UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

VIII SEMESTER

COMPUTER SCIENCE & ENGINEERING

SCHEME -2013

VIII SEMESTER

COMPUTER SCIENCE & ENGINEERING (R)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/ P				
13.801	Cryptography and Network Security (R)	4	3	1	-	50	3	100	150
13.802	Computer System Architecture (R)	4	3	1	-	50	3	100	150
13.803	Distributed Systems (R)	4	3	1	-	50	3	100	150
13.804	Elective III	4	3	1	-	50	3	100	150
13.805	Elective IV	4	3	1	-	50	3	100	150
13.806	Algorithm Design and Graphics Lab (R)	4	-	-	4	50	4	150	200
13.807	Project Work and Viva Voce (R)	5	-	-	5	150	-	100	250
	Total	**29**	**15**	**5**	**9**	**450**		**700**	**1200**

13. 804 Elective III

13.804.1	Soft Computing (FR)
13.804.2	Cloud Computing (FR)
13.804.3	Fundamentals of Neural Networks (R)
13.804.4	Mobile and Wireless Networks (R)
13.804.5	Optimization Techniques and Decision Making (R)

13.805 Elective IV

13.805.1	Robotics and Computer Vision (FR)
13.805.2	Graph Theory (FR)
13.805.3	Natural Language Processing (FR)
13.805.4	Mobile Computing (R)
13.805.5	Artificial Intelligence (R)

13.801 CRYPTOGRAPHY AND NETWORK SECURITY (R)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To introduce the classical encryption techniques for information hiding.*
- *To develop an awareness regarding the application of mathematical concept for developing cryptographic algorithms.*

Pre-requisites: 13.604-Computer Networks

Module – I

Symmetric Cipher Models- Substitution techniques- Transposition techniques- Rotor machines-Steganography- DES: Simplified DES- Block Cipher principals- The Data Encryption Standard. The Strength of DES- Differential and linear Cryptanalysis- Block Cipher Design principles- Block Cipher modes of operations- IDEA: Primitive operations- Key expansions- One round, Odd round, Even Round- Inverse keys for description. AES: Basic Structure- Primitive operation- Inverse Cipher- Key Expansion, Rounds, Inverse Rounds.

Module – II

Public key Cryptography: - Principles of Public key Cryptography Systems, Number theory- Modular arithmetic, Prime numbers. RSA algorithms- Key Management - Diffie-Hellman Key Exchange, Elliptic curve cryptography- Authentication requirements- Authentication functions- Message authentication codes- Hash functions- SHA, MD5, Security of Hash functions and MACS- Digital signatures- Authentication protocols- Digital signature standards.

Module – III

Network security: Electronic Mail Security: Pretty good privacy- S/MIME IP Security: Architecture- authentication Header- Encapsulating Security payload- Combining Security associations- Key management.

Module – IV

Web Security: Web Security considerations- secure Socket Layer and Transport layer Security- Secure electronic transaction. Firewalls-Packet filters- Application Level Gateway- Encrypted tunnels.

References:

1. William Stallings, *Cryptography and Network Security*, Pearson Education, 2014.
2. Behrouz A. Forouzan, *Cryptography and Network Security*, Tata McGraw-Hill, 2007.
3. Schneier B., *Applied Cryptography, Protocols, Algorithms, and Souce Code in C*, 2nd Edn, Wiley, 2015.
4. Charlie Kaufman, Radia Perlman, Mike Speciner, *Network Security*, Pearson publication, Second edition, 2002.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After successful completion of this course, the students will be able to:

- *Discuss various classical encryption techniques for information hiding.*
- *Use mathematical concepts to develop cryptographic algorithms.*
- *Choose and apply encryption algorithms to solve security problems in real world applications.*
- *Discuss various authentication functions and digital signatures to provide authenticity and/or confidentiality in digital communication.*
- *Apply the network security protocols for network applications.*

13.802 COMPUTER SYSTEM ARCHITECTURE (R)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To provide an understanding of the different kinds of computer system architectures and their evolution.*
- *To provide an insight into the implementation of parallel processing performed in computers.*
- *To give a thorough understanding of pipeline design and its various aspects.*

Pre-requisites: 13.402- Computer Organization and Design.

Module – I

Parallel computer models - The state of computing, multi processors and multi computers, multi vector and SIMD computers, Parallel Random Access Machines and VLSI complexity model, Architectural development tracks. Program and network properties - conditions of parallelism, system interconnect architectures. Principles of scalable performance-scalability analysis and approaches.

Module – II

Processors and memory hierarchy – advanced processor technology, superscalar and vector processors, memory hierarchy technology, virtual memory technology. Bus and shared memory - backplane bus systems, shared memory organizations.

Module – III

Pipelining and superscalar techniques – linear vs. nonlinear pipelining, instruction pipeline design, arithmetic pipeline design, superscalar and super pipeline design.

Module – IV

Multiprocessors and multicomputers - multiprocessor system interconnects, cache coherence and synchronization mechanism, three generations of multicomputers, Intel Paragon system architecture. Multivector and SIMD computers - vector processing principles, multivector multiprocessors, SIMD computer organizations. Scalable, multithreaded and data flow architectures - latency hiding techniques, principles of multithreading, scalable and multithreaded architectures, data flow and hybrid architectures.

References:

1. Hwang K., Advanced Computer Architecture, Parallelism, Scalability, Programmability, TMH, 2001.
2. Hwang K. and Briggs, *Computer Architecture and Parallel Processing*, McGraw Hill International.
3. Patterson D. A. and Hennessy J. L., *Computer Organization and Design: The Hardware/Software Interface*, 3rd Edn, Morgan Kaufmann Publication, 2014.
4. Hayes H. P., *Computer Architecture and Organization*, McGraw Hill, 1998.
5. Kogge P. M., *The Architecture of Pipelined Computer*, McGraw Hill.
6. Sasikumar M., D. Shikkare and P. Raviprakash, *Introduction to Parallel Processing*, PHI, 2006.
7. Flynn M. J., *Computer Architecture: Pipelined and Parallel Processor Design*, Narosa, 1995.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After successful completion of this course, the students will be able to:

- *Understand the different classes of computer architecture and select an appropriate architecture for a given application.*
- *Apply the various scalability analysis techniques.*
- *Familiarize the concepts of memory hierarchy and interconnection systems.*
- *Utilize the concept of pipelining to identify its various applications.*
- *Apply collision free scheduling for initiating operations in non linear pipeline design.*

13.803 DISTRIBUTED SYSTEMS (R)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To introduce the major concepts related to distributed systems and distributed file systems.*
- *To develop an awareness regarding transaction management and concurrency control.*

Pre-requisites: 13.503-Operating System & **13.604-**Computer Networks

Module – I

Characteristics of distributed System: Examples of distributed systems – resource sharing and web – world wide web – issues in the design of distributed system. System models: Architectural models and fundamental models. Networking and internetworking: Types of network – network principles – internet protocols.

Module – II

Interprocess communication: the API for internet protocol – external data representation and marshalling – client server communication - group communication- case study: inter process communication in Unix. Distributed objects and remote invocation: communication between distributed objects – remote procedure call – Events and notification.

Module – III

Operating system support: Operating system layer – protection – processes and threads-communication and invocation – Operating system architecture security: Overview of security techniques.

Module – IV

Distributed file system: File service architecture - network file system- Andrew file system-recent advances Transactions and concurrency control: nested transactions-locks-optimistic concurrency control-comparison of methods for concurrency control-flat and nested distributed transactions- distributed deadlocks, transactions recovery. Replication System model and group communication- fault tolerant services, transactions with replicated data.

References:

1. Coulouris G., J. Dollimore and T. Kindberg, *Distributed Systems: Concepts and Design,* Addison Wesley publication, 2005.

2. Tanenbaum A. S. and M. V. Steen, *Distributed Systems: Principles and Paradigms*, Pearson Education, Second edition, 2008.
3. Solomon M. and J. Krammer, *Distributed Systems and Computer Networks*, PHI.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After successful completion of this course, the student will be able to:

- *Describe the features of distributed systems and distributed file systems with their specific architectures.*
- *Understand the issues of distributed system and recognize various types of distributed systems*
- *Explain the networking and communicating perspectives of distributed systems.*
- *Associate the support of operating system and its security architecture used in distributed systems.*
- *Discuss the concurrency control, transaction management and recovery mechanisms used in distributed systems.*

13.804.1 SOFT COMPUTING (FR) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To provide a clear understanding on artificial neural networks and genetic algorithms.*
- *To solve various crisp and fuzzy set operations.*

Module – I

Introduction to Soft Computing – Artificial Neural Networks – introduction – basic models – linear separability – Hebb network – Supervised learning networks – perceptron – Adaptive Linear Neuron – back propagation network – radial basis function network – Associative Memory Network – auto associative and hetero associative memory networks – Bidirectional Associative Memory – Unsupervised learning networks – Kohonen self organizing feature maps – Learning Vector Quantization – Counter propagation networks.

Module – II

Crisp and Fuzzy sets – operations and properties – Crisp and Fuzzy relations – operations and properties – membership functions – features – methods of membership value assessment – Defuzzification – lambda cuts for fuzzy sets and fuzzy relations – Defuzzification methods – Fuzzy arithmetic – Extension principle – fuzzy measures – Fuzzy rules – fuzzy reasoning – Fuzzy inference system – Mamdani and Sugeno models – Fuzzy Logic Control Systems – control system design – architecture and operation – applications.

Module – III

Genetic Algorithm – introduction – basic operations and terminologies – general genetic algorithm – classification of genetic algorithm – genetic programming – applications.

Module – IV

Hybrid systems – neuro-fuzzy, neuro-genetic and fuzzy-genetic hybrids – Adaptive Neuro-Fuzzy Inference Systems – architecture – hybrid learning algorithm – Genetic Algorithm based Internet search technique – Soft Computing based hybrid fuzzy controllers – Soft Computing based rocket engine control.

References:

1. Sivanandam S. N., S. N. Deepa, *Principles of Soft Computing*, Wiley India, 2007.
2. Ross T. J., *Fuzzy Logic with Engineering Applications*, Wiley India, Third edition, 2009.
3. Goldberg D. E., *Genetic Algorithms: Search, Optimization and Machine Learning*, Addison Wesley, N.Y., 1989.

4. Rajasekaran S. and G. A .V. Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms,* PHI, 2003.
5. Eberhart R., P. Simpson and R. Dobbins, *Computational Intelligence - PC Tools*, AP Professional, Boston, 1996.
6. Jang J. S R., C. T. Sun and E. Mizutani, *Neuro-Fuzzy and Soft Computing*, PHI/Pearson Education 2004.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Have a clear understanding on artificial neural networks.*
- *Perform crisp and fuzzy set operations.*
- *Identify various Defuzzification methods*
- *Explain various genetic algorithms.*
- *Apply genetic algorithm to solve real world problems.*

13.804.2 CLOUD COMPUTING (FR) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To understand the design of cloud services.*
- *To understand the concept of virtualization*
- *To apply different cloud programming models as per need.*
- *To be able to set up a private cloud.*
- *To learn to design the trusted cloud computing system*

Module - I

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

Module – II

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.

Module – III

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

Module – IV

Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security.

References:

1. Kai Hwang, Geoffrey C. Fox and Jack G. Dongarra, *Distributed and Cloud Computing, From Parallel Processing to the Internet of Things*, Morgan Kaufmann Publishers, 2012.
2. John W. Rittinghouse and James F. Ransome, *Cloud Computing: Implementation, Management, and Security*, CRC Press, 2010.
3. Toby Velte, Anthony Velte and Robert Elsenpeter, *Cloud Computing, A Practical Approach*, TMH, 2009.
4. Kumar Saurabh, *Cloud Computing, Insights into New-Era Infrastructure*, Wiley India, 2011.

5. George Reese, *Cloud Application Architectures: Building Applications and Infrastructure in the Cloud*, O'Reilly.
6. James E. Smith and Ravi Nair, *Virtual Machines: Versatile Platforms for Systems and Processes*, Elsevier/Morgan Kaufmann, 2005.
7. Katarina Stanoevska-Slabeva, Thomas Wozniak and Santi Ristol, *Grid and Cloud Computing, A Business Perspective on Technology and Applications*, Springer.
8. Ronald L. Krutz and Russell Dean Vines, *Cloud Security, A comprehensive Guide to Secure Cloud Computing*, Wiley, India, 2010.
9. Rajkumar Buyya, Christian Vecchiola and S.Tamarai Selvi, *Mastering Cloud Computing*, TMH, 2013.
10. Gautam Shroff, *Enterprise Cloud Computing*, Cambridge University Press, 2011.
11. Michael Miller, *Cloud Computing*, Que Publishing, 2008.
12. Nick Antonopoulos, *Cloud computing*, Springer Publications, 2010.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Have a clear understanding on cloud computing and virtualization techniques.*
- *Address core issues of cloud computing such as security, privacy, and inter-operability.*
- *Design cloud services and setup a private cloud.*
- *Design compute and storage clouds based on applications.*
- *Understand the characteristics and services provided by cloud.*

13.804.3 FUNDAMENTALS OF NEURAL NETWORKS (R) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To introduce the major concepts related to neural networks.*
- *To provide an awareness regarding the usage of different kinds of neural networks to solve different problems.*

Pre-requisites: 13.706.2- Data Mining and Information Retrieval

Module – I

Introduction – Brain and Computer – learning in biological systems and machines – the basic neuron – modeling a single neuron – learning in simple neurons – the perceptron – the perceptron learning rule – proof – limitations of perceptron – the multilayer perceptron – the multilayer perceptron learning rule – Back Propagation network – Counter Propagation network.

Module – II

Associative memory – introduction – the learning matrix – Hopfield networks – storage and retrieval algorithms – the energy landscape – Bi-directional associative memory – the Boltzman machine – Boltzman machine learning algorithm – Radial basis function networks.

Module – III

Kohonen self organizing networks – introduction – the Kohonen algorithm – weight training – neighbourhoods – reducing the neighbourhood – learning vector quantization – the phonetic typewriter

Module – IV

Adaptive resonance theory (ART) – architecture and operation – ART algorithm – training the ART network – classification – application of neural networks.

References:

1. Beale R. and Jackson T., Neural *Computing: An Introduction*, IOP Publishing Ltd/Adam Hilger, Taylor and Francis group publications.
2. Philip D. Wasserman, *Neural Computing: Theory and Practice*, Van Nostrand Reinhold Co publishing, 1989.
3. Freeman J. A. and D. M. Skapura, *Neural Networks Algorithms, Applications and Programming Techni*ques, Addison-Wesley/Pearson Education, 1991.

4. Fausett L., *Fundamentals of Neural Networks: Architectures, Algorithms, and Applications*, Prentice Hall Inc./Pearson Education.
5. Yegnanarayana B., *Artificial Neural networks*, PHI, 2009.
6. Kumar S., *Neural Networks: A Classroom Approach*, Tata McGraw Hill Publishing Company Ltd, 2004.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Compare and contrast the architecture, learning algorithms and functions of various types of neural networks.*
- *Select appropriate type of neural network and develop solution for a given problem*
- *Determine various parameters to achieve good performance of neural networks and analyze its behavior.*
- *Learn various applications of neural network in real life.*
- *Distinguish human brain from simple artificial neural network models.*

13.804.4 MOBILE AND WIRELESS NETWORKS (R) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To introduce the major concepts related to wireless communication.*
- *To develop awareness regarding the medium access control protocols in designing wireless networks.*
- *To provide an understanding regarding different generations of cellular wireless networks.*

Pre-requisites: 13.604-Computer Networks

Module – I

Introduction: Wireless Networks. Wireless transmission – Frequencies for radio transmission, Signals, Antennas, Signal propagation. Multiplexing. Modulation schemes - Advanced FSK, Advanced PSK, Multicarrier modulation. Spread spectrum – Direct sequence, Frequency hoping. Principles of Cellular Wireless Networks. Medium Access Control - SDMA, FDMA, TDMA, CDMA.

Module – II

Brief introduction to 2 G, 2.5 G and 3 G networks. Telecommunication Systems: GSM - Mobile services, System Architecture, protocol. Data services – GPRS. DECT, UMTS, IMT-2000.Satellite Networks – Introduction , Satellite Parameters and configurations, Capacity allocation – FAMA-FDMA, DAMA-FDMA, FAMA-TDMA, DAMA-TDMA. Broadcast Systems – Digital Audio Broadcasting, Digital Video Broadcasting. Cordless Systems, WLL.

Module – III

Wireless LANS: Wireless LAN Technology – Introduction. Infra Red Transmission, Radio Transmission, Wireless LAN Standards – IEEE 802 Protocol Architecture, IEEE 802.11 System Architecture, Protocol Architecture & Services, MAC Layer & Management. HIPERLAN: Requirements & Architecture. BLUETOOTH: Architecture & Protocol Stack.

Module – IV

Mobile internet-mobile network layer-mobile IP-dynamic host configuration protocol-ad hoc networks mobile transport layer-implications of TCP on mobility-indirect TCP-snooping TCP-mobile TCP transmission-selective retransmission, Transaction oriented TCP-support for mobility-file systems-WAP - WML -wireless telephony applications.

References:

1. Jochen Schiller, *Mobile Communications*, 2nd Edn, Pearson Education, 2008.

2. William Stallings, *Wireless Communication and Networks*, 2nd Edn, Pearson Education, 2009
3. Theodore S. Rappaport, *Wireless Communications*, *Principles and Practice* 2nd Edn, PHI, 2009.
4. Yi-Bing Lin and Imrich Chlamtac, *Wireless and Mobile Network Architectures*, Wiley, 2008.
5. Pahlavan K., and P. Krishnamoorthy, *Principles of Wireless Networks*, PHI/Pearson Education, 2003.
6. Mark J. W. and W. Zhuang, *Wireless Communications and Networking,* Pearson.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Explain different transmission techniques and modulation schemes for wireless communication*
- *Use appropriate medium access control protocol in designing wireless networks*
- *Summarize various technology trends for next generation cellular wireless networks.*
- *Identify the components of GSM, GPRS and Bluetooth software model for mobile computing.*
- *Describe protocol architecture of WLAN technology, WAP and WML file systems.*
- *Illustrate routing algorithms and different transmission control techniques in transport layer.*

13.804.5 OPTIMIZATION TECHNIQUES AND DECISION MAKING (R) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To learn basics of optimization techniques*
- *To learn basics of linear programming*
- *To learn meta-heuristic search techniques*
- *To develop solutions for conventional and non-conventional optimization problems*

Module I

Decision-making procedure under certainty and under uncertainty - Operations Research-Probability and decision-making- Queuing or Waiting line theory-Simulation and Monte-Carlo Technique-Nature and organization of optimization problems-Scope and hierarchy of optimization-Typical applications of optimization-Essential features of optimization problems - Objective function-Investment costs and operating costs in objective function - Optimizing profitably constraints-Internal and external constraints-Formulation of optimization problems.

Module II

Continuous functions - Discrete functions - Unimodal functions - Convex and concave functions - Necessary and sufficient conditions for optimum of unconstrained functions-Numerical methods for unconstrained functions - One-dimensional search - Gradient-free search with fixed step size. Linear Programming - Basic concepts of linear programming - Graphical interpretation-Simplex method - Apparent difficulties in the Simplex method.

Module III

Transportation Problem, Loops in transportation table, Methods of finding initial basic feasible solution, Tests for optimality. Assignment Problem, Mathematical form of assignment problem, methods of solution, Network analysis by linear programming and shortest route, maximal flow problem.

Module IV

Introduction to Non-traditional optimization, Computational Complexity – NP-Hard, NP-Complete. Genetic Algorithms- Basic concepts, Encoding, Selection, Crossover, Mutation. Simulated Annealing - Acceptance probability, Cooling, Neighbourhoods, Cost function. Tabu Search- Basic Tabu search, Neighbourhood, Candidate list, Short term and Long term memory. Application of GA, SA and TS in solving sequencing and scheduling problems and Travelling salesman problem.

References:

1. Rao S. S., *Optimization Theory and Applications*, Wiley Eastern.

2. Hamdy A. Taha, *Operations Research – An introduction*, Prentice Hall India.
3. Zapfel G., R. Barune and M. Bogl, *Metaheuristic Search Concepts : A Tutorial with Applications to Production and Logistics*, Springer.
4. Gass S. I., *Introduction to Linear Programming*, Tata McGraw Hill.
5. Reeves C., *Modern Heuristic Techniques for Combinatorial Problems*, Orient Longman.
6. Goldberg, *Genetic Algorithms in Search, Optimization and Machine Learning*, Addison Wesley.
7. Deb K., *Optimization for Engineering Design, Algorithms and Examples*, Prentice Hall of India.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Ability to formulate mathematical models for optimization problems.*
- *Ability to analyze the complexity of solutions to an optimization problem.*
- *Ability to design programs using meta-heuristic search concepts to solve optimization problems.*
- *Ability to develop hybrid models to solve an optimization problem.*

13.805.1 ROBOTICS AND COMPUTER VISION (FR) (Elective IV)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

To familiarize the concepts in image analysis, high-level vision and robotics.

Module - I

History, Present Status and Future Trends of Robotics: robotics and programmable automation, historical background, laws of robotics, robot definitions, robotics systems and robot anatomy, human systems and robotics, specifications of robots, present application status, machine intelligence, computer and robotics—future trends, flexible automation versus robotics technology, safety measures in robotics.

Module - II

Robot Kinematics and Dynamics : Introduction, forward and reverse kinematics (transformation) of three degrees of freedom robot arm, forward and reverse transformation of a four degrees of freedom manipulator in 3-D, homogeneous transformations, kinematic equations using homogeneous transformations, inverse kinematics of robot, robot arm dynamics.

Module - III

Vision as an information processing task, A geometrical framework for vision. 2D and 3D images interpretation, Segmentation, Binary and grey morphology operations, Thresholding, Filtering, Edge and corner detection, Features detection. Contours, Tracking edges and corners, object detection and tracking, Image data compression, Real time Image processing.

Module - IV

Robotics, Vision and Control: Position-Based Visual Servoing , Image Based Visual Servoing - Camera and Image Motion - Controlling Feature Motion- Depth- Performance Issues , Using Other Image Features - Line Features , Circle Features.

References:

1. Deb S. R. and S. Deb, *Robotics Technology and Flexible Automation*, Tata McGraw Hill Education Pvt. Ltd, 2010.
2. Peter Corke, *Robotics, Vision and Control: Fundamental Algorithms in MATLAB*, Springer Science & Business Media, 2011
3. Linda Shapiro and George Shockman, *Computer Vision,* Prentice Hall, 2001
4. Richard Szeliski, Ed., *Computer Vision: Algorithms and Applications*, Springer, 2010.

5. Simon J. D. Prince, *Computer Vision: Models, Learning, and Inference,* Cambridge University Press, 2012.
6. Mark Nixon and Alberto S. Aquado, *Feature Extraction & Image Processing for Computer Vision*, Third Edition, Academic Press, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Identify the role of inverse kinematics in position controlled robots*
- *Learn the basics of robotics to perform routine tasks.*
- *Understands the controls used in robotics.*
- *Implement various image processing algorithms.*
- *Identify the components used in computer vision.*

13.805.2 GRAPH THEORY (FR) (Elective IV)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To introduce the major concept areas of graph theory.*
- *To develop an awareness regarding the applications of theorems used in graph theory.*
- *To provide practical, hands on experience in real world applications of graph theory.*

Pre-requisites: 13.303-Discrete Structures

Module – I

What is graph – Application of graphs – finite and infinite graphs – Incidence and Degree – Isolated vertex, pendent vertex, Null graph. Paths and circuits – Isomorphism, sub graphs, walks, paths and circuits, Connected graphs, disconnect graphs, Euler graphs Hamiltonian paths and circuits – Travelling salesman problem. Trees – properties, pendent vertex, Distance and centres - Rooted and binary tree, counting trees, spanning trees.

Module – II

Combinatorial versus geometric graphs, Planar graphs, Different representation of planar graphs, geometric dual, combinatorial dual, vector spaces of graph, ban2 vectors of a graph, orthogonal vectors and spaces Directed graphs – types of digraphs, Digraphs and binary relation, Euler graphs, trees with directed edges.

Module – III

Graphs theoretic algorithms and computer programming - Algorithm for computer representation of a graph, algorithm for connectedness and components, spanning tree, directed circuits, shortest path, searching the graphs, Isomorphism.

Module – IV

Graphs in switching and cording theory – contact networks, Analysis of contact Networks, synthesis of contact networks, sequential switching networks, unit cube and its graph, graphs in coding theory.

References:

1. Hararay, *Graph theory,* Narosa Publishers, 1969.
2. Narasingh Deo, *Graph theory*, Pearson publications, 2004.
3. Foulds L. R., *Graphs Theory Applications*, Narosa, Springer-Verlag, 1992.

4. John Clark and Derek Allan Hotton, *A First Look at Graph Theory*, Allied.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Demonstrate knowledge of fundamental concepts in graph theory, including properties and characterization of bipartite graphs and trees, Euclidian and Hamiltonian graphs.*
- *Understand and apply some of the classical theorems of graph theory.*
- *Represent real life situations with mathematical graphs.*
- *Develop algorithms for connectedness and components, spanning tree, directed circuits, shortest path, searching the graphs, Isomorphism.*
- *Solve real world problems by applying graph theoretic results and algorithms.*

13.805.3 NATURAL LANGUAGE PROCESSING (FR) (Elective IV)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To impart conceptual and application level aspects of Natural Language Processing.*

Pre-requisites: 13.406-Formal Languages and Automata Theory

Module – I

Natural Language Processing, Ambiguity and uncertainty in language. The Turing test, Chomsky hierarchy, regular languages, and their limitations. Finite state automata. Practical regular expressions for finding and counting language phenomena. N-gram Language Models and Information Theory: n-gram models. Entropy, relative entropy, cross entropy, mutual information, perplexity. Statistical estimation and smoothing for language models.

Module – II

Statistical Machine Translation (MT), Statistical Alignment Models and Expectation Maximization (EM) and its use in statistical MT alignment models ; complete statistical MT system decoding and A* Search.

Module – III

Information Extraction (IE) and Named Entity Recognition (NER). Information sources, rule-based methods, evaluation (recall, precision). Introduction to supervised machine learning methods. Naive Bayes (NB) classifiers for entity classification, Maximum Entropy Classifiers

Module – IV

Syntax and Parsing for Context-Free Grammars (CFGs): Parsing, treebanks, attachment ambiguities. Context-free grammars. Top down and bottom-up parsing, empty constituents, left recursion, and repeated work, Probabilistic CFGs.

References:

1. Daniel Jurafsky and James H. Martin, *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition,* 2/e, Prentice Hall, 2008.
2. Christopher D. Manning and Hinrich Schuetze, *Foundations of Statistical Natural Language Processing*, MIT Press, 2003.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Understand the basics of Natural Language Processing and thereby figure out ambiguity and uncertainty that exist in languages.*
- *Apply the concept of N-gram models to solve problems.*
- *Become aware of the significance of Information Extraction and Named Entity Recognition in Natural Language Processing.*
- *Evaluate information retrieval methods using the concepts of precision and recall.*
- *Be thoroughly knowledgeable regarding syntax and parsing for Context Free Grammars.*

13.805.4 MOBILE COMPUTING (R) (Elective IV)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To study the relevance and underlining infrastructure of multimedia system.*
- *To enable the students to apply contemporary theories of multimedia learning to the development of multimedia products.*

Pre-requisites: 13.604-Computer Networks

Module – I

Introduction to wireless communication system:- 2G cellular network,2G TDMA Standards, 3G wireless networks, local loop and LMDS, Broadcast Systems-Broadcast transmission, Digital Audio Broadcasting-Multimedia Object Transfer Protocol. Digital Video Broadcasting. Cellular concepts-channel assignment strategy-hand off strategy-interface and system capacity- trunking –improving coverage and capacity in cellular system

Module – II

Wireless Communication Systems:-Telecommunication Systems-GSM-GSM services & features, architecture, channel type, frame structure, signal processing in GSM & DECT features & characteristics, architecture, functional concepts & radio link, personal access communication system (PACS)-system architecture-radio interface, Protocols. Satellite Systems-GEO, LEO, MEO.

Module – III

Wireless LAN and ATM:- Infra red and Radio Transmission, Infrastructure and ad hoc networks ,802.11- Bluetooth- Architecture, Applications and Protocol, Layers, Frame structure. Comparison between 802.11 and 802.16. Wireless ATM- Services, Reference Model, Functions, Radio Access Layer. Handover- Reference Model, Requirements, Types, handover scenarios. Location Management, Addressing, Access Point Control Protocol (APCP).

Module – IV

Mobile IP- Goals, Requirements, IP packet delivery, Advertisement and discovery. Registration, Tunneling and Encapsulation, Optimization, Reverse Tunneling, IPv6, Dynamic Host configuring protocol, Ad hoc networks – Routing, DSDV, Dynamic source routing. Hierarchical Algorithms.
Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Transmission.
WAP- Architecture, Protocols-Datagram, Transaction, Session.-Wireless Application Environment-WML- Features, Script- Wireless Telephony Application.
WWW- HTTP, Usage of HTML, WWW system architecture.

References:

1. Jochen Schiller, *Mobile Communications*, Pearson Education Asia, 2008.
2. Theodore S. Rappaport*, Wireless Communications Principles and Practice*, 2/e, PHI, New Delhi, 2004.
3. Andrew S. Tanenbaum, Computer Networks, PHI, Third edition, 2003.
4. Leon-Garcia and Indra Widjaja, *Communication Networks -Fundamental Concepts and Key Architectures,* Tata McGraw Hill, 2006.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Clearly differentiate 3-G and 2-G networks*
- *Learn the architecture of WAP & WWW.*
- *Usage of various standard communication protocols.*
- *Understand the services provided by wireless ATM.*
- *Implement wireless communication in a mobile network.*

13.805.5 ARTIFICIAL INTELLIGENCE (R) (Elective IV)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits: 4**

Course Objective:

- *To introduce the major concepts related to artificial intelligence and machine learning.*
- *To develop awareness on the languages and programming techniques related to artificial intelligence.*

Pre-requisites: 13.602-Principles of Programming Languages

Module – I

Artificial Intelligence: History and Applications, Production Systems, Structures and Strategies for state space search- Data driven and goal driven search, Depth First and Breadth First Search, DFS with Iterative Deepening, Heuristic Search- Best First Search, A* Algorithm, AO* Algorithm, Constraint Satisfaction, Using heuristics in games- Minmax Search, Alpha Beta Procedure.

Module – II

Knowledge representation - Propositional calculus, Predicate Calculus, Theorem proving by Resolution, Answer Extraction, AI Representational Schemes- Semantic Nets, Conceptual Dependency, Scripts, Frames, Introduction to Agent based problem solving. *Machine Learning*- Symbol based - A frame work for Symbol based Learning, Vision space search, Inductive Bias and learnability, Knowledge and learning, Connectionist – Foundation for connectionist Networks, Perceptron Learning, Back propagation learning. Social and Emergent models of learning – Genetic algorithm, Classifier Systems and Genetic Programming.

Module – III

Overview of Expert System Technology- Rule based Expert Systems, Natural Language Processing- Natural Language understanding problem, Deconstructing Language, Syntax, Stochastic tools for Language analysis, Natural Language applications- Story Understanding and Question answering, An information Extraction and Summarization System for the Web.

Module – IV

Language and Programming Techniques for AI- Introduction to PROLOG, Syntax for predicate calculus programming, Abstract Data Types in PROLOG, A production system example in PROLOG, Meta- Predicates, Types and Unification, Meta-Interpreters, Learning algorithms in PROLOG, Natural Language processing in PROLOG.

References:

1. Luger G. F., *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, Pearson Education.
2. Patterson D. W., *Introduction to Artificial Intelligence and Expert Systems*, PHI.
3. Rich E. and K. Knight, *Artificial Intelligence*, 2nd Edn, Tata McGraw Hill.
4. Nilsson N. J., *Artificial Intelligence: A New Synthesis*, Elsevier.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question (question may contain sub-divisions), out of the two from each module. Each question carries 20 marks.

Note: *The question paper shall contain at least 30% analytical/problem solving questions.*

Course Outcome:

After the successful completion of the course students will be able to:

- *Have a thorough understanding of algorithms related to artificial intelligence.*
- *Understand clearly the concept of machine learning.*
- *Usage of natural language applications in real life.*
- *Utilize the languages and programming techniques for artificial intelligence effectively.*
- *Understands the benefits of using logical programming language.*

13.806 ALGORITHM DESIGN AND GAPHICS LAB (R)

Teaching Scheme: 0(L) - 0(T) - 4(P) **Credits**: 4

Course Objective:

- *To implement various geometric algorithms.*
- *To develop programs for computer graphics animation.*

Pre-requisites: 13.603-Design and Analysis of Algorithm
13.701-Computer Graphics

Programs shall be developed using OpenGL

The exercises may include the following:

1. Line drawing algorithm,
2. Circle drawing algorithm,
3. Problems related to 2D transformations – Scaling, translation and rotation.
4. Line clipping and polygon clipping algorithms.
5. Polygon filling and hatching algorithms.
6. Alphanumeric character generation.
7. Animation,
8. Transformation and projections of 3D objects, back face removal algorithm.
9. Representation of graphs using adjacency lists, implementation of graph searching algorithms DFS and BFS.
10. Generation of tree edges.
11. Implementation of Kruskal's algorithm to compute minimum cost spanning tree.
12. Implementation of Dijkstra's shortest path algorithm and graphic simulation.
13. Height balanced trees (Red-black tree) - insertion and deletion operations.
14. Implementation of scan line algorithm for hidden surface elimination using height balanced trees.
15. Matrix chain ordering and multiplication using dynamic programming.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test

40% - Class work and Record (Up-to-date lab work, problem solving capability, keeping track of rough record and fair record, term project, etc.)

20% - Regularity in the class

University Examination Pattern:

Examination duration: 4 hours *Maximum Total Marks: 150*

Questions based on the list of exercises prescribed.

Marks should be awarded as follows:

20% - Algorithm/Design

30% - Implementing / Conducting the work assigned

25% - Output/Results and inference

25% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After successful completion of this course, students will be able to:

- *Implement different algorithms for lines, circles and characters, and compare the output obtained.*
- *Create geometric objects and implement algorithms for transformation, filling, clipping and back face elimination.*
- *Design and execute programs for computer graphics animation.*
- *Implement graph algorithms and demonstrate their working with graphical simulation.*
- *Implement algorithms graphically for creating and updating red black tree.*

13.807 PROJECT WORK AND VIVA VOCE (FR)

Teaching Scheme: 0(L) - 0(T) - 5(P) **Credits**: 5

Course Objective:

- *To provide motivation for the students to solve real world problems using mathematics and engineering principles.*
- *To motivate students to participate in group discussions and thereby exchange ideas.*
- *To serve as platform to identify research issues in existing systems.*

Pre-requisites: 13.702 Seminar, Project Design and Industrial Visit (R)

PROJECT WORK:

The project is the continuation of the seventh semester project. Students are expected to utilize the project time for the development and implementation of the project whose design and other works have been completed in the seventh semester. A detailed project report in soft bound in an approved format is to be submitted at the end of the semester.

The performance of the students in the project work shall be assessed on a continuous basis. There shall be at least an interim evaluation and a final evaluation of the project work. Each student in the group may give a power point presentation on the project work during the evaluation process. For the award of the sessional marks, the project report and the power point presentation of the project work shall be assessed by a panel consisting of the Head of the Department, project coordinator, project guide, and a senior faculty member. The Head of the Department shall be the chairman of the panel. The students may be assessed individually and in groups.

VIVA VOCE:

At the time of viva-voce examination, the project work has to be evaluated in addition to assessing the students' knowledge in the field of Computer Science and Engineering and other related and advanced topics. He/she is expected to present his/her academic records including project report, seminar report, etc. at the time of viva-voce examination. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners.

Internal Continuous Assessment *(Maximum Marks-150)*

Marks by Committee: 50% *Marks by Guide: 50%*

25% - Presentation/viva, clarity in presentation, awareness to the work/topic etc.

50% - Current relevance of the work, implementation/experimentation of the work, involvement in the work etc.

25% - Evaluation of the report

University Examination Pattern:

Viva-Voce *Maximum Total Marks: 100*

Marks should be awarded as follows:

50% - General topics covering Computer Science and Engineering and other related and advanced topics.

35% - Project work.

15% - Seminar topic

Course Outcome:

After successful completion of this course, the students will be able to:

- *Apply knowledge of mathematics, science and engineering principles to solve complex real world problems bringing out economically and socially feasible solutions upholding ethical values.*
- *Participate in peer group discussions and integrate ideas.*
- *Apply the knowledge base about advanced topics pertaining to area of study to design and implement solutions to challenging problems.*
- *Test and analyze the developed system for further improvement.*
- *Identify new research problems from issues raised during implementation.*
- *Communicate problems and solutions to society through reports.*
- *Manage time and resources effectively.*