-	-	-	-
PGSS303P	Project Seminar	-	-	8	-	-	-	-	-	-	200	200	100
Total		8	-	-		140	60	200	-	-	200	200	-
Semester Total		8		16	400 Marks								

Elective –IV (Open) PGOPEN301/1T-**Software Testing Methodologies,** PGOPEN301/2T-**Optimization Techniques**
Foundation Courses –II PGFD302T-**Project planning and Management**

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology
Choice Base Credit System(CBCS)

IV Semester M. Tech. Software System (SS)

Subject Code	Subject	Teaching Scheme			Examination Scheme								
					Theory					Practical			
		Hours per week		No. of Credits	Duration of Paper (Hrs.)	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks
		L	P			University Assessment	College Assessment			University Assessment	College Assessment		
PGSS401P	Project	-	-	16	-	-	-	-	-	400	-	400	200
Total		-	-		-	-	-	-	-	400	-	400	-
Semester Total		-		16	400 Marks								

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology
Choice Base Credit System (CBCS)

Absorption Scheme

Proposed Scheme of Absorption of Old course to New course of First to Fourth Semesters

I Semester M. Tech. Software System (SS)

Table-1

Subject Code (OLD)	Subject (OLD)		Subject Code (NEW)	Subject (NEW)	
1 SS101T	Advanced Data Structures		PGSS101T	Advanced Data Structure and Algorithms (ADSA)	
2 SS101P	Advanced Data Structures (Lab)		PGSS106P	Laboratory –I (ADSA)	
3 SS102T	Advances System Software Design		PGSS102T	Advances System Software Design (ASSD)	
4 SS102P	Advances System Software Design (Lab)		PGSS107P	Laboratory –II (ASSD)	
5 SS103T	Research Methodology		PGFD205T	Foundation Course-I Research Methodology	
6 SS104T	Elective-I AI and Expert System Design		PGSS104/1T	Elective –I (Discipline Specific) AI and Expert System Design	
6 SS104T	Elective-I Network System Design		PGSS104/2T	Elective –I (Discipline Specific) Network System Design	
6 SS104T	Elective-I Security Analysis of Software		---	---	
7 SS105T	Elective-II Data Ware Housing and mining		---	---	
7 SS105T	Elective-II Real Time System and Software		---	---	
7 SS105T	Elective-II Software Architecture		PGSS103T	Software Architecture	
8 SS106T	Seminar		---	---	

Table-2

Subject Code (NEW)	Subject (NEW)		Subject Code (OLD)	Subject (OLD)	Remark
PGSS101T	Advanced Data Structure and Algorithms		1 SS101T	Advanced Data Structures	1 SS101T Not Clear Have to appear New PGSS101T
PGSS102T	Advances System Software Design		3 SS102T	Advances System Software Design	3 SS102T Not Clear Have to appear New PGSS102T
PGSS103T	Software Architecture		7 SS105T	Elective-II Software Architecture	7 SS105/3T Not Clear Have to appear New PGSS103T
PGSS104T	Elective –I (Discipline Specific)				If you Have Clear old SS104T (AI and Expert System Design) OR SS104T (Network System Design) Then don't appear New PGSS104T Otherwise Have to appear New PGSS104T Elective –I (Discipline Specific)
PGOPEN105T	Elective –II (Open)		---------	----------	Have to appear
PGSS106P	Laboratory –I (ADSA)		2 SS101P	Advanced Data Structures (Lab)	2 SS101P Not Clear Have to appear New PGSS106P
PGSS107P	Laboratory –II (ASSD)		4 SS102P	Advances System Software Design (Lab)	4 SS102P Not Clear Have to appear New PGSS107P

Proposed Scheme of Absorption of Old course to New course of First to Fourth Semesters

II Semester M. Tech. Software System (SS)

Table-1

Subject Code (OLD)	Subject (OLD)		Subject Code (NEW)	Subject (NEW)	
1 SS201T	Automata and Advanced Computability		PGSS201T	Automata and Advanced Computability (AAC)	
2 SS201P	Automata and Advanced Computability (Lab)		PGSS206P	Laboratory –III (AAC)	
3 SS202T	Software Design and Construction		PGSS202T	Software Design and Construction (SDC)	
4 SS202P	Software Design and Construction (Lab)		PGSS207P	Laboratory –IV (SDC)	
5 SS203T	Device Driver Design and Development		PGSS203T	Device Driver Design and Development	
6 SS204T	Device Driver Design and Development (Lab)		---	---	
7 SS204T	Elective-III Mobile Application Development		---	---	
7 SS204T	Elective-III System Performance and Evaluation		PGSS204/1T	Elective –III (Discipline) System Performance and Evaluation	
7 SS204T	Elective-III Cyber Forensic and Computer Crimes		---	---	
8 SS205T	Elective-IV Software Engineering		---	---	
8 SS205T	Elective-IV Operation Research		PGOPEN105/2T	Elective –II (OPEN) Operation Research	
8 SS205T	Elective-IV Organization Theory & Behavior		PGSS204/2T	Elective –III (Discipline) Organization Theory and Behavior	
9 SS206T	Seminar		---	---	

Table-2

Subject Code (NEW)	Subject (NEW)		Subject Code (OLD)	Subject (OLD)	Remark
PGSS201T	Automata and Advanced Computability		1 SS201T	Automata and Advanced Computability	1 SS201T Not Clear Have to appear New PGSS201T
PGSS202T	Software Design and Construction		3 SS202T	Software Design and Construction	3 SS202T Not Clear Have to appear New PGSS202T
PGSS203T	Device Driver Design and Development		5 SS203T	Device Driver Design and Development	5 SS203T Not Clear Have to appear New PGSS203T
PGSS204/1T	Elective –III (Discipline) System Performance and Evaluation		7 SS204T	Elective-III System Performance and Evaluation	7 SS204T (System Performance and Evaluation) Not Clear Have to appear New PGSS204T
PGSS204/2T	Elective –III (Discipline) Organization Theory and Behavior		8 SS205T	Elective-IV Organization Theory & Behavior	8 SS205T (Organization Theory & Behavior) Not Clear Have to appear New PGSS204T
PGFD205T	Foundation Courses -I		---------	----------	Have to appear
PGSS206P	Laboratory –III (AAC)		2 SS201P	Automata and Advanced Computability (Lab)	2 SS201P Not Clear Have to appear New PGSS206P
PGSS207P	Laboratory –IV (SDC)		4 SS202P	Software Design and Construction (Lab)	4 SS202P Not Clear Have to appear New PGSS207P

Proposed Scheme of Absorption of Old course to New course of First to Fourth Semesters

III Semester M. Tech. Software System (SS)

Table-1

Subject Code (OLD)	Subject (OLD)		Subject Code (NEW)	Subject (NEW)	
1 SS301T	Elective-V Windows Kernel Programming		---	---	
1 SS301T	Elective-V Linux Kernel Programming		---	---	
1 SS301T	Elective-V Optimization Techniques		---	---	
2 SS302T	Elective-VI Software Testing Methodologies		---	---	
2 SS302T	Elective-VI Software Project Management		---	---	
2 SS302T	Elective-VI Enterprise resource Planning		---	---	
3 SS303T	Seminar on Dissertation/ Thesis Research Methodology		PGSS303P	Project Seminar	

Table-2

Subject Code (NEW)	Subject (NEW)		Subject Code (OLD)	Subject (OLD)	Remark
PGOPEN301T	Elective –IV (Open)		8 SS205T	Elective-IV Operation Research	IF old 8 SS205T Clear Then don't Appear New PGOPEN301T Otherwise Have to appear New PGOPEN301T
PGFD302T	Foundation Courses -II		---	---	Have to appear
PGSS303P	Project Seminar		3 SS303T	Seminar on Dissertation/ Thesis Research Methodology	3 SS303T Not Clear Have to appear New PGSS303P

IV Semester M. Tech. Software System (SS)

Table-1

Subject Code (OLD)	Subject (OLD)		Subject Code (NEW)	Subject (NEW)	
4 SS401D	Dissertation/Thesis		PGSS401P	Project	

Table-2

Subject Code (NEW)	Subject (NEW)		Subject Code (OLD)	Subject (OLD)	Remark
PGSS401P	Project		4 SS401D	Dissertation/Thesis	4 SS401D Not Clear Have to appear New PGSS401P

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology
Choice Base Credit System (CBCS)

M. Tech. Software System (SS) - I Semester

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGSS101T	Advanced Data Structure and Algorithms	4	-	4

UNIT I: Review of Elementary Data Structures: Arrays, linked lists, stacks, queues, binary trees, hashing, graphs, sorting & searching techniques. Sparse Matrices: Properties of sparse matrices, Linked list representation of sparse matrices.

UNIT II: Threaded Trees: Properties of threaded trees, insertion, deletion and traversal. AVL Trees: Properties of AVL trees, rotations, insertion and deletion. Red-Black Trees: Properties of red-black trees, rotations, insertion and deletion. B-Trees: Definition of B-trees, basic operations on B-trees, deleting a key from a B-tree.

UNIT III: Heaps: Properties of Min-max heaps, building a heap, basic operations on heaps, application of min-max heaps. Binomial heaps: Binomial tress and binomial heaps, operations on binomial. Fibonacci heaps: Structure of Fibonacci heaps, merge able heap operations, decreasing a key and deleting a node, bounding a maximum degree.

UNIT IV: Data Structures for Disjoint Sets: Disjoint set operations, linked list representation of disjoint sets, disjoint set forests. Graph Algorithms: Topological sort, minimum Spanning tree, single-source shortest paths, all-pairs shortest paths, bi-connected components, strongly connected components, cycles, articulation points, bridges.

UNIT V: String Matching: String-matching algorithm, Rabin-Karp algorithm, String matching with automata, Knuth-Morris- Pratt algorithm, Boyer-Moore algorithm. NP-completeness: Complexity classes P and NP, examples of reductions.

Reference Books:

1. Peter Brass, "Advanced Data Structures" Cambridge University Press, 2008.
2. Kurt Mehlhorn, Peter Sanders "Algorithms and Data Structures", Springer Berlin Heidelberg, 2008.
3. A.A.Puntambekar, "Advanced Data Structures And Algorithms", Technical Publications, 2008
4. Darren Redfern, Colin Campbell, "Advanced Data Structures" Springer New York, 1998.

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGSS102T	**Advances System Software Design**	4	-	4

UNIT I: Compiler Design and Optimization: Grammars – Lexical Analysis – Syntactic Analysis – Code Generation – Heap Management – Parameter Passing Methods – Semantics of Calls and Returns – Implementing Subprograms – Stack Dynamic Local Variables – Dynamic binding of method calls to methods – Overview of Memory Management, Virtual Memory, Process Creation – Overview of I/O Systems.

UNIT II: Device Drivers, System Boot, Symbol table structure – Local and Global Symbol table management Intermediate representation – Issues – High level, medium level, low level intermediate languages – MIR, HIR, LIR – ICAN for Intermediate code – Optimization – Early optimization –loop optimization.
Compiler Construction Tools: LEX and YACC.

UNIT III: Procedure optimization: In-line expansion – leaf routine optimization and shrink wrapping – register allocation and assignment – graph coloring – data flow analysis – constant propagation – alias analysis – register allocation – global references – Optimization for memory hierarchy - Code Scheduling – Instruction scheduling – Speculative scheduling– Software pipelining –trace scheduling – Run-time support – Register usage – local stack frame – run-time stack –Code sharing – position–independent code.

UNIT IV: Introduction to Virtual Machines (VM): Pascal P-Code VM – Object-Oriented VMs – Java VM Architecture – Common Language Infrastructure – Dynamic Class Loading – Security – Garbage Collection – Optimization.

UNIT V: Emulation: Interpretation and Binary Translation – Instruction Set Issues – Process Virtual Machines – Profiling – Migration – Grids – Examples of real world implementations of system software.

Suggested Readings/ Books:

1. Steven S. Muchnick, "Advanced Compiler Design Implementation", Morgan Koffman – Elsevier Science,India, First Edition 2004
2. James E Smith and Ravi Nair, "Virtual Machines", Elsevier, 2005.
3. Robert W. Sebesta , "Concepts of Programming Languages", 7th ed., Pearson Education, 2006.
4. Aho, "Compilers: Principles, Techniques and Tools", Pearson Education India, 1999.
5. Iain D Craig, "Virtual Machines", Springer, 2006.

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGSS103T	**Software Architecture**	4	-	4

UNIT I: Basics of Software Architecture: Architecture Business Cycle, Architecture Patterns, Reference Model and Reference Architecture, Architecture Structure and Views, Product Line Architecture, Functional and Non-functional Properties of Software Architectures.

UNIT II: Enabling Techniques for Software Architecture: Coupling and Cohesion, Sufficiency, Completeness and Primitiveness, Separation of Policy and Implementation, Separation of Interface and Implementation.

UNIT III: Architectural Styles: Pipes and Filters, Data Abstraction and Object-Orientation, Event-Based, Implicit Invocation, Layered Systems, Repositories, Interpreters, Process Control, Heterogeneous Architectures, Case studies based on architectural styles.

UNIT IV: Understanding and Achieving Software Qualities: Changeability, Efficiency, Interoperability, Reliability, Testability, Reusability, Security, Usability, Fault tolerant software, Tactics to achieve software qualities.
Designing of Software Architecture: Function Oriented Design, Object Oriented Design, Attribute Driven Design of Software Architecture, Case Studies.

UNIT V: Documenting Software Architecture: Software Architecture Documentation Template, Use of Documentation, and Creation of different views of Software Architecture with UML.
Reconstructing Software Architecture: Phases of Reconstruction, Uses of Reconstruction, Reconstruction of Software Architecture using tool.

Suggested Readings/ Books:

1. Bass Len, Clements Paul, Kazman Rick, "Software Architecture in Practice", dorling Kingsley, 2012.
2. Jan Bosch, "Software Architecture: System Design, Development and Maintenance", Springer, 2002.
3. Oliver Vogel, "Software Architecture: A Comprehensive Framework and Guide for Practitioners", Springer, 2011.
4. Shaw M, Garlan D, "Software Architecture Perspectives on an Emerging Discipline", Prentice-Hall, 1996.
5. Booch G., Rumbaugh J., Jacobson I., "The Unified Modeling Language User Guide", Addison-Wesley, 2005.

Elective –I (Discipline Specific)

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGSS104/1T	Elective –I (Discipline) **AI and Expert System Design**	4	-	4

UNIT I: Introduction: Scope of AI, AI problems, AI technique, Production system Characteristics, Basics of problem solving: problem representation paradigms Defining problem as a state space representation.

UNIT II: Search Techniques: Problem size, complexity, approximation and search; depth, breadth and best search; Heuristic Based Search: Heuristic search, Hill climbing, best-first search, branch and bound.

UNIT III: Knowledge representation: First order logic, Unification, Resolution in Predicate Logic. Structured Knowledge Representation: Semantic Nets, Frames, and Scripts.
Learning: Block architecture of learning system, Types of learning, performance Measures.
Uncertainty Treatment: formal and empirical approaches including Bayesian theory, belief functions, certainty factors and fuzzy sets.

UNIT IV: Expert Systems: Fundamental blocks, Knowledge Engineering, Knowledge Acquisition, Need and justification for expert systems, Detailed Discussion from Example Domains – (From) Industry, Language, Medicine, Verification, Vision, Knowledge Based Systems; concept of shells.

UNIT V: Language Machine: Introduction to Natural Language understanding. Level of knowledge in NLU, Approaches to NLU, Problems in NLU, Basic parsing techniques.

REFERENCE BOOKS:

1. E.Rich and Knight, Artificial Intelligence, Tata McGraw Hill, 1992.
2. Introduction to Artifitial Intelligence by E.Charniack and D. Mcdermott, Pearson Education.
3. Artifitial Intelligence structures and strategies for complex problem solving, 4th edition, Pearson education.
4. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd edition, Pearson Education.
5. Introduction to Artificial Intelligence & Expert system (PHI Pub.) - D.W.Patterson.
6. N. J. Nilsson, “Principles of AI”, Narosa Publ. House, 1990.
7. P. H. Winston, "Artificial Intelligence", Pearson Education, 3rd Edition, 2002.
8. M. N. Hoda, “Foundation Course in Artificial Intelligence”, Vikas Pub., 2004.

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGSS104/2T	Elective –I (Discipline) **Network System Design**	4	-	4

UNIT I: The art of performance evaluation: Professional organizations, journals, and conferences, Performance Projects, Common Mistakes in Performance Evaluation, A systematic approach to Performance Evaluation, Selection of techniques – Performance metrics, Utility classification, setting performance requirements.

UNIT II: Types of workloads: Instruction mixes, Kernels, Synthetic Programs, Application Benchmarks, Art of Workload selection, services exercised, level of detail, Representativeness, Timeliness, Other considerations in Workload selection, Workload Characterization Techniques, Terminology, Averaging, Specifying Dispersion , Single-Parameter and Multi parameter Histograms, Principal-Component Analysis, Markov models, Clustering.

UNIT III: Monitors – Terminology: Classifications, Software and Hardware Monitors, Firmware and Hybrid Monitors, Distributed-System Monitors, Program Execution Monitors, Accounting Logs, Analysis and Interpretation of log data, Capacity Planning and Benchmarking, Load Drivers, Remote-Terminal Emulation.

UNIT IV: Art of Data Representation, Guidelines for preparing good graphical charts, Gantt Charts, Kiviat Charts, Schumacher Charts.

UNIT V: Summarizing Measured Data: Basic Probability and Statistics Concepts, Geometric Mean, Harmonic Mean, Mean of a Ratio, Index of Dispersion, Determining Distribution of Data -Sample versus Population, Confidence Interval for the Mean, Testing for a Zero Mean, Hypothesis Testing versus Confidence Intervals and levels, Confidence Intervals for Proportions, Determining Sample Size.

Suggested Readings/ Books:

1. R.K Jain, "The Art of Computer Systems Performance Analysis – Techniques for Experimental Design, Measurement, Simulation, and Modeling", Wiley-India, 2008.

2. Daniel, Menascé, Virgílio, Almeida, Lawrence, "System Performance Evaluation: Methodologies and Applications", Prentice Hall Professional, 2004.

3. Krishna Kant, M. M. Srinivasan, "Introduction to computer system performance evaluation", McGraw-Hill, 1992.

Elective –II (Open)

II Semester M. Tech. (SS)

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGSS201T	**Automata and Advanced Computability**	4	-	4

UNIT I: Finite automata and Regular Languages: Finite state systems, Deterministic, non-deterministic finite automata, equivalence of deterministic and non-deterministic finite automata, finite automates with and without €-moves, 2way finite automata with output, equivalences of mealy and Moore machines.
Properties of regular sets: The pumping lemma for regular sets, closure properties of regular sets, decision algorithm of regular sets, the Myhill-nerode theorem and minimization of finite automata.

UNIT II: Context free grammars: introduction to context free grammars, derivation tress, top-down and bottom up parsing methods, ambiguous context free grammers,Chomsky and greibach normal forms.
Pushdown automata: Deterministic and non-deterministic pushdown automata, equivalence of context free languages and sets accepted by pushdown automata, deterministic context free languages.

UNIT III: Properties of context free languages: The pumping Lemma for context free languages, closure properties of context free languages, decision algorithm for context free languages, coke-kasmi-young algorithm.
Turning machines: Introduction to turning machines, deterministic, non-deterministic, two way infinite tape, multi tape, constructions of Turing machines for n!,n*n. Post correspondence Problem, Unsolvability of halting problems.

UNIT IV: Cellular Automata: Introduction to Cellular Automata (CA)Computing model, Neighbourhood and radius, Moore and Von Neumann Architecture, advantages over conventional machine.
Undecidability: A Language That Is Not Recursively Enumerable Enumerating the Binary Strings ,Codes for Turing Machines , The Diagonalization Language , Proof That L_d Is Not Recursively Enumerable ,An Undecidable Problem That Is RE ,Recursive Languages ,Complements of Recursive and RE languages ,The Universal Language ,Undecidability of the Universal Language , Undecidable Problems About Turing Machines , Reductions.
Turing Machines That Accept the Empty Language, Rice's Theorem and Properties of the RE Languages, Problems about Turing-Machine Specifications.

UNIT V: Intractable Problems: ,The Classes P and NP , Problems Solvable in Polynomial Time ,An Example: Kruskal's Algorithm ,Nondeterministic Polynomial Time , An NP Example: The Travelling Salesman Problem, Polynomial-Time Reductions ,NP-Complete Problems , The Satisfiability Problem ,Representing SAT Instances ,NP-Completeness of the SAT Problem.

Additional Classes of Problems : Complements of Languages in NP , The Class of Languages Co-NP , NP- Complete Problems and Co-NP , Problems Solvable in Polynomial Space Polynomial-Space Turing Machines, Relationship of PS and NPS to Previously Defined Classes , Deterministic and Nondeterministic Polynomial Space

Suggested Readings/ Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to automata theory languages and computation", Addison Wesley, 2007.

2. Peter Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett Learning, 2001.

3. Hopcroft "Introduction To Automata Theory, Languages, And Computation, 3/E", Pearson Education India, 2008.

4. Zvi Kohavi, "Finite Automata Theory 2E", Tata McGraw-Hill Education, 2007.

5. D C Kozen,"Automata and Computability", Springer,1997.

6. Luca Aceto, Monika Henzinger, Jiri Sgall,Automata, "Languages and Programming" Springer, 2011

Course Code	Course	Teaching Scheme		
PGSS202T	**Software Design and Construction**	**Hours Per Week**		**Credits**
		L	**P**	
		4	-	4

UNIT I: Software Design: Design concepts, the design model, software architecture, architectural design, data design, component level design, and user interface design.

UNIT II: Rational Software Architect: Use case diagram: Requirement Capture with Use case, Building blocks of Use Case diagram - actors, use case guidelines for use case models, Relationships between use cases - extend, include, generalize.

UNIT III: Activity diagram :Elements of Activity Diagram - Action state, Activity state, Object node, Control and Object flow, Transition (Fork, Merge, Join) , Guidelines for Creating Activity Diagrams, Activity Diagram – Action Decomposition (Rake).,Partition - Swim Lane.

UNIT IV: Software Construction: Basics of object-oriented approach, object-oriented programming and languages, Scope of class members-public, private, protected. Class constructor, destructor, copy constructor, virtual destructor. Derived classes, scope of derivation-public, private, protected.Virtual functions, Function overloading. Friend functions and friend classes, Operator overloading, Dynamic memory allocation to classes and class members, new and delete operators. Overloading new and delete operators. Explicit type conversion operators. Input output streams, Stream class hierarchies, standard I/O objects: cin, cout, cerr, overloading <<, >> operators, File Streams, opening, reading, writing to file. File pointers and their manipulators, Introduction to templates and container classes.

UNIT V: TEST MANAGEMENT AND AUTOMATION: Introduction – Test Planning – Test Management –Software test automation – Scope of automation – Test automation tools – Generic requirement for test tool/framework – Selecting a test tool – Challenges in automation.

Suggested Readings/ Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User”, Addison Wesley Professional Guide, Pearson Education,2005.
2. James Rumbaugh, Ivar Jacobson, Grady Booch,”The Unified Modeling Language Reference Manual”, Addison-Wesley, New York
3. Grady Booch, “Object-Oriented Analysis and Design”, Pearson Education , 2002.
4. Roger S. Pressman,”Software Engineering, A Practitioner‟s Approach”, McGrawHill International Edition, 2009.
5. J. Rumbaugh, “Object-Oriented Modeling and Design”, Prentice Hall, 2004.
6. G. Schneider, Applying Use Cases: A Practical Guide: Addison-Wesley Object Technology Series, Addison- Wesley, 2001.
7. Marget A.Eills and Bjame Stroustrup, “The Annotated C++ Reference Manual”, Addison Wesley, 1990.

8. Terry Quatrani, Jim Palistrant, “Visual Modeling With IBM Rational Software Architect And UML”, Prentice

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGSS203T	Device Driver Design and Development	4	-	4

UNIT I: Windows Driver Foundation (WDF): Introduction to the Windows Driver Foundation, Architecture of the WDF, I/O Flow and Dispatching in WDF Drivers, Plug and Play and Power Management in WDF Drivers, Writing USB Drivers with WDF.

UNIT II: Kernel-Mode Driver Framework (KMDF): Architecture of the Kernel-Mode Driver Framework, DMA Support in KMDF Drivers, An Introduction to How to Build, Install, Test, and Debug KMDF Drivers, Frameworks Verifier, KMDF Log.

UNIT III: User-Mode Driver Framework (UMDF): Introduction to the UMDF, Architecture, An Introduction to Component Object Model for UMDF Developers.

UNIT IV: General Windows Driver Concepts: Kernel-Mode Fundamentals: Common Driver Reliability Issues Scheduling, Thread Context, and request level IRQL, Locks, Deadlocks, and Synchronization Security Topics: Threat Modelling for Drivers.

UNIT V: Tools for Driver Developers: Driver Installation, Debugging and Tracing, Static Driver Verifier, PREfast for Drivers

Suggested Readings/ Books:

1. Ronald D. Reeves Ph.D., "Windows 7 Device Driver", Pearson Education, 2010.

2. Arthur, Baker, Jerry Lozano, "The Windows 2000 Device Driver Book: A Guide for Programmers", Prentice

Hall Professional, 2001.

3. Chris Cant, "Writing Windows WDM Device Drivers", R&D Books, 1999.

4. Penny Orwick, Guy Smith "Developing Drivers with the Windows® Driver Foundation", O'Reilly Media,

Course Code	Course	Teaching Scheme		
PGSS204/1T	Elective –III (Discipline) **System Performance and Evaluation**	**Hours Per Week**		**Credits**
		L	**P**	
		4	-	4

UNIT I: The art of performance evaluation: Professional organizations, journals, and conferences, Performance Projects, Common Mistakes in Performance Evaluation, A systematic approach to Performance Evaluation, Selection of techniques – Performance metrics, Utility classification, setting performance requirements.

UNIT II: Types of workloads: Instruction mixes, Kernels, Synthetic Programs, Application Benchmarks, Art of Workload selection, services exercised, level of detail, Representativeness, Timeliness, Other considerations in Workload selection, Workload Characterization Techniques, Terminology, Averaging, Specifying Dispersion , Single-Parameter and Multi parameter Histograms, Principal-Component Analysis, Markov models, Clustering.

UNIT III: Monitors – Terminology: Classifications, Software and Hardware Monitors, Firmware and Hybrid Monitors, Distributed-System Monitors, Program Execution Monitors, Accounting Logs, Analysis and Interpretation of log data, Capacity Planning and Benchmarking, Load Drivers, Remote-Terminal Emulation.

UNIT IV: Art of Data Representation, Guidelines for preparing good graphical charts, Gantt Charts, Kiviat Charts, Schumacher Charts.

UNIT V: Summarizing Measured Data: Basic Probability and Statistics Concepts, Geometric Mean, Harmonic Mean, Mean of a Ratio, Index of Dispersion, Determining Distribution of Data -Sample versus Population, Confidence Interval for the Mean, Testing for a Zero Mean, Hypothesis Testing versus Confidence Intervals and levels, Confidence Intervals for Proportions, Determining Sample Size.

Suggested Readings/ Books:

1. R.K Jain, "The Art of Computer Systems Performance Analysis – Techniques for Experimental Design,

Measurement, Simulation, and Modeling", Wiley-India, 2008.

2. Daniel, Menascé, Virgílio, Almeida, Lawrence, "System Performance Evaluation: Methodologies and Applications", Prentice Hall Professional, 2004.

3. Krishna Kant, M. M. Srinivasan, "Introduction to computer system performance evaluation", McGraw-Hill,1992.

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGSS204/2T	Elective –III (Discipline) **Organization Theory and Behavior**	4	-	4

UNIT I: Concept of organization and management: Development of management thought, different theories of management, Japanese management. Planning and planning process, Decision making. MBO, Decentralization, Span of management, Delegation. Line staff and functional relationship. Beurocratic organization.

UNIT II: Role of behavioral sciences in organization: Individual behaviour, different theories of motivation. Interpersonal and group behaviour, transactional analysis and group dynamics. Importance of human relations.

UNIT III: Controlling and directing human behaviour in organization, Leadership, theories of leadership and leadership styles, managerial grid, organizational conflicts, organizational effectiveness, Communication significance, process and variables.

UNIT IV: Business Cycles: Nature and phases of a business cycle, Theories of business cycles-psychological, profit, monetary, innovation, cobweb, Samuelson and Hicks Theories, Inflation, Definition, characteristics and types, Inflation in terms of demand – pull and cost-push factors, Effects of inflation.

UNIT V: Concept of personal management and industrial relations: role and scope, Planning personnel functions – Human resource development, functions and operations of personnel department, employees selection, recruitment and training, Job description and analysis, career planning, transfers and promotions, Compensation planning, wages and salary administration, Concept of workers participation in management.

Suggested Readings/ Books:

1. John W. Newstrom "Organizational Behavior: Human Behaviorat Work", McGraw-Hill/Irwin, 2010.

2. Michael R. Baye, "Managerial Economics and Business Strategy", McGraw-Hill/Irwin, 2010.

3. Nirmal Singh, "Organisational Behaviour: Concepts, Theory and Practices : Managing People and Organisations in the 21st Century", Deep and Deep Publications, 2001.

4. R S Dwivedi, "Human Relations And Organisational Behaviour", Macmillan, 2001.

5. S K Srivastava, "Organization Behaviour And Management", Sarup & Sons, 2005.

III Semester M. Tech. (SS)

Elective –IV (Open)

Foundation Course –II

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGFD302T	Foundation Course –II **Project planning and Management**	4	-	4