Semester I

Course Title: Mathematical concept in Computer Science Engineering	**Code: PGCSE101**
Type of Course: T h e o r y	**Course Designation: Compulsory**
Semester: I	**Contact Hours: 3L /week**
Credit: 3	
Continuous Assessment: 20+20	**Final Exam: 60**

PREREQUISITES:

Course Title:	Code:
B.Tech in CSE	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

CourseOutcomes	Details	ActionVerb	Bloom'sLevel
PGCSE101.CO1	Learn to apply various numerical methods which would enable to simulate different engineering problems to encounter in their profession life.	Apply	L3
PGCSE101.CO2	Understanding the ideas of probability and different optimization techniques and tools to apply the concept in real-life problems and use of stochastic process.	Understand	L2
PGCSE101.CO3	Learn to apply different tools in algebra and calculus which would enable them to devise engineering solutions to encounter in their profession life.	Analyze	L4
PGCSE101.CO4	Learn Graph Theory which is useful to solve engineering problems.	Apply	L3
PGCSE101.CO5	Understand the uses and applications of complex analysis in applied sciences and engineering problems.	Understand	L2
PGCSE101.CO6	Evaluate the Laplace transforms and inverse Laplace transforms to solve differential and integral equations in engineering fields like network analysis and control systems.	Evaluate	L5

SYLLABUS:

Module I

Numerical Analysis: Introduction to Interpolation formulae: Stirling, Bessel‟s, Spline. Solutions of system of linear and non-linear simultaneous equations: SOR algorithm, Newton‟s method, (6 L)

Module II

Stochastic process: Probability: review, random variables, random processes, Random walk, Brownian motion, Markov process, queues: (M/M/1) : (/FIFO), (M/M/1) : (N/FIFO). (6 L)

Module III

Advanced linear algebra: Vector spaces, linear transformations, Eigen values, Eigenvectors, some applications of Eigen value problems, symmetric, skew-symmetric and orthogonal matrices, similarity of matrices, basis of Eigen vectors, Diagonalisation. (6L)

Module IV

Advanced Graph Theory: Connectivity, Matching, Hamiltonian Cycles, Coloring Problems, Algorithms for searching an element in a data structure (DFS, BFS). (6 L)

Module V

Complex Variables: Review of Complex variables, conformal mapping and transformations, Functions of complex variables, Integration with respect to complex argument, Residues and basic theorems and applications of residues. (6L)

Module VI

Optimization Technique: Calculus of several variables, Implicit function theorem, Nature of singular points, Necessary and sufficient conditions for optimization, Elements of calculus of variation, Constrained Optimization, Lagrange multipliers, Gradient method, Dynamic programming. (6L)

Module VII

Fourier Transform: Revision of Fourier series, integrals and transforms and their properties, Convolution theorem, Parseval's formula.

Z-transform: Representation of sequence, basic operations on Sequences, Z-transforms, properties of Z-transforms, inverse Z-transform, solution of difference equations, region of Convergence.

Wavelet transform: Fundamentals, the Fourier transform and the short term Fourier transform, resolution problems, multi-resolution analysis, the Continuous wavelet transform, the discrete wavelet transform. (6L)

Unit	Content	Hrs/Unit	Text/Reference book serial no.
1.	Topic 1 [2L], Topic 2[2L], Topic 3[2L]	6	T1, T2, R1, R2
2.	Topic 1 [2L], Topic 2[2L], Topic 3[2L]	6	T1, T2, R3, R4
3.	Topic 1 [2L], Topic 2[2L], Topic 3[2L]	6	T1, T2, R5, R6
4.	Topic 1 [2L], Topic 2[2L], Topic 3[2L]	6	T1, T2, R7, R8
5.	Topic 1 [2L], Topic 2[2L], Topic 3[2L]	6	T1, T2, R9, R10
6.	Topic 1 [2L], Topic 2[2L], Topic 3[2L]	6	T1, T2, R11, R12
7.	Topic 1 [2L], Topic 2[2L], Topic 3[2L]	6	T1, T2, R13, R14

Text Books:

T1. Higher engineering mathematics by B. S. Grewal and J. S. Grewal

T2. Advanced Engineering Mathematics by Erwin Kreyszig

Reference Books:

R1. " Elementary Numerical Analysis" by Cone, S. D.-Mc. Graw Hill.

R2. "Applied Numerical Analysis" by Curtis F. Gerald and Patrick O. Wheatley

R3. "Stochastic Processes" by Sheldon M. Ross

R4. "Introduction to Probability Models" by Sheldon M. Ross

R5. "Linear Algebra and Its Applications" by Gilbert Strang

R6. "Matrix Analysis and Applied Linear Algebra" by Carl D. Meyer

R7. "Introduction to Graph Theory" by Douglas B. West

R8. "Graph Theory with Applications" by J.A. Bondy and U.S.R. Murty

R9. "Complex Analysis" by Elias M. Stein and Rami Shakarchi

R10. "Complex Variables and Applications" by James Ward Brown and Ruel V. Churchill

R11. "Optimization by Vector Space Methods" by David G. Luenberger

R12. "Nonlinear Programming: Theory and Algorithms" by Mokhtar S. Bazaraa, Hanif D. Sherali, and C. M. Shetty

R13. "Signals and Systems" by Alan V. Oppenheim and Alan S. Willsky

R14. "A Wavelet Tour of Signal Processing" by Stephane Mallat

Course Title: Advanced OS	**Code: PGCSE102**
Type of Course: T h e o r y	**Course Designation: Compulsory**
Semester:1	**Contact Hours: 3L/week**
Credit: 3	
Continuous Assessment: 20+20 Marks	**Final Exam: 60 Marks**

PREREQUISITES:

Course Title	Code
1. Programming for Problem Solving	ES-CS201

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Bloom's Level
PGCSE102.CO1	Demonstrate the concepts of Operating System Services, System calls, structure and types	Demonstrate	L4
PGCSE102.CO2	Discuss processes and threads for multiprogramming and multi-threading	Discuss	L1
PGCSE102.CO3	Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time	Develop	L5
PGCSE102.CO4	Explain Memory management, Virtual Memory, I/O Hard ware, File and Disk Management system.	Explain	L2
PGCSE102.CO5	Explain algorithmic solutions to process synchronization problems for Inter-Process communication	Explain	L3
PGCSE102.CO6	Security challenges in OS	Demonstrate	L4

SYLLABUS:

Unit	Content	Hrs/Unit	Text/Reference book serial no.
1	Introduction: Generations Concept of of Operating, Types of 3 Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, unix files systems and commands	6	T1
2	Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	6	T2, R1
	Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery	2	T2, R2
3	INTERPROCESS COMMUNICATION AND SYNCHRONISATION Signals, Pipes and Named Pipes (FIFOs); Threads and pthread library; Mutexes and Condition Variables; Semaphores; Producer-Consumer Problem and Solutions using mutexes, condition variables and semaphores.	6	T1, R2

4	Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU)	6	T1, R3, R4
5	I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	6	T1, R2
6	RESOURCE MANAGEMENT AND SECURITY Resource Management Issues; Types of Resources; Integrated Resource Scheduling; Queuing Models of Scheduling; Protection of Resources – hardware, software, and attacks; Security Policies.	4	R3

Text Books:

1. Operating Systems Design and Implementation (Hardcover) by Andrew S. Tanenbaum
2. UNIX: A Database Approach (McGraw-Hill Unix/C) by Sumitabha Das

Reference Books:

1. Brian Kernighan, Rob Pike, “The UNIX Programming Environment”, 1st Edition, Prentice Hall, 19832.Michael Kerrisk, “The Linux Programming Interface: A Linux and UNIX System ProgrammingHandbook”, 1st Edition, No Starch Press, 2010
2. Robert Love, “Linux Kernel Development”, 3rd Edition, Addison- Wesley Professional, 20104. Uresh Vahalia, “UNIX Internals: The New Frontiers”, 1st Edition, Prentice Hall, 1996
3. Daniel P. Bovet, Marco Cesati, “Understanding the Linux Kernel”, 3rd Edition, O‟Reilly, 20056. Jonathan Corbet, Alessandro Runini, Greg Kroah-Hartman, “Linux Device Drivers”, 3rd Edition, O‟Reilly,2005
4. Sreekrishnan Venkateswaran, “Essential Linux Device Drivers”,1st Edition, Prentice Hall, 2008

Course Title: Advanced Algorithms	**Code: PGCSE103**
Type of Course: T h e o r y	**Course Designation: Compulsory**
Semester: 1st	**Contact Hours: 3L+1T/week**
Credit: 3	
Continuous Assessment: 20+20 Marks	**Final Exam: 60 Marks**

PREREQUISITES:

Course Title	Code
1. Design and Analysis of Algorithms	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Bloom's Level
PGCSE103.CO1	Analyze the time and space complexity of algorithms.	Analyze	L4
PGCSE103.CO2	Apply the Greedy method to solve optimization problems.	Apply	L3
PGCSE103.CO3	Employ Dynamic Programming techniques to optimize solutions.	Employ	L3
PGCSE103.CO4	Demonstrate proficiency in advanced concepts such as Matroids and Graph Matching.	Demonstrate	L3
PGCSE103.CO5	Solve constraint satisfaction problems using Backtracking, Forward Checking, and Conflict-Directed Back Jumping, with applications to the N-Queens Problem.	Solve	L3
PGCSE103.CO6	Classify problems into complexity classes (P, NP, NP-Hard, NP-Complete).	Understanding	L2

SYLLABUS:

Unit	Content	Hrs/Unit	Text/Reference book serial no.
1.	Time and Space Complexity, Recurrence for divide and conquer and its solution, Methods for solving recurrences, Merge sort, Heap sort, Quick sort and Complexity analysis.	6	T1,T2, R2
2.	Greedy Method: Knapsack problem, Huffman coding, Minimum spanning tree by Prim's and Kruskal's algorithms.	3	T1,T3
3.	Dynamic Programming: Matrix-chain multiplication, All pair shortest paths, Single source shortest path, Travelling salesman problem, 0-1 knapsack problem.	6	T1, T2, R2
4.	Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	3	T1, R3
5.	N-queen's Problem: Constraint Satisfaction, Backtracking, Forward Checking, Look-ahead, Conflict directed back jumping.	4	T2, R2
6.	Set and String Problem: Set cover, String matching, Approximate string matching, longest common subsequence.	4	T1, T3, R3
7.	Matching Problem: Stable Marriage, Hospital Resident Problem(2L) Amortized Analysis	2	T1

8.	Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Complexity Classes: P, NP, NP-Hard, NP-Completeness, SAT, 3-SAT, Graph Colouring, Hamiltonian Cycle, Approximation Algorithms, Randomized Algorithms	8	T1, T2, R1,R4

Text Books:

- T1. **Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C.** (2009). *Introduction to Algorithms* (3rd ed.). MIT Press.
- T2. **Horowitz, E., & Shani, N.***Fundamentals of Computer Algorithms* (2nd ed.). W. H. Freeman.
- T3. **Aho, A., Hopcroft, J., & Ullman, J.***The Design and Analysis of Algorithms*. Addison-Wesley.

Reference Books:

- R1. **Knuth, D. E.***The Art of Computer Programming*, Vol. 3: *Sorting and Searching*. Addison-Wesley.
- R2. **Kleinberg, J., & Tardos, E.***Algorithm Design*. Pearson.
- R3. **Motwani, R., & Raghavan, P.***Randomized Algorithms*. Cambridge University Press.
- R4: **Vazirani, V. V.***Approximation Algorithms*. Springer-Verlag.

Course Title: Machine Learning Applications	**Code: PGCSE104A**
Type of Course: Theory	**Course Designation: Elective 1**
Semester: 1	**Contact Hours: 3L/week**
Credit: 3	
Continuous Assessment: 20+20	**Final Exam: 60**

PREREQUISITES:

Course Title	Code
1. Artificial Intelligence	PEC-IT501B

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Bloom's Level
PGCSE104A.CO1	Explain the basic concepts of Regression/ Classification. Extend the concepts of statistical learning theory of various Regression / Classification methods.	Explain	L2
PGCSE104A.CO2	Analyze the liner discriminant, logistic regression, non-linear SVM, Kernel methods.	Analyze	L4
PGCSE104A.CO3	Analyze the various concepts of Unsupervised learning, Generative Models (mixture models and latent factor models), Dimension reduction, Kernel PCA, Matrix factorization.	Analyze	L4
PGCSE104A.CO4	Explain Sparse Modeling and Estimation, Modeling Sequence / Time-Series Data, Deep Learning and Feature Representation Learning.	Explain	L2
PGCSE104A.CO5	Evaluate Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	Evaluate	L5
PGCSE104A.CO6	Explain the concepts of Scalable Machine Learning (Online and Distributed Learning), Inference in Graphical Models, Introduction to Bayesian Learning and Inference, the recent trends in various learning techniques of machine learning and classification methods.	Explain	L2

SYLLABUS:

Unit	Content	Hrs/Unit	Text/Reference book serial no.
1.	**Supervised Learning (Regression/ Classification)** Basic methods: Distance-based methods, Nearest-Neighbors, Decision Tree, Naïve Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machine, Nonlinearity and Kernel Methods Beyond Binary Classification: Multi-class / Structured Outputs, Ranking	10	T1, R1
2	**Unsupervised Learning** Clustering: K-means / Kernel K-Means Dimensionality Reduction: PCA and Kernel PCA Matrix Factorization and Matrix Completion	**7**	T1, R1

	Generative Models (mixture models and latent factor models)		
3	Evaluate Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6	T3, R2
4	Sparse Modeling and Estimation, Modeling Sequence / Time-Series Data, Deep Learning and Feature Representation Learning	9	T3, R2
5	Scalable Machine Learning (Online and Distributed Learning) A selection from some other advance topics, e.g. Semi-unsupervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	9	T2, T3, R2
6	Recent trends in various learning techniques of machine learning and classification methods	5	T3,R1

Text Books:

T1. Ethem Alpaydin," Introduction to Machine Learning", Third Edition, PHI, 2018

T2. Tom M. Mitchell," Machine Learning", McGraw Hill Education, 2018

T3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2018.

Reference Books:

R1.Stuart Russell and Peter Norvig," Artificial Intelligence - A Modern Approach", Fourth Edition, Pearson, 2022.

R2. Chip Huyen, "Designing Machine Learning Systems:An Iterative Process for Production Ready Applications.:O'Reilly, 2022.

Course Title: Data Mining & Data Ware Housing	**Code: PGCSE104D**
Type of Course: T h e o r y	**Course Designation: Elective**
Semester: 1st	**Contact Hours: 3L/week**
Credit: 3	
Continuous Assessment: 20+20 Marks	**Final Exam: 60 Marks**

PREREQUISITES:

Course Title	Code
Data Structure and Algorithms	
Database Management Systems	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Bloom's Level
PGCSE104D.CO1	Understand the principles and processes of data mining.	Understand	L2
PGCSE104D.CO2	Understand the principles and architectures of data warehousing.	Understand	L2
PGCSE104D.CO3	Analyze and design various pattern extraction techniques on the association rule mining.	Analyze and design	L4
PGCSE104D.CO4	Analyze and design various data mining techniques on the classification.	Analyze and design	L4
PGCSE104D.CO5	Analyze and design various mining techniques on the data clustering.	Analyze and design	L4
PGCSE104D.CO6	Understand web mining. Apply data mining techniques for solving real- life problems in various domains.	Understand, Apply	L3

SYLLABUS:

Unit	Content	Hrs/Unit	Text/Reference book serial no.
1	Module I: Basics of Data Mining. Data Mining Functionalities, Classification of Data Mining Systems, Data Mining Issues, Data Mining Goals. Stages of the Data Mining Process	5	Eg. T1, R1
2	Module II: Data Warehouse concepts, Data Warehouse Architecture, OLAP technology, DBMS, OLTP VS. Data Warehouse Environment, Multidimensional data model Data marts.	5	Eg. T1, R1
3	Module III: Data Mining Techniques: Statistics, Similarity Measures, Decision Trees, Neural Networks, Genetic algorithms.	5	Eg. T1, R1
4	Module IV: Mining Association Rules: Basic Algorithms, Parallel and Distributed algorithms, Comparative study, Incremental Rules, Advanced Association Rule Technique, Apriori Algorithm, Partition Algorithm, Dynamic Item set Counting Algorithm, FP tree growth Algorithm, Boarder Algorithm.	6	Eg. T1, T2, R1, R2

5	Module V: Clustering Techniques: Partitioning Algorithms-K- means Algorithm, CLARA, CLARANS, Hierarchical Algorithms DBSCAN, ROCK..	5	Eg. T1, R1
6	Module VI: Classification Techniques: Statistical–based, Distance-based, Decision Tree- based Decision tree.	5	Eg. T1, R1
7	Module VII: Applications and Trends in Data Mining: Applications, Advanced Techniques - Web Mining, Web Content Mining, Structure Mining.	5	Eg. T1, T2, R1, R2

Text Books:

T1. A.K.Pujari, Data Mining, University Press
T2. Roiger & Geatz, Data Mining, Pearson Education

Reference Books:

R1. J. Han and M. Kamber. Data Mining: Concepts and Techniques. Morgan Kaufman.
R2. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education.

Course Title: Advance Computer Architecture	**Code: PGCSE105A**
Type of Course: T h e o r y	**Course Designation: Elective**
Semester:1st	**Contact Hours: 3L/week**
Credit: 3	
Continuous Assessment: 20+20 Marks	**Final Exam: 60 Marks**

PREREQUISITES:

Course Title	Code
1. Computer architecture	
2. Parallel Computing.	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Bloom's Level
PGCSE105A.CO1	Understand the Evolution and Performance Metrics of Computer Systems	Remember, Understand, Analyze	L1, L2, L4
PGCSE105A.CO2	Analyze and Design Pipeline and Vector Processors	Understand, Apply, Analyze, Evaluate, Create	L2, L3, L4, L5, L6
PGCSE105A.CO3	Design and Analyze High-Performance Computing Systems	Understand, Apply, Analyze, Evaluate, Create	L2, L3, L4, L5, L6
PGCSE105A.CO4	Develop Embedded Systems and Address Hardware-Software Co-Design Issues	Understand, Apply, Create	L2, L3, L6
PGCSE105A.CO5	Implement and Optimize Reconfigurable Architectures Using FPGA and HDL	Understand, Analyze, Evaluate	L2, L4, L5
PGCSE105A.CO6	Apply Parallel Computing Models and Performance Analysis for Scalability	Understand, Analyze, Evaluate, Create	L2, L4, L5, L6

SYLLABUS:

Unit	Content	Hrs/Unit	Text/Reference book serial no.
Module I: Evolution of Computer Systems & Performance Metrics		6	T1, R4
	Evolution of computer systems: DEC PDP-11, IBM 360/370, CDC Cyber 6600, Intel X86]	[2L]	
	- Performance measurement parameters: MIPS, MFLOPS, SPEC ratings, CP	[1L]	
	- Introduction to High-Performance Computing (HPC)	[1L]	
	- Flynn's classification of computer architectures: SISD, SIMD, MISD, MIMD	[1L]	
	- Amdahl's Law and Gustafson's Law in parallel processing	[1L]	
Module II:		7	T1, R2, R3

Pipelining, Processor Performance Enhancement & Vector Processing	- Basics of performance enhancement using pipelining	1	
	- Types of pipeline hazards: data hazards, control hazards, structural hazards	1	
	Solutions for pipeline hazards, Pipeline performance metrics: Speedup, efficiency, throughput	2	
	Arithmetic pipeline design (e.g., floating-point adder, multiplier) , Characteristics of vector processing and advantages over scalar processing	1	
	Vector processor architecture and vector instructions	1	
	Differences between scalar and vector processing with examples , Vector loops and pipeline chaining techniques	1	
Module III: High-Performance Computing (HPC) & Embedded Systems |		10	T1, T2, R5
	Overview of HPC and performance metrics: MIPS, MFLOPS, SPEC, CPI	1	
	SIMD array processors: organization, masking, data-routing, inter-processor communication	2	
	| - Multiprocessor architectures: Loosely coupled vs. tightly coupled systems	1	
	| - Definition, characteristics, and examples of embedded systems	1	
	- Embedded system architecture and classifications	1	
	| - Co-design of embedded systems and development cycle	2	
	- Hardware and software issues: Processor, Memory, Peripherals, RTOS	2	
Module IV: Reconfigurable Architectures & FPGA		5	T1, R6, R8
	Introduction to reconfigurable architectures and FPGA technology	1	
	- FPGA: Definition, classification, architecture, synthesis, and bitstream downloading	2	
	| - Design and testing using Hardware Description Languages (HDL)	2	
Module V: Parallel Computing Models, Scalability & Performance |		6	T1, R3, R7
	-Parallel computing models: Multiprocessors, multicomputers, SIMD, PRAM, VLSI models	2	
	Scalability metrics and speedup laws	2	
	Performance analysis and scalability approaches in parallel architectures	2	

Module VI: Advanced Memory Systems &Multiprocessor Interconnects		6	T1, T4, R3
	Advanced processor and memory hierarchy technologies |	1	
	| - Virtual memory, cache, and shared memory systems |	2	
	| - Cache coherence, synchronization, and memory consistency models	2	
	| - Multiprocessor system interconnects and synchronization mechanisms	1	

Text Books:

T1: Hwang, K., Jotwani, N., *Advanced Computer Architecture*, 2nd Edition, Tata McGraw Hill, 2010.
T2: Patterson, D.A., Hennessy, J.L., *Computer Organization & Design*, Morgan Kaufmann.
T3: Hayes, J.P., *Computer Architecture & Organization*, McGraw Hill.
T4:Stallings, W., *Computer Organization and Architecture: Designing for Performance*, PHI.

Reference Books:

R1: Noergaard, T., *Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers*, Elsevier.
R2: Flynn, M., *Computer Architecture*, Narosa.
R3:Tanenbaum, A.S., *Structured Computer Organization*, PHI.
R4:Stone, H.S., *High Performance Computer Architecture*, 3rd Edition, Addison-Wesley Publishing.

Course Title: Advanced System Lab	**Code: PGCSE191**
Type of Course: P r a c t i c a l	**Course Designation: Compulsory**
Semester: M.Tech 1 SEM	**Contact Hours: 4P**
Credit: 2	
Continuous Assessment: 60 Marks	**Final Exam: 40 Marks**

PREREQUISITES:

Course Title	Code
1.Python programming	PCC-S393

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Bloom'sLevel
PGCSE191.CO1	Explain the concept of IoT	Understand	L1, L2
PGCSE191.CO2	Analyze various protocols for IoT	Understand	L2
PGCSE191.CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino	Understand Analyze	L3
PGCSE191.CO4	Apply data analytics and use cloud offerings related to IoT	Understand, Analyze, Apply	L4
PGCSE191.CO5	Analyze applications of IoT in real time scenario	Implement	L4

SYLLABUS:

Unit	Content	Hrs/ Unit	Text/Reference book serial no.
1	Fundamentals of IoT: Evolution of Internet of Things - Enabling Technologies - IoT Architectures: oneM2M - IoT World Forum (IoTWF), and Alternative IoT models - Simplified IoT Architecture and Core IoT Functional Stack - Fog - Edge and Cloud in IoT - Functional blocks of an IoT ecosystem - Sensors - Actuators - Smart Objects and Connecting Smart Objects.	8	T1, R1
2	IoT Protocols IoT Access Technologies: Physical and MAC layers - topology and Security of IEEE 802.15.4 - 802.15.4g - 802.15.4e - 1901.2a - 802.11ah and LoRaWAN - Network Layer: IP versions - Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo - Routing over Low Power and Lossy Networks - Application Transport Methods: Supervisory Control and Data Acquisition - Application Layer Protocols: CoAP and MQTT.	10	R2
3	Design and Development Design Methodology: Embedded computing logic - Microcontroller - System on Chips - IoT system building blocks - Arduino Board details - IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.	8	R3, R4
4	Case Studies : - 1. Smart and Connected Cities: Layered architecture – Smart Lighting. 2. Introduction to Raspberry PI platform and python programming 3. Interfacing sensors with Raspberry PI 4. Communicate between Arduino and Raspberry PI using any wireless medium.	14	R5, R6

	5. Small projects on Raspberry PI using Temperature Sensors, pressure sensors and peripheral devices		

Text Books:

David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A Hands-on Approach”, Universities Press, 2015.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key Applications and Protocols”, Wiley, 2012 (for Unit 2).
3. Jan Holler et al., “From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence”, Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
5. Michael Margolis, “Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects”, Second Edition, O'Reilly Media, 2011.
6. [Online] https://www.arduino.cc/
7. [Online] https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplane

Course Title: Advanced Algorithm Lab	**Code: PGCSE192**
Type of Course: P r a c t i c a l	**Course Designation: Compulsory**
Semester: 1st	**Contact Hours: 4P/week**
Credit: 4	
Continuous Assessment: 60 Marks	**Final Exam: 40 Marks**

PREREQUISITES:

Course Title	Code
1. Design and Analysis of Algorithms **2. Python**	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Bloom's Level
PGCSE192.CO1	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.	Understand	L2
PGCSE192.CO2	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analyze them.	Apply	L3
PGCSE192.CO3	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.	Understand	L2
PGCSE192.CO4	Explain the major back tracking algorithms and their analyses. Synthesize new back tracking algorithms and algorithms that employ back tracking algorithms.	Evaluate	L5
PGCSE192.CO5	Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.	Apply	L3
PGCSE192.CO6	Explain what the Network Flow Algorithms and Approximation algorithms are, and the benefit of using those algorithms. Be familiar with some network flow and approximation algorithms.	Analyze	L4

SYLLABUS:

Unit	Content	Hrs/ Unit	Text/Reference book serial no.
1.	**Divide and Conquer Algorithms:** Merge Sort, Quick Sort, Matrix Multiplication (Strassen's Algorithm)	5	T1, T3
2	**Greedy Algorithm:** Implementation of Prims and Kruskal Algorithms, Boruvka's algorithm to find MST, Dijkstra's Dial implementation.	5	T1, T3
3	**Dynamic Programming:** Pascal's Triangle, Minimum cost to reach the top of the floor by climbing stairs, Catalan number, Binomial Coefficient.	5	T1, T2
4	**Backtracking Algorithms:** Hamiltonian Path and Cycle Problem, o Graph Coloring Problem, Rat in a maze problem, Sudoku.	5	T1, T2
5	**Advanced Graph Algorithms:** Topological Sorting (DFS and Kahn's Algorithm), Floyd-Warshall Algorithm for All-Pairs Shortest Paths.	5	T1, T3
6	**Network Flow Algorithms:** Ford-Fulkerson Algorithm for Maximum Flow, Minimum Cut Theorem.	5	T1, T2

7	**Approximation Algorithms:** Approximation Algorithms for the Traveling Salesman Problem (TSP), Knapsack Approximation Algorithms.	5	T1, T2
8	**Project Work:** Objective: Apply learned algorithms to a real-world project or research problem. Topics Covered: • Choose a problem that can be solved using one or more advanced algorithms. • Optimize the solution for performance and scalability.	5	T1, T2, T3

Text Books:

1. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
2. Algorithm Design Manual by Steven S. Skiena.
3. Advanced Data Structures and Algorithms by Peter Brass.

Online coding platforms like Leet Code, Hacker Ra