KANNUR UNIVERSITY

(Abstract)

M-Tech Degree Programme in **Computer Science and Engineering (Networks and Security)**–Scheme, Syllabus & Model Question Papers -Implemented with effect from **2014** admission - Orders issued.

ACADEMIC BRANCH

No.Acad/C5/ 91/2015 (ii) Dated, Civil Station P.O , 05-05-2015.

Read: 1. U.O No.Acad/C3/ 10834/2011 dated 22.08.2012
2. U.O No.Acad/C3/ 10834/2011 (2) dated 07.10.2013
3. Minutes of the meeting of the Board of Studies in Engineering (PG) held on 29.01.2015
4. Letter dated 5-03-2015 from the Convenor of the Expert Committee for framing the Scheme, Syllabus & Pattern of Question Papers for M. Tech Degree Programme in **Computer Science and Engineering (Networks and Security)**
5. Minutes of the meeting of the Board of Studies in Engineering (P.G) held on 5.03.2015.
6. Minutes of the meeting of the Faculty of Engineering held on 21.04.2015.

ORDER

1. The modified Regulations for M-Tech Degree Programmes were implemented in the University with effect from 2011 Admission, as per the paper read (1) above ,and certain modifications were effected to the same w.e.f 2013 admission vide paper read (2).

2. As per the paper read (3) above, an Expert Committee was constituted as recommended by the BOS in Engineering (PG) at its meeting held on 29.01.2015, for framing the Scheme, Syllabus and Model Question Papers for M-Tech Degree Programme in **Computer Science and Engineering (Networks and Security)** to be implemented in the University with effect from 2014 Admission.

3. The Convenor of the above Committee, vide paper read (4) above has submitted the Scheme ,Syllabus & Model Question Papers for M-Tech Degree Programme in **Computer Science and Engineering (Networks and Security)** to the University, for implementation with effect from 2014 Admission .

4. As per paper read (5) above , the Board of Studies in Engineering (P.G) finalized the Scheme and Syllabus for M.Tech programme in **Computer Science and Engineering (Networks and Security)** with effect from 2014 admission.

5.As per paper read (6) above the meeting of the Faculty of Engineering approved the Scheme and Syllabus.

The meeting also approved the modified pattern in Question Paper in respect of the M.Tech. Programme in Computer Science and Engineering (Networks and Security).

Contd...2

6. The Vice-Chancellor after examining the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with has

i) approved the draft Scheme ,Syllabus and Model Question Papers **in modified pattern** for M-Tech Programme in **Computer Science and Engineering (Networks and Security)** prepared by the Expert Committee appointed by the Board of Studies.

ii) accorded sanction to implement the Scheme, Syllabus and Model Question Papers **in modified pattern** for the M-Tech Degree Programme in **Computer Science and Engineering (Networks and Security)** with effect from 2014 Admission, subject to report to the Academic Council.

7. Orders are issued accordingly.

8. The implemented Scheme, Syllabus & Model Question Papers are appended.

To

Sd/-
DEPUTY REGISTRAR(Academic)
FOR REGISTRAR

The Principals of Affiliated Engineering Colleges
offering M.Tech .Programme .

Copy to

1. The Examination Branch (Through PA to CE)
2.The Chairman,BOS in Engineering (PG) 3.PS to VC/PA to CE/ P.A to Registrar.
4. DR/AR-I (Academic) 5. SF/DF/FC.

KANNUR UNIVERSITY
CIVIL STATION P.O.
KANNUR
Pin-670 002
THAVAKKARA

Forwarded/By Order

SECTION OFFICER

FOR MORE DETAILS : LOG ON www.kannuruniversity.ac.in

KANNUR UNIVERSITY

SYLLABUS OF M.TECH PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING(NETWORKS AND SECURITY)
w.e.f. 2014 admission

Preface

Kerala has achieved almost 100% literacy and the General Education facilities are among the top in the country. Technical education in Kerala is going through a phase of rapid change, keeping pace with changes in technology itself. Several technical institutions were setup in the state in the previous decade to provide quality technical education to students in Kerala.

In the field of Post Graduate level education in Engineering and Technology the state has some catching up to do, especially in the area of Computer Science and Engineering / Information Technology. At present, there are more than 130 Engineering Colleges and an NIT in the state. For under graduate level, annual intake is around 9850 for Computer Science / Information Technology disciplines. However for post graduate level, there are below 300 seats including the inter-disciplinary ones in the state. This situation makes the talented and interested students in the state to depend neighboring states for their PG studies. Many students are forced to be satisfied with a B. Tech degree.

Due to the increase in the number of engineering colleges in Kerala around 1100 personnel are required to occupy various teaching positions in the existing engineering colleges in the field. At present most of the faculty members in the subject are fresh recruits having bachelor's degree alone; but, new AICTE norms insists a post graduate degree at the entry level posts in teaching profession. Numerous leading R&D wings of the private and government organizations such as ISRO, CDAC, and DRDO in the state also require post graduate engineers. The present job market demands more number of software, hardware, and IT/CS engineers with specialization in computer networking, image processing, security etc. Tremendous opportunities are open for specialized Engineers in several IT companies including the giants like Infosys, Wipro, TCS, Tata Elxsi, etc. Around 80 IT-based companies are functioning in Technopark campus, Trivandrum and Infopark, Cochin. Many projects such as Smartcity and Technocity which can employ 10000 professionals are coming up in the state. Also, various communication based companies like BSNL, MTNL, Airtel, Reliance Communications etc. are looking for specialist engineers in the area of computer science and engineering.

Eligibility

The eligibility for admissions to the proposed M.Tech. course shall be as per the norms set by the Government of Kerala, related Government orders for admission to Engineering colleges, G.Os issued by the Government of Kerala for reservation and as recognized by the AICTE. Admission to this course is regulated on the basis of merit as assessed in the GATE.

B. Tech. / B.E. holders in Computer Science / Computer Engineering / Computer Technology / Computer Science and Engineering / Information Technology are eligible for enrolling to the prescribed M. Tech Program.

Academic Objectives

To provide high quality education opportunity for graduates in Computer Science and specialization in network engineering as the present availability of seats for the same in the state is very limited.

To promote academic growth by offering state-of-the-art knowledge.

To produce technically qualified and competent post graduates with potential to carry out research works in the field of Computer Science and Engineering with specialization in Networks and Security.

To undertake collaborative and socially relevant projects which offer opportunities for long-term interaction with academics and industry.

Areas of Focus

The proposed M.Tech. programme in Computer Science and Engineering(Networks and Security) is devised so as to provide quality post graduate level education to engineering graduates in Computer Science and Engineering / Information Technology. Hence the proposed programme contains advanced courses on both the core subjects and the emerging areas of computer science, network engineering and security.

Scheme of Examinations and Syllabi for M-Tech in Computer Science and Engineering(Networks and Security)

FIRST SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination		Credit
		L	T	P		Hrs	Marks	
CNS 101	Mathematical Foundations	3	-	-	50	3	100	3
CNS 102	Advanced Algorithms and analyzes	3	-	-	50	3	100	3
CNS 103	Topics in Networking	3	-	-	50	3	100	3
CNS 104	Network Design and Performance Evaluation	3	-	-	50	3	100	3
CNS 105	Elective I	3	-	-	50	3	100	3
CNS 106	Elective II	3	-	-	50	3	100	3
CNS 107(P)	Advanced Networking Laboratory	-	-	2	50	3	100	2
CNS 108(P)	Seminar	-	-	2	50	-	-	2
TOTAL		**18**		**4**	**400**		**700**	**22**

ELECTIVE-I

CNS 105 (A) Laws and Ethics in Computing
CNS 105 (B) Cyber Legislation and Security Policies

ELECTIVE II

CNS 106 (A) Computer Architecture
CNS 106 (B) Applied Probability and Statistics
CNS 106 (C) Ethical Hacking
CNS 106 (D) Wireless Networks
CNS 106 (E) Storage Management and Security
CNS 106 (F) High Performance Networks
CNS 106 (G) Energy Aware Computing
CNS 106 (H) Data Mining and Knowledge Discovery
CNS 106 (I) Virtualization Techniques
CNS 106 (J) Networking in Embedded Systems

SECOND SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination		Credit
		L	T	P		Hrs	Marks	
CNS 201	Path and Flow Problems in Networks	3	-	-	50	3	100	3
CNS 202	Topics in Security	3	-	-	50	3	100	3
CNS 203	Internet Information and Application Security	3	-	-	50	3	100	3
CNS 204	Elective III	3	-	-	50	3	100	3
CNS 205	Elective IV	3	-	-	50	3	100	3
CNS 206	Elective V	3	-	-	50	3	100	3
CNS 207(P)	Secure Computing Laboratory	-	-	2	50	3	100	2
CNS 208(P)	Term Paper	-	-	2	50	-	-	2
TOTAL		**18**		**4**	**400**		**700**	**22**

ELECTIVE-III

CNS 204 (A) Research Methods and Techniques
CNS 204 (B) Entrepreneurship Development

ELECTIVE-IV

CNS 205 (A) Modern Database Systems
CNS 205 (B) Game Theory
CNS 205 (C) Network Forensics
CNS 205 (D) Mobile Computing
CNS 205 (E) Security threats and Management
CNS 205 (F) High Performance Scientific Computing
CNS 205(G) Managing Big Data
CNS 205(H) Language Technologies
CNS 205(I) Cloud Computing
CNS 205(J) Real Time Systems

ELECTIVE-V

CNS 206 (A) Advanced Operating Systems
CNS 206 (B) Multi Objective Optimization Techniques
CNS 206 (C) Cryptanalysis
CNS 206 (D) Next Generation Networks
CNS 206 (E) Biometric Technologies
CNS 206(F) Distributed Algorithms
CNS 206(G) Social Network Analysis
CNS 206(H) Machine Learning Techniques
CNS 206(I) Software Defined Networking
CNS 206(J) Internet of Things

THIRD SEMESTER

Code	Subject	Hrs / Week			Marks					Credits
		L	T	P	Internal		University		Total	
					Guide	Evaluation Committee	Thesis	Viva		
CNS 301(P)	Thesis Preliminary			22	200	200	--	--	400	8
	Total			**22**	**200**	**200**			**400**	**8**

THESIS PRELIMINARY

This shall comprise of two seminars and submission of an interim thesis report. This report shall be evaluated by the evaluation committee. The fourth semester Thesis-Final shall be an extension of this work in the same area. The first seminar would highlight the topic, objectives, methodology and expected results. The first seminar shall be conducted in the first half of this semester. The second seminar is presentation of the interim thesis report of the work completed and scope of the work which is to be accomplished in the fourth semester.

FOURTH SEMESTER

Code	Subject	Hrs / Week			Marks					Credits
		L	T	P	Internal		University		Total	
					Guide	Evaluation Committee	Thesis	Viva		
CNS 401(P)	Thesis			22	200	200	100	100	600	12
	Total			**22**	**200**	**200**	**100**	**100**	**600**	**12**

Towards the middle of the semester there shall be a pre-submission seminar to assess the quality and quantum of the work by the evaluation committee. This shall consist of a brief presentation of Third semester interim thesis report and the work done during the fourth semester. The comments of the examiners should be incorporated in the work and at least one technical paper is to be prepared for possible publication in journals / conferences. The final evaluation of the thesis shall be an external evaluation.

Continuous Assessment(CA)

A. Sessional marks for all the Theory subjects:

The marks allotted for internal continuous assessment and end-semester university examinations shall be 50 marks and 100 marks respectively with a maximum of 150 marks for each theory subject.

The weightage to award internal assessment marks should be as follows:

Test papers (two tests)	: 25 marks
Assignments and/or class performance	: 25 marks

B. Sessional marks for all Practical subjects:

The marks allotted for internal continuous assessment and end-semester university examinations shall be 50 marks and 100 marks respectively with a maximum of 150 marks for each practical subject.

The weightage to award internal assessment marks should be as follows:

Test paper	: 15 marks
Laboratory class work and records	: 35 marks

C. Sessional marks for the Thesis Preliminary:

The marks allotted for the third semester is purely internal. This has to be done with two components: One with an evaluation of the thesis preliminary work by the guide(200 Marks) and the other with the evaluation of the same work by an evaluation committee (200 Marks).

The overall evaluation process shall comprise of two seminars and submission of an interim thesis report. The first seminar would highlight the topic, objectives, methodology and expected results which shall be conducted in the first half of this semester. The second seminar is presentation of the interim thesis report of the work completed and scope of the work which is to be accomplished in the fourth semester.

D. Sessional marks for the Thesis:

The marks allotted for the fourth semester is with an internal one of 400 and an external one of 200. The internal mark of 400 is to be allotted with two components: One with an evaluation of the thesis work by the guide (200 Marks) and the other with the evaluation of the same work by an evaluation committee (200 Marks).

Towards the middle of the fourth semester there shall be a pre-submission seminar to assess the quality and quantum of the work by the evaluation committee. This shall consist of a brief presentation of third semester interim thesis report plus the work done during the fourth semester. The comments of the examiners should be incorporated in the work before final submission. The final evaluation of the thesis shall be an external evaluation of the pattern: **Evaluation of Thesis + Viva Voce: 100 + 100 Marks**

Pattern of Question paper (Theory subjects)

3 hours lecture per week	**L-3**	**T-0**	**P-0**	**C-3**
Part A of 20 marks(covering all modules, one question from one module, mark per question will vary depending on number of modules). For example, if the syllabus has 5 modules, what is expected is 5 questions with 4 marks each. Part B will have 80 marks(covering all modules, one question from one module, mark per question will vary depending on number of modules) with one choice. For example, if the syllabus has 5 modules, 6 questions x 16marks out of which 5 need to be answered. For a 4 module course, it will be 5 questions x 20marks out of which 4 need to be answered. Questions preferably be analytic in nature. If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory. The question setter has the freedom to fix the additional choice question; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. For example, for a 4 module course, it is certain that the first four questions will cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.				

CNS 101 : MATHEMATICAL FOUNDATIONS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 - Number Theory[8 Hrs.]: The Euclidean algorithms, gcd, Fundamental theorem of arithmetic, Euler function, linear diophantine equations, Congruence, Solution of congruences, Modular inverse, Complete residue system, Reduced residue system, Euler's theorem, Fermat's little theorem, Wilson's theorem, The Chinese reminder theorem.

Module 2 - Queuing Models[10 Hrs.]: General concepts, Arrival pattern, service pattern, Queue Disciplines, FIFO Queuing systems, M/M/1, M/M/c, M/M/∞, M/G/1, M/M/m/m and other Markov models, non markov models, Network queues, Burke's theorem, Jackson's theorem

Module 3 - Formal Logic[8 Hrs.]: Propositional Logic, Validity of arguments, Quantifiers, Predicates, Predicate Logic and validity, Prenex Normal form, Proof, Techniques for theorem proving, Direct Proof, Proof by Contra position, Proof by exhausting cases and proof by contradiction, Resolution and Unification, principle of mathematical induction, principle of complete induction.

Module 4 - Graph Theory[9 Hrs.]: Graphs, isomorphic graphs, Euler path & hamiltonian circuits, Sub graphs, regular graphs, Euler's formula (proof) five color theorem and four color problem (without proof) and the chromatic number of a graph, Directed graphs, Computer representation of graphs, Warshall's, algorithms, Trees, Depth-first and breadth first search, trees associated with DFS & BFS, Connected components, articulation points.

Module 5 - Algebra & Coding[15 Hrs.]: Definition of group, monoid & semi group, elementary group theorem-uniqueness of identity and inverses, Subgroups, Cyclic groups, group isomorphism. Cosets, Lagranges' theorem. Rings and fields, Ideals, Polynomial rings, Division Algorithm, Linear codes, matrix of linear codes, Check matrix, one error correcting codes, decoding problem, Coset leader, Syndrome, Hamming Distance, Error correcting code, The hamming sphere packing bound, Hamming codes, Perfect code, Irreducible polynomials, Cyclic codes, Classification and properties, several error correcting, BCH codes, Properties of BCH codes.

Text:

1. Grimaldi P.R, "Discrete & Combinatorial Mathematics", Addison Wesley

2. James L. Hein, Discrete Structures, Logic,and Computability, Jones and Bartlett Publishers, 3rd Edition
3. Kolman, Busby & Ross "Discrete Mathematical Structures", PHI.
4. J.P. Tremblay & R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", TMH, New Delhi (2000).
5. Norman L. Biggs, 'Codes: An Introduction to Information Communication and Cryptography' , Springer 2008
6. C Y Hsuing, 'Elementary Theory of Numbers', Allied publishers
7. Dimitri P. Bertsekas and Robert G. Gallager, 'Data Networks' , 2nd Edition, PHI

References:

1. J. Truss, "Discrete Mathematics", Addison Wesley.
2. C.L.Liu, "Elements of Discrete Mathematics", McGraw Hill Book Company.
3. M.Lipson & Lipshutz, "Discrete Mathematics", Schaum's Outline series.
4. Iyengar, Chandrasekaran and Venkatesh, "Discrete Mathematics", Vikas Publication
5. Niven I., Zuckerman H.S. and Montgomery H. L.,' An Introduction to the Theory of Numbers', John Wiley and Sons.
6. Tom M Apostol, 'Introduction toanalytic Number Theory', Springer

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 102 : ADVANCED ALGORITHMS AND ANALYZES

3 hours per week	L-3	T-0	P-0	C-3

Module 1[11 Hrs.]: Model of Computation- RAM Model- Notations; Recurrence Analysis: Substitution Method, Recursion tree Method, Master Method- Masters Theorem and its Proof; Amortized Analysis: Aggregate analysis, The Accounting method, The Potential method-;Case Study with Datastructures: B-Trees, Binomial Heaps;

Module 2[15 Hrs.]: Complexity Classes, NP Hard & NP Complete Problems, Reductions and NP Completeness, Cook's Theorem.; Randomized Algorithms: Las Vegas and Monte Carlo Algorithms, Randomized Divide and conquer Approach, Randomized version of Quick Sort Algorithm, Miller Rabin Randomized Primality Test, De-Randomization; Randomized Complexity Classes; Probabilistic Algorithms.

Module 3[13 Hrs.]: Linear Programming: Standard and Slack forms, Formulating problems as linear programs, The simplex algorithm, Duality, The initial basic feasible solution; Number Theoretic Algorithms: Elementary number theoretic notions, Greatest Common Divisor, Modular Arithmetic, Solving modular linear equations, the Chinese remainder theorem, powers of an element, the RSA Public key crypto system, Primality testing.

Module 4[11 Hrs.]: Approximation Algorithms, Polynomial Time and Fully Polynomial Time Approximation Schemes; Randomized Approximation Schemes; Parallel and Distributed Algorithms: Introduction, the parallel random access machine, Sorting networks, Parallel Architectures, Distributed algorithms;

References:

1. Thomas H Cormen, C E Leiserson, R L Rivest, C Stein Introduction to Algorithms

2. Dexter C Kozen The Design and Analysis of Algorithm

3. Rajeev Motwani and Prabakar Ragavan Randomized Algorithms

4. Jon Kleinberg, Eva Tardos Algorithm Design

5. Prabakar Gupta, Vineet Agarwal, Manish Varshney Design and Analysis of Algorithms

6. Vijay V Vazirani Approximation Algorithms

7. Richard Johnsonbaugh, Marcus Schaefer Algorithms

8. Christos H Papadimitriou, Kenneth Steiglitz Combinatorial Optimization Algorithms and Complexity.

9. Chandra Mohan Design & Analysis of Algorithm

10. Sara Baase, Allen Van Gelder Computer Algorithm

11. Michael Sipser Introduction to Theory of Computation

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 103 : TOPICS IN NETWORKING

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Protocol Specification and Verification[11 Hrs.]: Communication protocol - Communication protocol development methods, protocol engineering process - Protocol Specification - Components, Communication Service, Protocol Entity, Interface, Multimedia protocol, Internet protocol Specification: Examples - SDL: Examples - Protocol Verification - Verification Using FSMs, Protocol validation, Protocol Design Errors, Protocol validation approaches, SDL based protocol verification, SDL based protocol validation.

Module 2 – Routing and Addressing[11 Hrs.]: Address types of TCP/IP stack - IP Address format & assignment order - Mapping IP to local addresses – DNS – DHCP - IP Routing method - Routing using masks - Routing Information Protocol - Network Address Translation - Router architectures, Packet Processing - IPv6 addressing - IPv6 network settings - configuring a router for IPv6 - IPv6 Routing - Troubleshooting IPv6 connection.

Module 3 – Congestion, Traffic Management & QoS in IP Networking[11 Hrs.]: Congestion Control And Resource Allocation - Issues in Resource allocation (Network Model, Taxonomy, Evaluation Criteria), Queuing Disciplines, TCP Congestion Control, Congestion Avoidance Mechanism(DECbit, RED, Source based congestion avoidance), End System traffic management - Link level flow and error control - Transport level traffic control - Network Traffic Management - Internetwork traffic management, Traffic and Congestion Control in ATM Networks - QoS in IP Networks(Integrated and Differentiated services), Protocols for QoS Support, QoS Routing.

Module 4 – Network Management Tools and Applications[11 Hrs.]: Network Management and its infrastructure-Internet standard management framework - SNMPv2 and SNMPv3 - Remote Monitoring - RMON SMI and MIB - Network management tools, Systems and engineering - NMS Design, Network management systems - Network Management applications - Fault & performance management - event correlation technique - Security, accounting, report, service level and policy based managements - Management in IPv6

Module 5 – Multimedia Communications in Networks[11 Hrs.]: Multimedia Communications - multimedia information representation, multimedia networks, Multimedia applications in networks - application level framing, audio/video conferencing, Video servers, Application requiring reliable multicast, Multimedia applications in WWW, Interactive multiplayer games, application and networking terminology, Standards for multimedia communications, Video transport across generic

networks, multimedia transport across ATM networks, The Internet: IPv6, IPv4/IPv6 Interoperability.

References:

1. Pallapa Venkataram and SunilKumar S. Manvi: Communication Protocol Engineering, PHI, 2004

2. Mohammed G. Gouda: Elements of protocol Design, Wiley Student Edition, 2004.

3. High-speed networks and internets: performance and quality of service. Author, William Stallings. Publisher, Pearson Education, 2002

4. Network Routing: Algorithms, Protocols and Architectures Deepankar Medhi and Karthikeyan Ramasamy(Morgan Kaufmann Series in Networking)

5. Larry L Peterson and Bruce S Davie "Computer Networks: A system approach", 3rd edition,morgan Kauffman publishers.

6. William Stallings "High Speed Networks: TCP/IP and ATM Design Principles" Prentice Hall Upper saddle river new Jersey 07458

7. J.F. Kurose and K.W. Ross, Computer Networking: A Top-Down Approach Featuring Internet,3/e, Perason Education, 2005.

8. Mani Subramaniam, 'Network Management: Principles and Practices', Pearson Education, 2000

9. Multimedia Communications: protocols and applications, Franklin F Kuo, J. Joaquin Garcia, Wolf gang Effelsberg, Prentice Hall Publications

10. Multimedia Communications: Applications, Networks, Protocols and Standards, Fred Halsall, Pearson Publications.

11. Multimedia Communication Systems: Techniques, standards and Networks' author: K.R. Rao. Zoran.S. Bojkovic, Dragorad A.Milovanovic, PHI,2009.

12. "A practical guide to advanced networking", Third Edition, Jeffrey. S. Beasley and Piyasat Nilkaew, Pearson publication.

13. "Computer Networks: Principles, Technologies and protocols for network design" author: Natalia Olifer and Victor Olifer, Wiley India Edition.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all

modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 104 : NETWORK DESIGN AND PERFORMANCE EVALUATION

3 hours per week	L-3	T-0	P-0	C-3

Module 1 - Introduction to Network Design[9 hrs] : Overview of Analysis, Architecture and Design Process - System Methodology, Service methodology, Service Description - Service characteristics - Performance Characteristics - Network supportability - Requirement analysis - User Requirements - Application Requirements - Device Requirements - Network Requirements - Other Requirements - Requirement specification and map

Module 2 [12 hrs]:

Network requirements: Requirement Analysis Process – Gathering and Listing Requirements- Developing service metrics – Characterizing behavior – Developing RMA requirements – Developing delay Requirements - Developing capacity Requirements - Developing supplemental performance Requirements –Requirements mapping – Developing the requirements specification.

Network flows: introduction - identifying and developing flows - data sources and sinks - flow models - flow prioritization and specification.

Module 3 [15 hrs]:

Network architecture: models-addressing and routing architecture-performance architecture-security and privacy architecture

Network design: Design Concepts – Design Process - Network Layout – Design Traceability – Design Metrics – Logical Network Design – Topology Design – Bridging, Switching and Routing Protocols - Physical Network Design – Selecting Technologies and Devices for Campus and Enterprise Networks – Optimizing Network Design

Module 4 - Analytical Network modeling and performance evaluation [14 hrs]:

Probability review, Queuing Systems review, Network of queues: The Product Form Solution - Algebraic Topological Interpretation of P.F. Solution - Recursive Solution of Non-Product Form Networks; Numerical Solution of Models; Closed Networks; Convolution Algorithm - Mean Value Analysis - Discrete Time Queuing Systems - Simulation of Communication Networks.

Text books:

1. Network Analysis, Architecture, and Design By James D. McCabe, Morgan Kaufmann, Third Edition, 2007.ISBN-13: 978-0123704801

2. Top-down Network Design: [a Systems Analysis Approach to Enterprise Network Design] By Priscilla Oppenheimer, Cisco Press , 3rd Edition, ISBN-13: 978-1-58720- 283-4 ISBN-10: 1-58720-283-2

3. Computer Networks and Systems:Queueing Theory and Performance Evaluation, Thomas G. Robertazzi

References:

1. Simulation Modeling and Analysis, 2nd Ed., by Law and Kelton, McGraw-Hill, 1991.

2. Fundamentals of Queueing Theory , D. Gross and CM Harris, John Wiley and Sons, 1974.

3. Queueing Systems - Vol. I & II, by L. Kleinrock, John Wiley and Sons, 1975.

4. Probability and Statistics with Reliability, Queuing and Computer Science Applications, by Kishor Trivedi.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 105(A) : LAWS AND ETHICS IN COMPUTING

3 hours per week	L-3	T-0	P-0	C-3

Module I[9 Hrs.]:

Ethics – philosophy and issues - Vacuum of policies - conceptual muddles - social context - moral and legal issues - uniqueness of ethical issues - role of analogy - descriptive and normative claims - ethical relativism - utilitarianism, other theories;

Professional Ethics - Characteristics – the system of professions – computing as a profession – professional relationship – responsibilities – code of ethics and professional conducts.

Module II[13 Hrs.]:

Computing and Intellectual Property rights - Overview of intellectual property rights - Copyright basics - Computer software and copyright – Copyright in Computer-generated works - The law of confidence - Copyright and electronic publishing - Copyright in the information society - Patent law - Trade marks and passing-off – product designs;

Introduction to Computing Contracts - Fundamentals of computer contracts – Liability for defective hardware and software - Contracts for writing software - Licence agreements for "off-the-shelf" software - Contract between software author and publisher – WEB and Hardware contracts.

Module III[16 Hrs.]:

Computer Crime: Computer Fraud – Hacking – Unauthorized modification of information – Piracy – Pornography and harrassment.

Computer Forensic: Introduction to Computer Forensics, history of computer forensics, understanding case law, developing Computer forensics resources, preparing for computer investigations - understanding law enforcement agency investigations, understanding corporate investigations, maintaining professional conduct, Understanding Computer Investigations - Preparing a computer investigation, taking a systematic approach, procedures for corporate high tech investigations, understanding data recovery workstations and software, conducting an investigation, completing the case - Requirements for forensic lab certification , determining the physical requirements for a

computer forensics lab, selecting a basic forensic workstation, building a business case for developing a forensic lab.

Module IV[12 Hrs.]: Cyber laws in India:Basic Concepts of Technology and Law : Understanding the Technology of Internet, Scope of Cyber Laws, Cyber Jurisprudence Law of Digital Contracts - Intellectual Property Issues in Cyber Space - Rights of Netizens and E-Governance - Information Technology Act 2000 data protection - Legislation on waste management and green technology – Legislation and Enforcement of usage of green technology.

References:

1. Deborah G Johnson, Computer Ethics (Paperback), 3rd edition, Pearson education.

2. D. Bainbridge, Introduction to Computer Law, 5/e, Pearson Education, 2004.

3. P. Duggal, Cyber Law – The Indian Perspective, Saakshar Law Publications, New Delhi, 2009.

4. Computer Forensics and Investigations- Bill Nelson, Amelia Phillips, Frank Enfinger, Christofer Steuart , second Indian Reprint 2009, Cengage Learning India.

4. Cyber Law Simplified by Vivek Sood, Tata McGrawHill (Unit V: Chapter 7)

5. Guide to Cyber Laws by Rodney Ryder, Wadhwa Publications, Nagpur.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 105(B) : CYBER LEGISLATION AND SECURITY POLICIES

3 hours per week	L-3	T-0	P-0	C-3

Module I[11 Hrs.]: Introduction to Computer Security: Definition - Threats to security - Government requirements - Information Protection and Access Controls; Computer security efforts - Standards, Computer Security mandates and legislation; Privacy considerations - International security activity.

Module II[11 Hrs.]: Protecting Programs and Data – Copyrights – patents - trade secret - Information and the Law - protecting information - Rights of Employees and Employers - Redress for Software Failures - Computer Crime - Ethical Issues in Computer Security - Ethical Decision Making: Types of ethical choices, Making defensible decisions; Case Studies of Ethics.

Professional Ethics - Characteristics – the system of professions – computing as a profession – professional relationship – responsibilities – code of ethics and professional conducts.

Module III - Information security policies and procedures[11 Hrs.]: Corporate policies - Tier 1, Tier 2 and Tier3 policies - process management - planning and preparation - developing policies - asset classification – policy - developing standards - Employee responsibilities.

Module IV[15 Hrs.]: Writing The Security Policies - Computer location and Facility construction – Contingency Planning - Periodic System and Network Configuration Audits - Authentication and Network Security – Addressing and Architecture – Access Control – Login Security – Passwords – User Interface – Telecommuting and Remote Access – Internet Security Policies – Administrative and User Responsibilities – WWW Policies – Application Responsibilities – E-mail Security Policies.

Organizational and Human security: Adoption of Information security management standards – Human factors in security, Role of information security professionals.

References:

1. Deborah Russell and Sr. G.T Gangemi, Computer Security Basics (Paperback), 2nd Edition, O' Reilly Media, 2006.

2. Charles P. Pfleeger Security in computing, 4th edition, Printice Hall, 2006

3. Thomas R. Peltier, Information Security policies and procedures: A Practitioner's Reference, 2nd Edition Prentice Hall, 2004.

4. Scott Barman, Writing Information Security Policies, Sams Publishing, 2002.

5.] Deborah G Johnson, " Computer Ethics", 4th Edition, Pearson Education Publication, 2008

6. Kenneth J Knapp, Cybersecurity and global information assurance: Threat analysis and Response solutions, IGI Global, 2009

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 106 (A) : COMPUTER ARCHITECTURE
Same as MCS 104

3 hours per week	L-3	T-0	P-0	C-3

Module I[10 Hrs.]: Advanced ILP Exploitation Techniques: Hardware and software techniques for ILP extraction - speculative execution - studies on ILP. Overview and history of computing – Architectural Classification schemes - High performance computing - overview and performance quantification criteria.

Module II[10 Hrs.]: Multiprocessor Architecture: Symmetric and distributed shared memory architectures – Cache coherence issues - Performance Issues – Synchronization issues – Models of Memory Consistency - Interconnection networks – Buses, crossbar and multi-stage switches.

Module III[10 Hrs.]: Multithreaded processors and Multicore processors, methodologies and analysis. Speculative multithreading. Multicore processor design and compilation issues, scheduling. CMPs and Polymorphic processors Concept, Studies and Analysis, Intel Multi-core architecture – SUN CMP architecture

Module IV[10 Hrs.]: Simulators in Computer Architecture Introduction – methods, ADLs, traces, dynamic compilation. Multicore simulators. Functional and performance Simulators Design of high performance architecture, parallel vs. pipeline architectures. Pipeline processing. Theory of pipeline scheduling and implementation. Hazards in Pipeline processors. Hazard detection and resolution techniques.

Module V[10 Hrs.]: Memory Technology and Optimizations – Transactional Memory - Optimizations of Cache Performance - Protection: Virtual Memory and Virtual Machines - Design of Memory Hierarchies - Case Studies.

References:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, 3rd Edition, Morgan Kaufmann Publishers, 2002.

2. The WWW Computer Architecture page http://arch-www.cs.wisc.edu/tools/ (23/07/2012)

3. David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture : A hardware/

software approach” , Morgan Kaufmann / Elsevier, 1997

4. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGrawHill, 1984.

5. ACM SIGARCH Computer Architecture News.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 106(B) : APPLIED PROBABILITY AND STATISTICS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – One Dimensional Random Variables[10 Hrs.]: Random variables - Probability function — Moments — Moment generating functions and their properties — Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions — Functions of a Random Variable.

Module 2 – Two Dimensional Random Variables[10 Hrs.]: Joint distributions — Marginal and Conditional distributions — Functions of two dimensional random variables — Regression Curve — Correlation.

Module 3 – Estimation Theory[10 Hrs.]: Unbiased Estimators — Method of Moments — Maximum Likelihood Estimation - Curve fitting by Principle of least squares — Regression Lines.

Module 4 – Testing of Hypothesis[10 Hrs.]: Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions — Tests for Independence of attributes and Goodness of fit.

Module 5 – Multivariate Analysis[10 Hrs.]: Random Vectors and Matrices - Mean vectors and Covariance matrices - Multivariate Normal density and its properties - Principal components Population principal components - Principal components from standardized variables.

References:

1 Jay L. Devore, "Probability and Statistics For Engineering and the Sciences",Thomson and Duxbury, 2002.

2 .Richard Johnson. "Miller & Freund's Probability and Statistics for Engineer", Prentice Hall , Seventh Edition, 2007.

3. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", Pearson Education, Asia, Fifth Edition, 2002.

4. Gupta S.C. and Kapoor V.K."Fundamentals of Mathematical Statistics", Sultan an Sons, 2001.

5. Dallas E Johnson , "Applied Multivariate Methods for Data Analysis", Thomson an Duxbury press,1998.

6. T. Veerarajan- Probability, Statistics and Random Processes(II Edn) (Tata McGraw Hill)

7. Irwin Miller, Marylees Miller- Mathematical Statistics(7th Edn)(Pearson Edn)

8. Douglas.C.Montgomery, George.C.Runger-Applied Statistics & Probability for

Engineers -5th Edn(wiley Student Edn)
9. Hogg, Tanis,Tao- Probability & statistical Inference(7th Edn) –Pearson Edn)
10. Vijay. K. Rohagi, A.K. Md.Ehsanes Saleh- An introduction to probability and statistics

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 106(C) : ETHICAL HACKING

3 hours per week	L-3	T-0	P-0	C-3

Module I – Introduction to Hacking[11 Hrs.]: Casing the Establishment -What are Foot Printing - Internet Foot printing – Scanning – Enumeration - Basic banner grabbing - Enumerating common network services. Case study - Network security monitoring Security permission;

Securing file and folder permission - Using the encrypted file system; Securing registry permissions; Securing services - Managing service permission - Default services in windows 2000 and windows XP; UNIX - The Quest for Root - Remote Access vs. Local Access - After hacking root.

Module II – Network Hacking[11 Hrs.]: Dial-up, PBX,Voice mail and VPN hacking - preparing to dial-up – War-Dialing - Brute-Force scripting - Network Devices – Discovery - Autonomous System Lookup - Public Newsgroups - Service Detection - Network Vulnerability - Detecting Layer 2 Media.

Module III – Wireless Hacking[13 Hrs.]: Wireless hacking - wireless foot printing - Wireless Scanning and Enumeration - Gaining Access - Tools that exploiting WEP Weakness - Denial of services attacks – Firewalls - Firewalls landscape - Firewall Identification - Scanning through firewalls - Packet filtering - Application Proxy Vulnerabilities - Denial of Service Attacks - Motivation of DoS attacks - Types of DoS attacks - Generic DoS attacks - UNIX and Windows DoS.

Module IV – Software Hacking[15 Hrs.]: Remote Control Insecurities - Discovering Remote Control Software - Connection Weakness – VNC - Microsoft Terminal Server and Critrix ICA - Advanced Techniques: Session Hijacking, Back Doors, Trojans – Cryptography - Subverting the systems Environment - Social Engineering - Web hacking - Web server hacking, web application hacking - Hacking the internet User - Malicious Mobile codes' fraud - mail hacking, IRC hacking - Global Counter measures to Internet User hacking.

References:

1. Staurt McClure, Joel Scambray and George Kurtz, "Hacking Exposed Network Security Secrets &Solutions", Tata McGraw-Hill Publishers,2010 (6th Edition)

2. Bensmith and Brian Komer,"Microsoft Windows Security Resource Kit", Prentice Hall of India,2010

3. Staurt McClure, Joel Scambray and George Kurtz, “Hacking Exposed Network Security Secrets &Solutions”, Tata McGraw-Hill Publishers(2nd Edition).

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 106(D) : WIRELESS NETWORKS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 - Overview of Wireless Networks[12 Hrs.]: Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer-MAC Management Sublayer- Wireless ATM - HIPERLAN- HIPERLAN-2, WiMax, Wireless Local Loop (WLL). Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, CDMA2000 overview- Radio and Network components, Network structure. 4G features and challenges, Technology path, IMS Architecture, Convergent Devices, 4G technologies, Advanced Broadband Wireless Access and Services.

Module 2 - Mobile and Adhoc Networks[11 Hrs.]: Introduction to Mobile Networks, Heterogeneity in Mobile Devices, Types of Mobile Communications, Types of Mobile Host Movements, Challenges Facing Mobile Networks, Introduction to Ad-hoc Wireless Networks, Overview, MAC Protocols. Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, DSDV, WRP, AODV, DSR, TORA.

Module 3 - Wireless Sensor Networks[14 Hrs.]: Introduction to Wireless Sensor Networks, Overview, Characteristics, Network Applications, Design Objectives, Technological Background, Wireless Sensor Networks Architecture, Classification, Protocol stack, MAC Protocols. Routing Protocols – Flat – Architectural Protocols – Hierarchical Protocols – Geographic Routing Protocols – QoS Based Protocols. Time Synchronization – Localization and Positioning – Topology Management.

Module 4 - Special Wireless Sensor Networks[13 Hrs.]: Wireless Sensor and Actor Networks – Network Architecture – Sensor Actor Coordination – Actor Actor Coordination. Wireless Multimedia Sensor Networks – Network Architecture. Wireless Underwater Sensor Networks – Network components – Communication Architecture – Basics of Acoustic Propagation. Wireless Underground Sensor Networks – Applications – Network Architecture – Communication.

Text Books:

1. Ian F. Akyildiz and Mehmet Can Vuran, Wirless Sensor Networks, Wiley

2. Siva Ram Murthy C. and Manoj B. S., “Ad Hoc Wireless Networks: Architectures and Protocols”, 2nd Edn. Pearson Education 2005

References:

1. Imielinski T. and Korth H.F., “Mobile Computing”, Kluwer Academic Publishers, 1996.

2. William Stallings, “Wireless Communications and Networks”, Prentice Hall, 2004.

3. Clint Smith. P.E., and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.

4. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific, 2007.

5. Toh C. K., “Ad Hoc Mobile Wireless Networks Protocols and Systems”, Prentice Hall, PTR, 2001.

6. Yi-Bing and Imrich Chlamtac, “Wireless and Mobile Networks Architectures”, John Wiley & Sons, 2001.

7. Introduction to Wireless and Mobile System, Dharma Prakash Agrawal, Qing-An Zewg, edition 3, Celengage Learning, 2010

8. From GSM to LTE: An Introduction to Monile Network and Mobile Broadband, Martin Sauter, John Wiley and sons, 2010

9. Fundamental of Wireless Sensor Network Theory and Practical, Waltenegus Dargie and Christian Poollabaner, John Wiley and sons, 2010

10. Wireless Sensor Network: Technology, Protocols and Application by Kazem Sohrahy, Daniel Minoli Tailab Znati, John Wiley and sons, 2007

11. IP for 4G, Dave Wisely, John Wiley and sons, 2009

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 106(E) : STORAGE MANAGEMENT AND SECURITY

3 hours per week	L-3	T-0	P-0	C-3

Module I – Introduction to Information Storage and Management[11 Hrs.]: Introduction, History: computing, networking, storage, Need for storage networking - SAN, NAS, SAN/NAS Convergence, Distributed Storage Systems.

Mainframe/proprietary vs. open storage - Storage Industry Organizations and Major Vendors Market - Storage networking strategy (SAN/NAS) Technology.

Module II – Storage System Environment[13 Hrs.]: Storage Components; Data organization: File vs. Block, Object, Data store;

Searchable models: Storage Devices (including fixed content storage devices) - File Systems - Volume Managers - RAID systems – Caches – Prefetching;

Error Management: Disk error Management - RAID Error Management - Distributed Systems Error Management.

Module III – Large Storage Systems[17 Hrs.]: Google FS/Big Table, Cloud/Web - based systems (Amazon S3) - FS÷DB convergence;

Programming models: Hadoop - Archive 1 5Ssiems' - Content addressable storage;

Backup: server less, LAN free, LAN Replication issues - Storage Security;

Storage Management:- Device Management - NAS Management - Virtualization - Virtualization solutions;

SAN Management: Storage Provisioning, Storage Migration.

Module IV – Storage Security and Management[9 Hrs.]: Securing the storage infrastructure - Storage Security framework - Risk Triad - Storage Security Domains - Security Implementation in Storage Networking - Managing the Storage Infrastructure - Monitoring the Storage Infrastructure - Storage Management Activities - Developing an Ideal Solution - Concepts in Practice.

References:

1. EMC Education Services" Information Storage and Management: Storing, Managing and Protecting Digital Information", John Wiley & Sons, 2010.

2. lohn Chirillo, ScottB]aul " Storage Security: Protecting SANs, NAS and DAS", Wiley, 2003.

3. David Alexander, Amanda French, Dave Sutton"Information Security Management Principles" BCS, The Chartered Institute 2008.

4. Gerald J.Kowalski, Mark T.Maybury" Information Storage and Retrieval Systems: Theory And Implementation ", Springer, 2000.

5. Foster Stockwell , "A history *or* information storage and retrieval" McFarland, 2001.

6. R. Kelly Rainer, Casey G. Cegielski ,"Introduction to Information Systems: Enabling and Transforming Business, John Wiley & Sons, 2010.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 106(F) : HIGH PERFORMANCE NETWORKS

3 hours per week	L-3	T-0	P-0	C-3

Module I[10 Hrs.]:

Network Performance analysis : Objectives and requirements for Quality of Service (QoS) in high performance networks; Architecture of high performance networks (HPN) - design issues - protocols for HPN - VHF backbone networks - virtual interface architectures - virtual interface for networking - High-speed switching and routing - internet and PSTN IP switching techniques - SRP protocols - SRP authentication and key exchange - comparison of TCP/IP, FTP, TELNET, queuing systems - network modeling as a graph.

Module II[10 Hrs.]:

Gigabit Ethernet : Architecture, standards, interface, applications, network design

Frame relay: Frame relay protocols and services, frame relay congestion Control

ATM: Architecture, protocol, switching, traffic and congestion control, flow control ATM service categories, ATM in LAN environment, classical IP over ATM

ADSL and DSL Technologies : Background and technological capabilities, Standards and associations, Architecture.

Fiber Optics Communication: GPON (Gigabit capable Passive Optical Network), SONET/SDH and comparison with other available standards.

Module III[15 Hrs.]:

Introduction to MPLS and QOS - Network Components of MPLS - working RSVP protocol - MPLS network Components - MPLS basic working – Applications - IETF approach - RSVP protocol - Integrated & differential Services Framework.

Storage and networking concepts – SCSI bus architecture – Networking in front of the server – Networking behind the server – Network-attached Storage – Fibre channel internals – Layers – Data encoding – Framing protocol – class of service – flow control – Name and addressing conventions.

Module IV[15 Hrs.]

SAN topologies – Point-to Point – Arbitrated Loop – Loop Addressing-Loop Initialization-Port Login-Loop port state machine – Design considerations for Arbitrated Loop –Fabrics – Fabric login – Simple Name Server – State Change Notification – Private Loop Support – Fabric Zoning – Building Extended SANs.

Fibre Channel Products – Gigabit Interface Converters (GBICs) – host Bus Adapters – Fibre channel RAID – Fibre channel JBODs – Arbitrated Loop Hubs – hub Architecture – Unmanaged Hubs – Managed Hubs – Switching Hubs – Fabric Switches – Fibre Channel-to-SCSI Bridges – SAN software Products – Problem isolation in SANs – Isolation Techniques – Fibre channel Analyzers.

References:

1. Storage Networks Explained – Uif Troppens, Raiver Erkens and Wolfgang Muller, John Wiley & Sons, 2003.

2. Alex Goldman, "Storage Area Networks Fundamentals", Cisco Press 2002

3. Storage Area Network Essentials: a Complete Guide to understanding andimplementing SANs- Richard Barker and Paul Massiglia, John Wiley India

4. William Stallings: ISDN And BISDN

5. William Stallings: High Speed Networks

6. M Shwartz: Telecommunication Network Protocol Modeling And Analysis: Addison Wesley

7. Gallangar: Data Networks: Prentice Hall

8. Fred Halsall: Data Communication Computer Networks, And Open Systems: Addison Wesley

9. Kershanbaum : Telecommunication Network Design Algorithms: MGH

10. Jochetl Schiller: Mobile Communication: Addison Wesley.

11. Tanenbaum: Computer Networks: PHI

13. Johnson: Fast Ethernet

14. Tom Clark, "Designing Storage Area Networks", Addison-Wesley Professional, 1stedition, 1999

15. Storage Networks: The Complete Reference – Robert Sparding, Tata Mcgraw Hills, 2003.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks;

remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 106(G) : ENERGY AWARE COMPUTING

3 hours per week	L-3	T-0	P-0	C-3

Module I – Introduction[10 Hrs.]: Energy efficient network on chip architecture for multi core system - Energy efficient MIPS CPU core with fine grained run time power gating - Low power design of emerging memory technology.

Module II - Energy Efficient Storages[8 Hrs.]: Disk energy management - Power efficient strategy for storage system - Dynamic thermal management for high performance storage system - Energy saving technique for disk storage system.

Module III – Energy Efficient Algorithms[12 Hrs.]: Scheduling of parallel tasks - Task level dynamic voltage scaling - Speed scaling - Processor optimization - Memetic algorithms - Online job scheduling algorithms.

Module IV – Real Time Systems[12 Hrs.]: Multi-processor systems - Real time tasks - Energy minimization - Energy aware scheduling - Dynamic reconfiguration - Adaptive power management - Energy harvesting embedded system.

Module V – Energy Aware Applications[8 Hrs.]: On chip network - Video Codec Design - Surveillance camera - Low power mobile storage.

Textbooks:

1. Ishfaq Ah mad, Sanjay Ranka, Handbook of Energy Aware and Green Computing, Chapman and Hall/CRC, 2012
2. Chong-Min Kyung, Sungioo yoo, Energy Aware System Design Algorithm and Architecture, Springer, 2011

Reference:

1. Bob steiger waid, Chris:Luero, Energy Aware Computing, Intel Press 2012

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks;

remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 106(H) : DATA MINING AND KNOWLEDGE DISCOVERY

3 hours per week	L-3	T-0	P-0	C-3

Module 1 - Data Mining[10 Hrs.]:

Data Mining and Knowledge Discovery – Desirable Properties of Discovered Knowledge – Knowledge representation – Classification – Dependence Modeling

Introduction to Data Mining - Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Attribute selection - Data Discretization and Concept Hierarchy Generation – Attribute construction.

Evolutionary Algorithms for Data Preparation – Attribute selection – Attribute weighting – Combining selection and weighting

Module 2 - Rule discovery[12 Hrs.]:

Association Rule Mining: -Efficient and scalable frequent item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

Genetic Algorithms for Rule Discovery – Individual representation – Task-specific operators – Task-specific population initialization and seeding – Task-specific rule selection - Fitness evaluation

Module 3 - Classification and Prediction[14 Hrs.]:

Issues Regarding Classification and Prediction –Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section

Module 4 - Cluster Analysis and Applications and Trends in Data Mining[14 Hrs.]:

Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis

Scaling up Evolutionary Algorithms for Large Datasets – Using data subsets in fitness evaluation – Basics of parallel processing – Parallel EA for data mining - Data Mining Applications – Trends in Data Mining.

References:

1. Jiawei Han and Micheline Kamber "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.
2. Alex A. Freitas, "Data Mining and Knowledge Discovery with Evolutionary Algorithms", Natural Computing Series, Springer International Edition, Springer
3. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
4. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 106(I) : VIRTUALIZATION TECHNIQUES

3 hours per week	L-3	T-0	P-0	C-3

Module I – Basics of Virtualization[11 Hrs.]: Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization- Virtualization Advantages – Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines – System Virtual Machines – Hypervisor - Key Concepts.

Module II – Server Consolidation[11 Hrs.]: Hardware Virtualization – Virtual Hardware Overview - Sever Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Sever Virtualization – Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform.

Module III - Network virtualization[14 Hrs.]: Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design – WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability theory - Network Device Virtualization Layer 2 - VLANs Layer 3 - VRF Instances Layer 2 - VFIs - Virtual Firewall Contexts - Network Device Virtualization - Data- Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation – Ipsec L2TPv3 Label Switched Paths - Control-Plane Virtualization–Routing Protocols- VRF - Aware Routing Multi-Topology Routing.

Module IV – Virtualizing Storage[14 Hrs.]: MEMORY MANAGEMENT IN VIRTUALIZATION: partitioning, reclamation, ballooning; SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries.

Overview of Hypervisors : Xen Virtual machine monitors- Xen API – VMware – VMware products – Vmware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server.

References:

1. William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008.

2. Chris Wolf , Erick M. Halter, Virtualization: From the Desktop to the Enterprise, APress 2005.

3. Kumar Reddy, Victor Moreno, Network virtualization, Cisco Press, July, 2006.

4. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.

5. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 106(J) : NETWORKING IN EMBEDDED SYSTEMS

3 hours per week	L-3	T-0	P-0	C-3

Module I – Embedded Communication Protocols[12 Hrs.]: Embedded network: Introduction - Serial parallel communication - Serial communication protocols – RS232 standard - RS485 standard - Synchronous serial protocols - Serial peripheral interface(SPI) - Inter integrated circuits - PC parallel port programming - ISA/PCI bus protocol – Firmware.

Module II – USB and CAN BUS[16 Hrs.]: USB bus – Introduction - Speed identification on the bus - USB state - USB Bus Communication: Packets - Data flow types – Enumeration – Description - PIC Micro controller USB Interface - C Program - CAN Bus- Introduction - Frames - Bit stuffing - Types of errors - Nominal Bit Timing - PIC micro controller CAN Interface - A simple application with CAN.

Module III – Embedded Ethernet[13 Hrs.]: Element of a network - Inside Ethernet - Building a network: Hardware option - Cables - Connections and network speed - Design choices: Selecting components - Ethernet Controllers - Exchanging message using UDP and TCP - Serving web page with dynamic data - Serving web pages that respond to user input - Email for embedded systems - Using FTP - keeping device and network secure.

Module IV – Wireless Embedded Networking[13 Hrs.]: Wireless Sensor Networks – Introduction – Application - Network Topology – Localization - Time Synchronization - Energy efficient MAC Protocols – SMAC - Energy Efficient and Robust routing - Data Centric Routing.

References:

1. Frank Vahid, Givargis, Embedded System Design: A Unified Hardware/Software Introduction, Wiley publications
2. Jan Axelson, Parallel Port Complete, Penram publications
3. Dogan Ibrahim, Advanced PIC microcontroller projects in C, Elsevier 2008
4. Jan Axelson, Embedded Ethernet and Internet Complete, Penram publications
5. Bhaskar Krishnamachari, Networking wireless sensors, Cambridge press 2015
6. PIC Microcontroller and Embedded System by Muhammad Ali Mazidi, Rolind D Mekinlay, Danny Causey
7. Introduction to Wireless and Mobile System,Dharma Prakash Agrawal, Qing-An Zewg, edition 3, Celengage Learning, 2010
8. Wireless Sensor Network: Technology, Protocol and Application, Kazem Sohraby,Daniel Minoili Taileb Znati, John Wiley and sons, 2007

9. Serial Port Complete: Com Port, USB Virtual Com Ports and Port for Embedded System, Jan Axelson, Lakeview Research, U.S.; 2nd Revised edition edition (14 November 2007)

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 107(P) : ADVANCED NETWORKING LABORATORY

2 hours per week	L-0	T-0	P-2	C-2

Experiments Of Network Programming and Security using C/Java

1) Implementation of ARP and improvisation of protocol by resolving various security problems involved in it.

2) Implementation of Remote Command Execution with the various scenarios such as Remote File copy, Remote Distribution etc.

3) Programs to integrate Link State and Distance Vector Routing Protocols.

4) Implement a protocol which ensures reliable QoS to transfer a file across a network and measure its performance in comparison with TCP.

5) Implementation of network protocol used on the Internet or local area networks to provide a bidirectional interactive communications facility.

6) Implement a protocol for Authenticated Routing in LAN networks.

Network Simulation and performance Evaluation Using Simulator (like NS2)

7) Simulation and Performance Comparison of various Routing Protocols.

8) Simulation of Wireless Networks (Eg. Wifi, Adhoc etc).

9) Simulation and Performance Comparison of different congestion control and avoidance mechanisms which have been proposed for TCP/IP protocols.

Mapping Of Experiments to purpose to show the scope/usage of each experiment

Ex No	N/w Programming	Protocol Design	Network Simulation	Performance Evaluation	Security	Internetworking Experiments	Tracking	Management
1	Y	Y			Y		Y	
2	Y							Y
3	Y	Y				Y		
4	Y	Y						Y
5	Y	Y				Y		
6	Y	Y			Y		Y	
7			Y	Y				
8			Y					
9			Y	Y				

Reference:

1. W. Richard Stevens, “UNIX Network Programming”, PHI , Eastern Economy Edition

2. J.F. Kurose and K.W. Ross, Computer Networking: A Top-Down Approach Featuring Internet,3/e, Perason Education, 2005.

3. Using Java2 Platform – Weber (AWL)

4. Douglas E.Comer, Hands on Networking with Internet Technologies, Pearson Education.

5. Network And System Security, edited by John R. Vacca

CNS 108(P) : SEMINAR

Same as MCS 108(P)

2 hours per week	L-0	T-0	P-2	C-2

The student is expected to present a seminar in one of the current topics in the field of specialization and related areas. The student shall prepare a Paper and present a Seminar on any current topic related to the branch of specialization under the guidance of a staff member. The student will undertake a detailed study based on current published papers, journals, books on the chosen subject and submit seminar report at the end of the semester. The student shall submit typed copy of the paper to the Department. Grades will be awarded on the basis of contents of the paper and the presentation. A common format in (.pdf format) shall be given for reports of Seminar and Project. All reports of Seminar and Project submitted by students shall be in this given format.

Sessional work assessment:

Presentation : 25

Report : 25

Total marks : 50

CNS 201 : PATH AND FLOW PROBLEMS IN NETWORKS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Introduction[8 Hrs.]:

Network Flow Problems - Network Representations - Network Transformations - Complexity Analysis - Developing Polynomial Time Algorithms - Search Algorithms - Flow Decomposition Algorithms

Module 2 - Shortest Path Algorithms[8 Hrs.]:

Shortest Paths: Label Setting Algorithms – Dijkstra's Algorithm, Dial's Implementation, Heap Implementation, Radix Heap Implementation

Shortest Paths: Label Correcting Algorithms – Generic Label Correcting Algorithms,Special Implementations of the Modified Label Correcting Algorithm, Detecting Negative Cycles, All Pairs Shortest Path Problem.

Module 3 - Maximum and Minimum Flow Algorithms[16 Hrs.]:

Maximum Flows: Generic Augmenting Path Algorithm - Labeling Algorithm and Max-Flow Min–Cut Theorem - Capacity Scaling Algorithm - Distance Labels and Layered Networks -Generic Pre-Flow Push Algorithm - FIFO Pre-Flow Push Algorithm - Flows in Unit Capacity Networks - Flows in Bipartite Networks - Flows in Planar Undirected Networks.

Minimum Cost Flows: Optimality Conditions - Cycle Canceling Algorithm and the Integrity Property - Successive Shortest Path Algorithm - Primal–Dual Algorithm - Out–of Kilter Algorithm - Capacity Scaling Algorithm - Cost Scaling Algorithm - Minimum Mean Cycle Canceling Algorithm.

Module 4 - Trees and Forests[8 Hrs.]:

Minimum Spanning Trees - Kruskal's Algorithm - Prim's Algorithm - Sollin's Algorithm -Convex Cost Flows - Pseudo Polynomial Time Algorithm, Polynomial Time Algorithm - Generalized Flows - Augmented Forest Structures - Determining Potentials and Flows for an Augmented Forest Structure - Generalized Network Simplex Algorithm

Module 5: Linear programming and network flows[10 Hrs.]:

Linear programming - modeling, geometric solution - Simplex method and minimum cost network flows - Representation of a Non-basic Vector in Terms of the Basic Vectors - The Simplex Method for Network Flow Problems - LP formulation of matching

Textbooks:

1. Ravindra K. Ahuja, Thomas L. Magnanti, James B.Orlin, “Network Flows – Theory, Algorithms and Applications”, 1st Edition, Prentice Hall, 1993.

2. Mokhtar S. Bazaraa, John J. Jarvis, Hanif D. Sherali, “Linear Programming and Network Flows”, 4th Edition, John Wiley & Sons, 2009.

References:

1. Gunther Ruhe, Kluwer, “Algorithmic Aspects of Flows in Networks”, Academic Publishers Group, 1991.

2. Michael W. Lucas, “Network Flow Analysis”, No Starch Press, 2010.

3. Alexander Engau, Vdm Verlag Dr. Muller, “Semi-Simultaneous Flows in Multiple Networks”, Aktiengesellschaft & Co. Kg, 2008.

4. Wai-kai Che, “Theory of Nets: Flows In Networks”, John Wiley & Sons, 1990.

5. Jon kleinberg, Eva tardos “Algorithm design”, pearson publication.

6. Christros Papadimitriou, Kennet h Steiglitz, Combinatorial optimization:algorithms and complexity, PHI, 2000

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 202 : TOPICS IN SECURITY

3 hours per week	L-3	T-0	P-0	C-3

Module 1[6 Hrs.]: Security Mechanism and principles; Security Goals and Violations; Security Requirements; Security Services; Honeyword generators, decoy passwords.

Module 2[10 Hrs.]: Discrete Logs; Encryption/Decryption Functions - Perfect secrecy, One-Time Pad; Cryptographic Hash Functions - definitions, Requirements and Algorithmic Implementation of One-Way Functions; random oracle model, desirable properties, applications; Keccak-SHA-3 overview; MAC Functions - message authentication codes, Requirements for MAC, Security of MAC, Algorithmic Implementation - HMAC, CBC - MAC, PRF - MAC, One Time MAC

Module 3[8 Hrs.]: OS Security Violations and Techniques to Prevent Them; Access Control Models; Secure Programming Techniques; Intrusion Detection; Malicious Software Detection; Firewalls; Database and Datamining security.

Module 4[10 Hrs.]: Block Ciphers and Stream Ciphers; Block Ciphers- DES, AES, Ideal Block Cipher; Modes of Encryption; Modes of operations, ECB (Electronic Code Book), CTR (Counter Mode), CBC (Cipher Block Chaining), CFB(Cipher Feedback); Secret Sharing - Shamir's secret sharing - key management – interpolation – bi-linear maps;

Digital signatures – Identity based encryption, 3 way agreement; Authentication Protocols - Nonce and Timestamps - Authenticated Diffie-Hellman Key Establishment Protocols; Group Key Establishment Protocols.

Module 5[8 Hrs.]: Pedersen Commitment - PK Encryption (Public Key Encryption) - El-Gamal PK Encryption - DDH (Decision Diffie-Hellman) - PKI and X.509 Authentication Service – Kerberos.

Module 6[8 Hrs.]: E-mail Security; IP Security; Secure Socket Layer and Transport Layer Security; Secure Electronic Transactions; Impacts on Emerging Technologies - RFID, Electronic Voting, VoIP and Skype.

References:

1. William Stallings Cryptography and Network Security principles and practice Fifth Edition pearson publications.

2. Behrouz A Forouzan, Debdeep Mukhopadhyay Cryptography and Network security Mc Graw Hill publications
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-857-network-and-computer-security-spring-2014/lecture-notes-and-readings/
4. Juels, Ari, and Ronald Rivest. "Honeywords: Making Password-Cracking Detectable." *ACM CCS* (2013): 145–60
5. Charles P. Pfleeger, Shari Lawrence Pfleeger Security in Computing , 4/e Pearson Education.

Question pattern:

This is a 6 module course. It will have Part A of 22 marks(covering all modules, one question from first module of 2 marks, one each remaining module, 4 mark per question). Part B will have 78 marks(covering all modules, one question from one module, 7 questions x 13marks out of which 6 need to be answered). If essays are asked, limit it to one sub-part question with at most 10 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first six questions to cover the six modules respectively while the 7th question(choice question) may refer to multiple modules.

CNS 203 : INTERNET INFORMATION AND APPLICATION SECURITY

3 hours per week	L-3	T-0	P-0	C-3

Module I – Finding and Exploiting Hacking[11 Hrs.]: Web application security - Key Problem factors - Core Defense Mechanisms - Handling user access - Handling user input - Handling attackers - Web Spidering - Discovering hidden content - Transmitting Data via the client - Hidden form fields - HTTP Cookies - URL Parameters - Handling Client side data Securely - Attacking authentication - Design Flaws in authentication mechanisms - Securing Authentication - Attacking access controls - Common Vulnerabilities - Securing access controls.

Module II – Attacks and Defenses of SQL Injection[10 Hrs.]: SQL Injection - How it happens - Dynamic string building - Insecure Database Configuration - Finding SQL Injection - Exploiting SQL injection - Common techniques - Identifying the database - UNION Statements - Preventing SQL injection - platform level defenses - Using run time protection - Web application Firewalls - Using Mod Security intercepting filters - Web Server filters - Application filters - Securing the database - Locking down the application data - Locking down the Database server.

Module III – Securing Web Applications from Hacking[10 Hrs.]: Mod Security - Blocking common attacks - HTTP Finger printing - Blocking Proxies requests - Cross-site scripting - Cross-site request forgeries - Shell Command execution attempts - Null byte attacks - Source code revelation - Directory traversal attacks - Blog Spam – Website defacement - Brute force attack - Directory indexing - Detecting the real IP address of an attacker.

Module IV – Hacking Defense[19 Hrs.]: Web server Hacking - Source code disclosure Canonicalization attacks – Server extensions - Denial of service - Web application Hacking - Web crawling - Database Hacking - Database discovery - Database vulnerabilities

References:

1. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker’s Handbook, 2nd Edition, Wiley Publishing, Inc.

2. Justin Clarke, SQL Injection Attacks and Defense, 2009, Syngress Publication Inc.

3. Magnus Mischel, ModSecurity 2.5, Packt Publishing

4. Stuart McClure Joel, ScambRay, George Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, 7th Edition, 2012, The McGraw-Hill Companies.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 204(A) : RESEARCH METHODS AND TECHNIQUES

3 hours per week	L-3	T-0	P-0	C-3

Module 1 [10 Hrs.]:

Introduction to Research Methodology: Introduction – Meaning – Objective - Motivation for research - Types of research - Research approach - Research process;

Defining research problem: Selecting the problem - Necessity of defining the problem;

Literature review - Importance of Literature review in defining a problem - Critical literature review - Identifying gap areas from literature review;

Research Design: Need - Features of good design - Different research designs - Basic principles of experimental design - Sampling Design - Implications and steps - Characteristics and criteria for sampling design - Random and Complex random sampling designs.

Module 2 [14 Hrs.]:

Measurement and Scaling Techniques: Measurement and Scaling technique - Source of error in measurement - Test of good measurement - Scaling technique - Measurement uncertainty - Methods of data collection - Observation method;

Processing and Analysis of data: Processing options - Types of analysis Statistics in research - Interpretation of results - Measures of central tendency, dispersion, asymmetry - Registration analysis - Interview — Questionnaire — Differences between questionnaires and schedules - Other methods of data collection - Selection of appropriate methods.

Module 3 [15 Hrs.]:

Sampling Fundamentals: Definitions - Sampling distributions - Central limit theorem -- Sampling theory - Sandler's A-test - Standard error Estimation - Estimating population mean, proportion Sample size and determination -- Determination of sample size - Testing hypotheses - Basic concepts Procedure and flow diagram - Measuring the power of a hypothesis test - Tests of hypotheses - Important parametric tests - Hypothesis testing of means - difference between means - Chi-square test - ANOVA - Short-cut method - Coding method - Two-way ANOVA.

Ethics: Ethics of research- Ethical standards - Responsibilities of authors and institutions – Scientific misconduct – Fabrication – Obfuscation – Plagiarism – misappropriation of Data – Data interpretation and Report writing – Techniques of interpretation – Evaluation of scientific journals and scientists - Role of computers in research – Impact factor – h-index.

Module 4 – The Research Report Style[11 Hrs.]: Guidelines for writing research papers and reports - Types of Report - Research report, Research proposal, Technical paper – Significance - Different steps in the preparation - Layout, structure and Language of typical reports – Writing the title – Guidelines for writing the Doctoral Thesis - Oral presentation.

References:

1. CR Kothari, “Research Methodologies - Methods and Techniques", Second Edition, New Age International.

2. Ranjit Kumar, Research Methodology. A step by step approach (Pearson Publishers, NewDelhi,2005

3. John W Best and James V Kahn, “ Research in Education", Fifth Edition, PHI, NEWDELHI

4. R. Panneerselvam, Research Methodology (Prentice Hall of India, New Delhi, 2011)

5. Coley S M and Scheinberg C A, 1990, "Proposal Writing", Newbury Sage Publications

6. Leedy P D, "Practical Research : Planning and Design", 4th Edition, N W MacMillan Publishing Co

7. Day R A, "How to Write and Publish a Scientific Paper", Cambridge UniversityPress, 1989

8. Research Methods in Social Science: P K Majumdar, Viva Books Pvt Ltd, New Delhi, 2005

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 204(B) : ENTREPRENEURSHIP DEVELOPMENT

3 hours per week	L-3	T-0	P-0	C-3

Module 1[13 Hrs.]:

Introduction: Evolution, Characteristics, Types - Functions of Entrepreneur - Distinction between an Entrepreneur and a Manager – Concept - Growth of entrepreneurship in India - Role of Entrepreneurship in Economic Development;

Rural Entrepreneurship: Concept, Need, Problems – Rural Industrialization in Retrospect - How to Develop Rural Entrepreneurship - NGOs and Rural Entrepreneurship;

Women Entrepreneurship: Concept, functions - Growth of Women Entrepreneurs – Problems - Development of Women Entrepreneurs - Recent Trends;

Entrepreneurial Motivation: Concept, Theories, factors - Entrepreneurial Competencies Concept - Major Entrepreneurial Competencies

Small Enterprises: Definition, Characteristics – Relationship between Small and Large Units – Rationale – Objectives, Scope, Opportunities for an Entrepreneurial Career - Role of small Enterprise in Economic development - Problems of SSIs

Module 2[12 Hrs.]:

Project Identification And Selection (PIS): Meaning of Project - Project Identification - Project Selection.

Project Formulation: Meaning, Significance – Contents – Formulation – Planning - Commission's Guidelines for Formulating a Project Report - Specimen of a Project Report - Network Analysis - Common Errors in Project Formulation;

Project Appraisal: Concept - Methods of project appraisal - Growth of Business Ideas - Intellectual Property.

Module 3[11 Hrs.]: Accountancy - Preparation of balance sheets and assessment of economic viability - decision making - expected costs - planning and production control - quality control - marketing, industrial relations - sales and purchases – advertisement - wages and incentive - inentory control - preparation of financial reports - accounts and stores studies.

Module 4[14 Hrs.]:

Project Planning and control: The financial functions - cost of capital approach in project planning and control - Economic evaluation - risk analysis - capital expenditures - policies and practices in public enterprises - profit planning and programming - planning cash flow - capital expenditure and operations - control of financial flows - control and communication -Laws concerning entrepreneur viz. partnership laws - business ownership - sales and income taxes and workman compensation act - Role of various national and state agencies which render assistance to small scale industries.

Textbooks:

1. Rajeev Roy "Entrepreneurship", Oxford University Press, 2nd edition, 2011

2. E. Gordon & K. Natarajan"Entrepreneurship Development", Himalaya Publishing house, 2008

3. Forbat, John, "Entrepreneurship", New Age International, 1st edition 2007, 2011 Re-print

4. Coulter Mary, "Entrepreneurship in Action", PHI, Second Edition, 2008

5. Helen Toner, "Partnership Rights, Free Movement, and EU Law", Hart publishing, 2004

References:

1. P. C. Jain "Handbook For New Entrepreneur" , Oxford University Press, 1998

2. S. S. Khanka "Entrepreneurial Development" S. Chand Publishers, 2006

3. Thomas W. Zimmerer & Norman M. Scarborough, "Essentials of Entrepreneurship and small business management", PHI/Pearson international, 4 th Edition, 2005

4. Dr. Vidya Hattangadi, "Entrepreneurship – Need for the hour", Himalaya publishing house, Mumbai

5. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya publishing house, Mumbai

6. Dr. v. B. Angadi, Dr. H. S. Cheema & Dr. M. R. Das “Entrepreneurship, Growth, and Economic Integration- A linkage”, Himalaya publishing house

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(A) : MODERN DATABASE SYSTEMS
Same as MCS 201

3 hours per week	L-3	T-0	P-0	C-3

Module I[13 Hrs.]: Revisiting Relational Database Systems , Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies

Module II[13 Hrs.]: Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems : Object Relational featuresinSQL/Oracle – Case Studies

Module III[11 Hrs.]: Multidimensional Data Structures – Image Databases – Text/Document Databases- Video Databases – Audio Databases – Multimedia Database Design

Module IV[13 Hrs.]: Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution – Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes

References:

1. Elmasri, Navathe. Fundamentals of Database Systems, Third Edition, Pearson Education,

2000.

2. Thomas Cannolly and Carolyn Begg, " Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.

3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2006.

4. C.J.Date, A.Kannan and S.Swamynathan,”An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006

5. . V.S.Subramanian, “Principles of Multimedia Database Systems”, Harcourt India Pvt Ltd., 2001.

6. Vijay Kumar, “ Mobile Database Systems”, John Wiley & Sons, 2006

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(B) : GAME THEORY

3 hours per week	L-3	T-0	P-0	C-3

Module 1[11 Hrs.]: Fundamentals: Conflict - Strategy and Games - Game theory - The Prisoner's Dilemma - Scientific metaphor - Business case - Games in normal and extensive forms – Representation, Examination, Examples.

Module 2[11 Hrs.]: Non Cooperative Equilibrium in Normal Games: Dominant Strategies and Social Dilemmas - Nash Equilibrium - Classical Cases in Game theory - Three person games - Introduction to Probability and Game theory - N-Person games.

Module 3[14 Hrs.]: Cooperative Solutions: Elements of Cooperative Games - Credible commitment - A Real Estate Development - Solution Set - Some Political Coalitions - Applications of the Core to Economics – The Market Game - The Core of a Two Person Exchange Game - The Core with More than Two Pairs of Traders - The core of Public Goods Contribution Game - Monopoly and Regulation.

Module 4[14 Hrs.]: Sequential Games: Strategic Investment to Deter Entry - The Spanish Rebellion game, Embedded Games – Planning Doctoral Study - Centipede Solved - Repeated play - Campers Dilemma - Pressing the shirts - Indefinitely Repeated Play – A Repeated Effort Dilemma - The Discount Factor;

Applications: Voting Games - Games and Experiments – Auctions - Evolution and Boundary Rational Learning.

References:

1. Roger A. McCain, "Game Theory – A Non-Technical Introduction to the Analysis of Strategy", Thomson South-Western, 2005.

2. Tirole, "Game Theory", Mit press 2005.

3. Osborne, "An Introduction to Game Theory", Oxford Press 2006.

4. E. N. Barron, “Game Theory: An Introduction”, Wiley India Pvt Ltd, 2009.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(C) : NETWORK FORENSICS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Introduction to Network Forensics[11 Hrs.]: Concepts in digital evidence - Challenges related to network evidence - Network forensic investigative methodology;

Technical Fundamentals: Sources of network based evidence - On the wire, In the air, Switches, Routers, DHCP servers, Name servers, Authentication servers, Central log servers; Evidence Acquisition - Physical interception of cable, Radio frequency, Hubs, Switches; Traffic acquisition software - Libpcap and WinPcap, The Berkeley packet filter(BPF) language, Tcpdump, Wireshark, Tshark, Dumpcap; Active acquisition - Common interfaces, Inspection without access, strategy.

Module 2 – Traffic Analysis[13 Hrs.]: Protocol Analysis - Protocol analysis tool, Protocol analysis technique; Packet analysis - Packet analysis tool, Packet analysis technique; Flow analysis - Flow analysis tool, Flow analysis technique; Higher-layer traffic analysis - Common higher-layer protocols, Higher-layer analysis tool, Higher layer analysis technique; Statistical flow analysis - Processor overview – Sensors - sensors types, Sensor software, Sensor placement; Flow record export protocols - Netflow, IPFIX, sFlow - Collection and aggregation; Wireless access point - Type of WAP, WAP evidence; Wireless traffic capture and analysis: Spectrum analysis, Wireless passive evidence acquisition; Common attacks: Sniffing, Rogue wireless access points, Evil twin, WEP cracking, Locating wireless devices.

Module 3 – Network Devices[13 Hrs.]: Intrusion detection and analysis - Typical NIDS/NIPS functionality – sniffing - Higher layer protocol awareness - Alerting on suspicious bits modes of detection - Modes of Detection - Signature based analysis - Protocol awareness - Behavioural analysis - Type of NIDS/NIPS, NIDS/NIPS evidence acquisition - Comprehensive packet logging - Event log aggregation - Correlation and analysis - Source of logs, Operating system logs, Application logs, Physical device logs, Network equipment logs; Network log architecture - Three type of logging architecture; Remote logging - Common pitfall and strategy, Log aggregation and analysis tool; Collecting and Analysing Evidence, Switches: Content-addressable memory table - ARP, Switch evidence; Routers - Type of routers, Router evidence; Firewalls - Type of firewalls, Firewall evidence.

Module 4 – Advanced Topics[13 Hrs.]: Web Proxies - Web proxy functionality: Caching, URI Filtering, Content Filtering; Distributed cache – Squid - Squid configuration, Squid access logfile, Squid Cache; Encrypted web traffic - Transport Layer Security - Gaining

access to encrypted content - Commercial TLS/SSL Interception Tools; Network Tunneling - Tunneling for functionality - Inter-switch link(ISL), Generic routing encapsulation(GRE), Tunnelling for confidentiality; Internet protocol security(IPSec) - Transport layer security(TLS) and Secure socket layer(SSL) - Covert tunnelling: Covert tunnelling strategy, TCP sequence number; DNS tunnelling - ICMP tunnels - Malware forensics - Trends in malware evolution, Network behaviour of malware - Propagation, Command and control communications, Payload behaviour.

Textbook:

1. Sherri Davioff, Jonathan Ham, "Network Forensics: Tracking Hackers through Cyberspace", Pearson Education, 2012

References:

1. John Vecca, "Computer Forensics: Crime Scene Investigation", Firewall Media
2. Christopher L.T. Brown, "Computer Evidence: Collection and Preservation", Firewall Media

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(D) : MOBILE COMPUTING

3 hours per week	L-3	T-0	P-0	C-3

Module 1 - Mobile Computing Architecture[12 Hrs.]: Internet - The ubiquitous network; Schematic representation of mobile computing environment - The three layer mobile computing architecture - Design considerations of mobile computing - Mobile computing through internet - Making existing applications mobile-enabled - Mobile Computing through Telephony - Multiple Access Procedures - Satellite Communication Systems - Mobile Computing through telephone - developing an IVR application - Voice XML, Telephony Application Programming Interface; Emerging technologies – RFID, WIMAX, Mobile IP, IPv6, Java Card.

Module 2 - Mobile Communications[13 Hrs.]: Introduction - The GSM Architecture - GSM Entities - Call Routing in GSM - PLMN interfaces - GSM Addresses and identifiers - Network Aspects in GSM - Mobility Management - GSM Frequency allocation - Personal Communications services - Authentications and security - Short message service - Mobile Computing over SMS - Value added services through SMS - Accessing the SMS Bearer;

GPRS: GPRS and Packet Data Network - GPRS Network Architecture - GPRS Network Operations - Data Services in GPRS - Limitations in GPRS - Applications for GPRS.

Module 3 - Mobility Management & Intelligent Networks[15 Hrs.]: CDMA - Spread Spectrum Technology – DSSS - Walsh Function – IS-95 - Speech and Channel Coding - IS-95 Architecture - Channel Structure - Call Processing - Handoff and Roaming - Channel Capacity - CDMA and Data protocol Stack - Intelligent Networks and Internetworking - Fundamentals of call processing - Intelligence in the network - SS#7 Signalling - SS#7 Protocol Stack - SS#7 Signal Unit - IN Conceptual Model, IN services - Virtual Calling Card service - Local Number Portability.

Module 4 - Mobile Device Operating System[10 Hrs.]: Introduction to Symbian Operating System - Symbian OS Architecture - Applications for Symbian - Controls and Compound Control - Active Objects - Localization, Security in Symbian OS.

IP Multimedia Subsystems: Architecture of IMS Networks - Protocols Used in IMS - Building Blocks of IMS networks - Call Session Control Function - Identities in IMS - Call flow in IMS Network - IMS Charging - IMS service Architecture - Security in IMS.

References:

1. Asoke K. Talukder and Roopa R. Yavagal; Mobile Computing- Technology Application, and service creation; TMH Publication, 2006
2. T Rappaport, “Wireless Communication: Principle and Practice”; Pearson Education.
3. G. S. Rao “Mobile Cellular Communication”, Pearson Learning.
4. Gonzalo camarillo, Miguel-Angel Garcia- Martin “The 3G IP Multimedia Subsystem(IMS)” Merging the internet and the cellular worlds.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(E) : SECURITY THREATS AND MANAGEMENT

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Introduction[9 Hrs.]: Security threats - Sources of security threats - Motives - Target Assets and vulnerabilities – Consequences of threats- E-mail threats - Web-threats - Intruders and Hackers, Insider threats, Cyber crimes.

Module 2 – Network Threats[10 Hrs.]: Active / Passive – Interference – Interception – Impersonation – Worms – Virus – Spam's – Ad ware - Spy ware – Trojans and covert channels – Backdoors – Bots – IP Spoofing - ARP spoofing - Session Hijacking – Sabotage - Internal treats- Environmental threats - Threats to Server Security.

Module 3 - Threats to Wireless networks[10 Hrs.]: ESM - ECM and ECCM - Proliferation of device and technologies - Practical aspects - Wireless availability - Privacy Challenges - Risks: Denial of Service, Insertion Attacks - Interception and monitoring wireless traffic - MIS configuration - Wireless Attacks – Surveillance - War Driving, Client-to-Client Hacking - Rogue Access Points - Jamming and Denial of Service.

Module 4 - Security Threat Management[10 Hrs.]: Risk Assessment - Forensic Analysis - Security threat correlation – Threat awareness - Vulnerability sources and assessment - Vulnerability assessment tools - Threat identification - Threat Analysis - Threat Modeling - Model for Information Security Planning.

Module 5 - Security Elements[11 Hrs.]: Authorization and Authentication - types, policies and techniques – Security certification - Security monitoring and Auditing - Security Requirements Specifications - Security Policies and Procedures - Firewalls, IDS, Log Files, Honey Pots - Access control - Trusted Computing and multilevel security - Security models - Trusted Systems - Software security issues - Physical and infrastructure security - Human factors – Security awareness - training - Email and Internet use policies.

References:

1. Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005.

2. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.

3. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Prentice Hall,2008.

4. Thomas Calabres and Tom Calabrese, "Information Security Intelligence: CryptographicPrinciples & Application", Thomson Delmar Learning, 2004.

5. Cyrus Peikari and Seth Fogie, "Maximum Wireless Security" Sams, 2002.

6. Stallings William, "Wireless Communications and Networks" Second Edition, Pearson Education Ltd, 2009.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 205(F) : HIGH PERFORMANCE SCIENTIFIC COMPUTING

3 hours per week	**L-3**	**T-0**	**P-0**	**C-3**

Module 1 - High performance through parallelism[11 Hrs]:

Flynn's taxonomy - Need for parallel architecture - convergence of parallel architectures - fundamental design issues - evolution of super computing - modern parallel computers - parallel architectures - interconnection networks - processor arrays - multiprocessors, multi computers.

Module 2 - Multi core architecture and openMP [14 Hrs]:

Introduction to multi core architecture system overview of threading - fundamental concepts of parallel programming - threading and parallel programming constructs - openMP-a portable solution for threading - hyper threading technology - multiprocessors and multi-core processors.

Module 3 - Parallel algorithms and MPI[14 Hrs]:

Parallel algorithm design - Task channel model - Foster's design methodology - Boundary value problem - Finding the maximum - Message passing programming-model and interface - Circuit satisfiability using MPI,The sieve of Eratosthenes - Data decomposition options parallel algorithm, All pair shortest path problem - point to point communication - Matrix multiplication - Solving linear equations - monte-carlo methods - finite difference methods - vibrating string - Performance analysis – Correctness issues

Module 4 - Parallel computing with CUDA [11 hrs]:

CUDA programming model - Introduction, timing your kernel - CUDA execution model - Nature of wrap execution - Exposing parallelism - Avoiding branch divergence - Dynamic parallelism - CUDA memory model - matrix addition with unified memory - CUDA shared memory - Reducing global memory access - Streams and concurrency.

Text books:

1. David E. Culler, J aswinder Pal Singh, “Parallel computing architecture : A hardware/ software approach” , Morgan Kaufmann/Elsevier Publishers, 2004.

2. Michael J Quinn, “Parallel programming in C with MP1 and OpenMP”, Tata McGraw Hill, 2003.

3. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.

4. “Professional Cuda C programming” by John Cheng,Max Grossman,Ty McKercher, Wiley, 2014

References:

1. Wesley Petersen and Peter Arbenz, “Introduction to Parallel Computing”, Oxford University Press, 2004.

2. Jason Sanders, Jason Sanders, CUDA by Example: An Introduction to General-Purpose GPU Programming, Pearson, 2010

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(G) : MANAGING BIG DATA

3 hours per week	L-3	T-0	P-0	C-3

Module 1 - Understanding BigData[12 HOURS]: What Is Big Data - Why Big Data - Challenges Of Conventional Systems - convergence Of Key Trends – Structured, Semistructured And Unstructured Data, Industry Examples Of Big Data - Web Analytics - Big Data And Marketing - Fraud And Big Data - Risk And Big Data - Credit Risk Management - Big Data And Algorithmic Trading - Big Data And Healthcare - Big Data In Medicine - Advertising And Big Data - Big Data Technologies - Introduction To Hadoop - Open Source Technologies - Cloud And Big Data - Mobile Business Intelligence - Crowd Sourcing Analytics - Inter And Trans Firewall Analytics

Module 2 - Basics of Hadoop and MapReduce[17 HOURS]: What Is Hadoop - Why Hadoop, Data Format - Comparison With Other Systems - Analysis Data With Hadoop - Scaling Out - Hadoop Streaming - Hadoop Pipes - Hadoop Distributed File System(Hdfs) - Hadoop I/O - Devoleping A Mapreduce Application - Mapreduce Working - Yarn- Mapreduce Formats - Resource Management - Map-reduce Scheduler

Module 3 - Hadoop Related Tool[10 HOURS]: Introduction to Hbase – Data Model And Implementations – Hbase Clients – Hbase Examples – Praxis - Hbase Vs Rdms.Introduction to Cassandra – Cassandra Data Model – Cassandra Examples – Cassandra Clients – Hadoop Integration.Introduction to Pig – Grunt – Pig Data Model – Pig Latin – Developing And Testing Pig Latin Scripts - Sql Vs Pig.Introduction to Hive – Data Types And File Formats – Hive Architecture - Hiveql Data Definition – Hiveql Data Manipulation – Hiveql Queries - Hive Vs Rdbms.

Module 4 - Introduction to NoSQL[9 HOURS]: Aggregate Data Models – Aggregates – Key - Value And Document Data Models – Relationships – Graph Databases – Schemaless Databases – Materialized Views – Distribution Models – Sharding – Master-Slave Replication – Peer-Peer Replication – Sharding And Replication – Consistency – Relaxing Consistency – Version Stamps. Case Study: Mongodb

Textbooks:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

2. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

3. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

4. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

5. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.

6. Alan Gates, "Programming Pig", O'Reilley, 2011.

7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

8. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison Wesley Professional, 2012

References:

1. Vignesh Prajapati “Big Data Analytics with R and Hadoop”, Set up an integrated infrastructure of R and Hadoop to turn your data analytics into Big Data analytics
2. “MongoDB vs Hadoop Big Solutions for Big Problems”, Deep Mistry, Open Software Integrators
3. Shashank Tiwari,” Professional NoSQL”, 2011, Wrox press.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(H) : LANGUAGE TECHNOLOGIES

3 hours per week	L-3	T-0	P-0	C-3

Module1 – Introduction[12Hrs.]:

Introduction to natural Language Processing – Mathematical foundations – Elementary Probability Theory – Essential Information Theory – Linguistic Essentials – Parts of Speech and Morphology – Phrase Structure – Semantics and Pragmatics – Corpus based Work

Module 2 – Words[12 Hrs.]:

Collocations, Frequency, Mean and Variance, Hypothesis Testing, Mutual Information – Statistical Inference, n-gram models, Statistical Estimators, Combining Estimators – Word Sense Disambiguation, Methodological Preliminaries, Supervised Disambiguation, Dictionary Based Disambiguation, Unsupervised Disambiguation – Lexical Acquisition

Module 3 – Grammar[10 Hrs.]:

Hidden Markov Models, Implementation, Properties, Variants – Parts-of-speech Tagging, Markov Model Taggers, Uses of Taggers – Probabilistic Context free Grammars – Probabilistic Parsing, Parsing for Disambiguation

Module 4 – Information Retrieval[8 Hrs.]:

Information Retrieval Architecture, indexing, storage, Compression Techniques, Retrieval approaches, evaluation – Search Engines, Commercial search engine features, comparison , Performance measures – Document processing, NLP based information retrieval, Information Extraction

Module 5 – Text Mining[8 Hrs.]:

Categorization, Extraction based categorization – Clustering, Hierarchical clustering – Document Classification and routing – Finding and organizing answers from Text search – Text categorization and Efficient summarization using Lexical chains – Machine translation, Transfer metaphor, Interlingual and statistical approaches.

Text books:

1. Christopher D. Manning and Hinrich Schutze, " Foundations of statistical Natural Language Processing", MIT Press, 1999

2. Tomek Strzalkowski, "Natural Language Information Retrieval", Kluwer academic publishers,1999.

References:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Pearson, 2008

2. Ron Cole, J.Mariani, et.al "Survey of the state of the art in Human Language Technology", Cambridge University Press,1997

3. Michael W. Berry, "Survey of Text Mining: Clustering, Classification and Retrieval", Springer Verlag,2003

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 205(I) : CLOUD COMPUTING

3 hours per week	L-3	T-0	P-0	C-3

Module 1[10 Hrs.]:

Understanding Cloud Computing: History of Cloud Computing – Cloud Architecture - Cloud Storage- Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing- Companies in the Cloud today- Public vs Private cloud - Cloud Services;

Understanding cloud services: Pros and Cons of Cloud Service Development - Types of Cloud Service Development - Software as a Service - Platform as a Service - Infrastructure as a Service - On-Demand Computing - Discovering Cloud Services Development Services and Tools - Amazon Ec2 - Google App Engine – IBM Clouds.

Module 2[14 Hrs.]:

Web services, AJAX and mashups - Web services: SOAP and REST, SOAP versus REST - AJAX: asynchronous 'rich' interfaces - Mashups: user interface services - Virtualization Technology: Virtual machine technologies - virtualization applications in enterprises - pitfalls of virtualization - Multitenant Software: Multi entity support, Multi schema approach,multi tennance using cloud data stores - Cloud Software environment - Eucalyptus, CloudStack, OpenStack, Aneka, Cloudsim.

Module 3[12 Hrs.]:

Cloud Security fundamentals: Vulnerability assessment tool for cloud - Privacy and Security in cloud - Cloud computing security architecture: Architectural Considerations - General Issues - Trusted Cloud Computing - Secure Execution Environments and Communications - Micro Architectures;

Identity Management and access control: Identity management - Access control - Autonomic Security - Cloud computing security challenges - Virtualization security management virtual threats - VM Security Recommendations - VM-specific Security techniques - Secure Execution Environments and Communications in cloud

Module 4[14 Hrs.]:

Communicating with the cloud - media and streaming - managing cloud services: Examining Organizations issues, Looking at the technical interface - Managing cloud resources - Administering cloud services - Cloud management standards - Monitoring the cloud - Migrating to the Cloud: cloud services for individuals - Enterprise class cloud offerings - Migration - Broad Approaches to migrating into the cloud - The seven-step

model of migration into a cloud - Mobile clouds and mobile web services - best practices - Enterprise cloud computing ecosystem.

Refereneces:

1. Michael Miller, Cloud Computing: Web-Based Applications That change the Way You Work and Collaborate Online, Que Publishing, August 2008.

2. Sosinky B., “Cloud Computing Bible” , Wiley India.

3. Gautam shroff “Enterprise Cloud Computing”, Cambridge university press.

4. Ronald Krutz and Russel Dean Vines,”Cloud Security – a comprehensive Guide to secure cloud computing, Wiley-India.

5. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, John Wiley and Sons.

6. Kai Hwang, Geoffery C Fox, Jack G Dongarra, “ Distributed and Cloud computing, from parallel Processing to the Internet of things”, Morgan Kaufmann Publishers, 2012.

7. Tim Malhar, S. Kumaraswamy, S. Latif, “ Cloud Security & Privacy”, (SPD, O’REILLY)

8. Judith Hurwitz, R.Bloor, M. Kanfman, F. Halper, “Cloud Computing for Dummies”(Wiley India Edition).

9. Antohy T Velte,et.al, “ Cloud Computing: A Practical Approach,” McGraw Hill.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(J) : REAL TIME SYSTEMS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Introduction[7 Hrs.]:

Real time systems - Applications, Basic Model, Characteristics - Safety and reliability - Real time tasks - Timing constraints - Modelling timing constraints

Module 2 - Handling Real Time Tasks[15 Hrs.]:

Scheduling RT: Concepts - Type of RT task and their characteristics - Task scheduling - Clock driven scheduling - Hybrid schedulers - Event-Driven scheduling - EDF scheduling - RMA, Issue with RMA - Issue in using RMA in practical situation.

Sharing Among RT Tasks: Resource sharing among RT tasks - Priority inversion - PIP, HLP, PCP - Type of priority inversion under PCP, Feature of PCP - Issue in using resource sharing protocols - Handling task dependencies

Module 3 – RT tasks in commercial systems[14 Hrs.]:

Scheduling RT in Multiprocessor and Distributed System: Multi-processor task allocation - Dynamic allocation of task - Fault-tolerance scheduling of task - Clocks in distributed RT systems - Centralized and distributed clock synchronization.

Commercial RT Operation System: Time services - Features of RT OS - Unix as a RT OS, Unix based RT OS - Windows as a RT OS - POSIX, VRTX, VxWork, QNX, µC/OS-II, RT Linux, Lynx, Window CE - Benching RT system.

Module 4: **RT Communication and Databases[14 Hrs.]:**

RT Communication: Example of applications requiring RT communication - Basic concepts - RT communication in a LAN - Soft and hard RT communication in a LAN, -Bounded access protocol for LAN - Performance comparison - RT communication over packet switched networks - QoS framework - Routing - Resource reservation - Rate control - QoS Models

RT Database: Example application of RT database - RT databases - Characteristics of temporal data - Concurrency control in RT database - Commercial RT database

Textbook:

1. Rajib Mall, “Real Time System: Theory and Practice”, Pearson 2008

References

1. Jane W Liu, “Real-Time Systems”, Pearson Education, 2001
2. Resource Management in Real-Time System and Network, C.Siva Ram Murthy and G. Maninaram, MIT Press, March 2001
3. Phillip A Laplante, Seppo j Ovask , “Real Time System Design and Analysis: Tools for the Practitioner”, John Wiley and Sons, 2012

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(A) : ADVANCED OPERATING SYSTEMS
Same as MCS 202

3 hours per week	L-3	T-0	P-0	C-3

Module I[11 Hrs.]: Uniprocessing operating system: Review of Operating system concepts. Process Concept – Threads process Scheduling – process synchronization – Interprocess Communication - semaphores – Messages – Monitors – critical Regions – conditional critical regions – dead Locks. Real and virtual Memory management Schemes.

Module II[9 Hrs.]: Multiprocessor Operating System: Multiprocessor UNIX design goals - Master slave and multithreaded UNIX - Multicomputer UNIX extensions.

Module III[11 Hrs.]: Distributed Operating System: Introduction - Design Issues. Communication in distributed systems Layered protocols – ATM - client server model - remote Procedure call – Group communication.

Module IV[11 Hrs.]: Synchronization distributed systems: Clock Synchronization – Mutual Exclusion – Election algorithms – Atomic transactions - Deadlocks in distributed systems. Processes and processors in distributed systems: Threads – system models - Processor allocation - Scheduling in distributed Systems.

Module V[8 Hrs.]: Distributed file system – Design and implementation – Trends in distributed file systems. Case study AMOEBA, MACH, Recent trends and developments

References:

1. A.S.Tanenbaum, “Modern Operating Systems”, PHI Edition, 1992

2. A.S.Tanenbaum, “Distributed Operating systems”, PHI.

3. M. Singhal and N.G.Sivarathri, “Advanced Concepts in Operating Systems”, M.C.Grawhill Inc. 1994.System Concepts, Wiley, 2000.

4. J.L.Peterson and A. Silberchatz, “Operating System Concepts”

5. M.Maekawa, A.E.Oldehoeft And R.R. Oldehoeft, “Operating systems.”

6. M.Milenkovic, “Operating Systems : Concepts and Design” , McGrawhill Inc Newyork, 1992

7. K.Khawng, “Advanced Computer Archiecture : Parallelism , Scalability, Programmmability”, M.C.Grawhill Inc, 1993

8. C.Crowley, “Operating Systems – A design Oriented Approach”, Irwin 1997.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 206(B) : MULTI-OBJECTIVE OPTIMIZATION TECHNIQUES

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Introduction and Classical Approaches[10 Hrs.]:

Introduction – Multi objective optimization problem - principles – Difference between single and multi objective optimization – Dominance and Pareto Optimality , Classical Methods – Weighted Sum – ε- Constraint method – Weighted Metric methods – Benson's method - Value Function - Goal Programming methods – Interactive Methods

Module 2 – MOP Evolutionaly Algorithms[10 Hrs.]:

Generic MOEA - Various MOEAs: MOGA, NSGA-II, NPGA, PAES, SPEA2, MOMGA, micro

GA - Constrained MOEAs: Penalty Function approach - Constrained Tournament – Ray – Tai –Seow's Method.

Module 3 – Theoretical Issues[10 Hrs.]:

Fitness Landscapes - Fitness Functions - Pareto Ranking - Pareto Niching and Fitness Sharing - Recombination Operators - Mailing Restriction - Solution Stability and Robustness

– MOEA Complexity - MOEA Scalability - Running Time Analysis - MOEA Computational Cost - No Free Lunch Theorem.

Module 4 – MOEA Testing, Analysis and Parallelization[10 Hrs.]:

MOEA Experimental Measurements – MOEA Statistical Testing Approaches – MOEA Test Suites - MOEA Parallelization: Background – Paradigms – Issues - MOEA Local Search Techniques.

Module 5 – Application and Alternative Meta-heuristics[10 Hrs.]:

Scientific Applications: Computer Science and Computer Engineering - Alternative Metaheuristics: Simulated Annealing – Tabu Search and Scatter Search – Ant System – Distributed Reinforcement Learning – Particle Swarm Optimization – Differential Evolution – Artificial Immune Systems - Other Heuristics.

REFERENCES:

1. Carlos A. Coello Coello, Gary B. Lamont, David A. Van Veldhuizen, "Evolutionary Algorithms for Solving Multi-objective Problems", Second Edition, Springer, 2007.

2. Kalyanmoy Deb, " Multi-Objective Optimization Using Evolutionary Algorithms", John Wiley, 2002.

3. Aimin Zhoua, Bo-Yang Qub, Hui Li c, Shi-Zheng Zhaob, Ponnuthurai Nagaratnam Suganthan b, Qingfu Zhangd, "Multiobjective evolutionary algorithms: A survey of the state of the art", Swarm and Evolutionary Computation (2011) 32–49.

4. E Alba, M Tomassini, "Parallel and evolutionary algorithms", Evolutionary Computation, IEEE Transactions on 6 (5), 443-462.

5. Crina Grosan, Ajith Abraham, "Hybrid Evolutionary Algorithms: Methodologies, Architectures, and Reviews", Studies in Computational Intelligence, Vol. 75, Springer, 2007.

6. Christian Blum and Andrea Roli. 2003. Metaheuristics in combinatorial optimization: Overview and conceptual comparison. *ACM Comput. Surv.* 35, 3 (September 2003), 268-308.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 206(C) : CRYPTANALYSIS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 - CRYPTANALYSIS OF CLASSICAL CIPHERS[13 Hrs.]: Vigenere cipher - Affine cipher – Hill-cipher - Linear Shift Register Random Bit Generator - Berlekamp-Massey algorithm for the cryptanalysis of LFSR - Correlation attack on LFSR based stream ciphers - Cryptanalysis of ORYX - Fast algebraic attack.

Module 2 - CRYPTANALYSIS OF BLOCK CIPHERS[9 Hrs.]: Man in the middle attack - Double DES - Linear and Differential cryptanalysis - Algorithmic Number theory: Stein's binary greatest common divisor algorithm - Shanks Tonelli algorithm for square root in Fp - Stein's greatest common divisor algorithm for polynomials.

Module 3 - ALGORITHM FOR DLP[13 Hrs.]: Pollard Rho method for DLP - Shank's baby step and Giant step algorithm for DLP - Silver-Pohling-Hellman algorithm for DLP - Index calculus for DLP algorithms: Trial division method - Fermat method - Legendre-convergence method - Continued fraction method - Elliptic curve method - Quadratic sieve method.

Module 4 - LATTICE BASED CRYPTANALYSIS[15 Hrs.]: Direct attacks using lattice reduction - Coppersmith's attacks - Attacks on cryptographic hash functions: Birthday paradox - Birthday paradox for multi collisions - Birthday paradox in two groups - Applications of Birthday paradox in Hash functions – Multi collision attack on hash functions.

References:

1. Antoine Joux, "Algorithmic Cryptanalysis", Chapman & Hall/CRC Cryptography and Series, 2009.

2. Song Y Yang, "Number Theory for Computing", Second Edition, Springer Verlag, 2010.

3. Gregory V. Bard "Algebraic Cryptanalysis "Springer 2009.

4. Hffstein, Jeffray Piper, Jill and Silverman, “An Introduction to Mathematical Cryptography”, Springer 2010.

5. “Applied Cryptanalysis –Breaking ciphers in the real world”-Mark Stamp and Richard M.Low, Wiley-IEEE press, 2007.

6. Cryptography & Net work security, principles & practices, William Stallings, Fifth Edition, Pearson Education.

7. https://eprint.iacr.org/2009/457.pdf

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(D) : NEXT GENERATION NETWORKS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Introduction[9 Hrs.]:

Evolution of public mobile services - motivations for IP based services, wireless IP network architecture – 3GPP packet data network architecture; Introduction to next generation networks - Changes, Opportunities and challenges, Technologies, Network, and Services, Next generation society, future trends.

Module 2 - IMS AND CONVERGENT MANAGEMENT[12 Hrs.]:

IMS Architecture - IMS services - QoS Control and Authentication - Network and Service management for NGN - IMS advantages - Next generation OSS Architecture - standards important to OSS Architecture - Information framework - OSS interaction with IMS - NGN OSS function/ information view reference model - DMTF CIM.

Module 3 - MPLS AND VPN[11 Hrs.]:

Technology overview – MPLS & QoS - MPLS services and components- layer 2 VPN, layer 2 internetworking - VPN services – Signalling - layer 3 VPN - Technology overview - Remote Access and IPsec integration with MPLS VPN.

Module 4 – MULTICAST[9 Hrs.]:

MPLS Multicast VPN overview- Applications, examples, IPV6 and MPLS – Technology overview, Future of MPLS- Integrating IP and optical networks, Future layer 3 services, future layer 2 services.

Module 5 – Next Generation Network Management[9 Hrs.]:

Management and Provisioning - Configuration, Accounting, performance, security - case study for MPLS - Future enhancements - Adaptive self healing networks.

REFERENCE:

1. Thomas Plavyk, ”Next Generation Telecommunication networks,Services and Management.”, Wiley & IEEE Press Publications,2012.
2. Neill Wilkinson, “Next Generation Network Services”, John Wiley Publications, 2002.
3. Robert Wood, “MPLS and Next Generation Networks: Foundations for NGN Enterprise Virtualizations”, CISCO Press 2006.
4. Monique J Morrow, “Next Generation Networks”, CISCO Press,2007.

5. Ina Minie, Julian Lucek, “MPLS Enabled Applications- Emerging Developments and New Technology” 3rd Edition, Wiley,2011.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 206(E) : BIOMETRIC TECHNOLOGIES

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Biometrics[12 Hrs.]: Introduction - Benefits of biometrics over traditional authentication systems - Benefits of biometrics in identification system - Selecting a biometric system – Application - Key biometric terms and processes - Biometric matching methods - Accuracy in biometric system.

Module 2 – Physical Biometric Technology[13 Hrs.]: Fingerprints - Technical description - Characteristics - Competing technology - Strengths, Weaknesses, Deployments - Facial scan technical description - Characteristics, Weaknesses, Deployments - Retina vascular pattern Technical description - Characteristics, Strength, Weaknesses, Deployments - DNA biometrics.

Module 3 – Behavioral Biometric Technologies[14 Hrs.]: Handprint biometrics - Signature and handwriting technology - Technical description – Classification - Comprehensive packet logging - Keyboard or keystroke dynamics - Voice, Data acquisition, Feature extraction - Characteristics, Strength, Weakness, Deployment.

Module 4 - Multi Biometrics[11 Hrs.]: Multi biometrics and multi factor biometrics - Two factor authentication with password - Tickets and tokens - Executive decision - Implementation plan - Case study on physiological, Behavioural and multifactor biometrics in identification system.

Textbooks:

1. Samir Nanavathi, Michel Thieme, and Raj Nanavathi, “Biometrics- identity verification in a network”, Wiley Eastern 2002
2. John Chirillo and Scott Blaul, “Implementing Biometric Security”, Wiley Eastern Publication, 2005

References:

1. John Berger, “Biometrics for Network Security”, Prentice Hall, 2004

2. Julian Ashbourn," Guild to Biometric for Large Scale System: Technological, Operational and User Related Factor", Springer Data London Limited, 2011

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(F) : DISTRIBUTED ALGORITHMS

3 hours per week	L-3	T-0	P-0	C-3

Module 1[9 Hrs.]: Introduction to model of synchronous distributed computing system - Leader election in a General Network - Simple Flooding Algorithm - Basic Breadth-First Search Algorithm – Bellman-Ford algorithm.

Module 2[17 Hrs.]: Algorithms in Synchronous Networks - Minimum Spanning Tree - Leader Election in a Synchronous Ring - LCR algorithm - HS algorithm - Time Slice Algorithm - Variable Speeds Algorithm – Lower Bound for Comparison-based Algorithms

Maximal Independent Set - LubyMIS algorithm - Distributed Consensus with Link Failures and Process Failures – Basics

Module 3[10 Hrs.]: Introduction to model of asynchronous distributed computing system - Send/Receive systems - Broadcast systems - Multicast systems - Basic algorithms - Peterson Leader - Election Algorithm – Local Synchronizer - Safe Synchronizer.

Module 4[14 Hrs.]: Asynchronous System Model. Shared Memory Systems - Environment Model - Shared Variable Types, Mutual Exclusion - Asynchronous Shared Memory Model - Dijkstra's Mutual Exclusion Algorithm;

Resource Allocation - Nonexistence of Symmetric Dining Philosophers Algorithms – Right-Left Dining Philosophers Algorithm - Mutual exclusion and consensus - Relationship between shared memory and network models Asynchronous networks with failures

Text books:

1. Nancy A. Lynch," Distributed Algorithms", Morgan Kaufmann Publishers, Inc, 1996

References:

1. Sukumar Ghosh, ”Distributed Systems: An Algorithmic Approach ”, 2nd Edition, CRC Press, 2014

2. Wolfgang Reisig, W. Reisig, “Elements Of Distributed Algorithms: Modeling And Analysis With Petri Nets”, Springer-verlag, 1998

3. Tel Gerard , “Introduction To Distributed Algorithms”, 2nd Edition, Cambridge UniversityPress, 2000

4. Sukumar Ghosh, ”Distributed Systems: An Algorithmic Approach”, Chapman &Hall / CRC Press, 2006

5. Valmir C. Barbosa,”An Introduction To Distributed Algorithms”, MIT Press, 2003

6. Randy Chow, Theodore Johnson, “Distributed Opearating Systems and Algorithm Analysis, Pearson Education, 1997

7. Santoro N., Nicola Santoro, “Design And Analysis Of Distributed Algorithms”, Wiley-Interscience, 2006

8. Ajay D. Kshemkalyani, Mukesh Singhal, “Distributed Computing - Principles, Algorithms,And Systems”, Cambridge University Press, 2011

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(G) : SOCIAL NETWORK ANALYSIS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 - Introduction[11 Hrs.]: Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks - Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

Module 2 – Evolution[12 Hrs.]: Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities-Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - With Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.

Module 3 - Modeling and Visualization[12 Hrs.]: Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation – Centrality – Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix based Representations - Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications – Use of Hadoop and MapReduce - Ontological representation of social individuals and relationships.

Module 4 – Mining[15 Hrs.]:

Mining Communities: Aggregating and reasoning with social network data - Advanced Representations - Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

Text and Opinion Mining: Text Mining in Social Networks - Opinion extraction – Sentiment classification and clustering - Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product review mining – Review Classification – Tracking sentiments towards topics over time.

Textbooks:

1. Charu C. Aggarwal Social Network Data Analytics", Springer; 2011

2. Peter Mika , "Social Networks and the Semantic Web", Springer,1st edition2007.

3. BorkoFurht, "Handbook of Social Network Technologies and Applications", Springer, 1stedition, 2010

4. GuandongXu , Yanchun Zhang and Lin Li, " Web Mining and Social Networking– Techniques and applications", Springer, 1stedition, 2011.

5. Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 2010.

References:

1. Panagiotis Karampelas "Techniques and Tools for Designing an Online Social Network Platform", Springer, 2013

2. Bo Pang, Lillian Lee "Opinion Mining and Sentiment Analysis", Now publishers Inc, 2008

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(H) : MACHINE LEARNING TECHNIQUES

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Foundations of Learning[11 Hrs.]: Components of learning – learning models – geometric models – probabilistic models – logic models –grouping and grading – learning versus design - binary and multiclass classification – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation generalization tradeoff – bias and variance – learning curve

Module 2 – Linear Models and Distance-based Models[15 Hrs.]: Linear classification – regularized regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures - Kernel Methods and the Evolution of SVM - Support Vector Machines - Non Linear SVM and Kernel Trick - Nearest neighbor models – K-means – clustering around medoids – silhouttes – hierarchical clustering – kernels to distance – locality sensitive hashing – non-parametric regression – Principal component analysis(PCA) - PCA algorithm - PCA and nearest neighbours - High Dimensional data - PCA via singular value decomposition(SVD) - ensemble learning – bagging and random forests – boosting – meta learning

Module 3 – Tree and Rule Models[14 Hrs.]: Decision trees – learning decision trees – ranking and probability estimation trees – regression trees – clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining – first-order rule learning

Module 4 – Reinforcement Learning[10 Hrs.]: Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal difference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in Robot control

Text Books:

1. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, “Learning from Data”, AMLBook Publishers, 2012.
2. P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge
University Press, 2012.
3. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice",Easter Economy Edition, Prentice Hall of India, 2006.

4. 8. S. Russel and P. Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition,Prentice Hall, 2009
5. D. Barber, “Bayesian Reasoning and Machine Learning”, Cambridge University Press,2012.

References:

6. K.P. Soman, R. Loganathan, V. Ajay, “Machine Learning with SVM and Other Kernel Methods”, PHI Learning Pvt. Ltd., 02-Feb-2009
7. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.
8. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
9. M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
10. T. M. Mitchell, “Machine Learning”, McGraw Hill, 1997.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(I) : SOFTWARE DEFINED NETWORKING

3 hours per week	L-3	T-0	P-0	C-3

Module 1[12 Hrs.]:

Basics and History: Central Control - Programmable Networks - Network Virtualization - Control Plane Evolution - Control and Data Plane Separation - Opportunities in various domains - Challenges in Realizing Control and Data Plane Separation - Routing Control Platform (RCP) - The 4D Network Architecture;

Motivation: SDN / Openflow Applications - The mini-net emulation platform.

Module 2[12 Hrs.]:

Overview of Control Plane - Examples of SDN Controllers (Nox, Pox, Floodlight, Ryu, Open Daylight) - Customizing the control plane behavior with mininet - What is network virtualization and how is it implemented? - Examples of network virtualization and applications - Virtual networking in Mini-net - Slicing network control - Virtualization in multi-tenant data centers.

Module 3[14 Hrs.]:

Programmable Software Data Planes: Click - Making Software Faster: RouteBricks - Making Hardware Programmable: RMT - Protocol Independent Forwarding: P4 (and POF) - Building a Programmable Data Plane: NetASM - Motivation for "Northbound APIs" and SDN Programming Languages - Frenetic: A Programming Language for SDN - Composing SDN Control: The Pyretic Programming Language - Event Based SDN Control - Data Centers Internet Exchange Points (IXPs) - Wide-Area Backbone Networks - Home Networks.

Module 4[12 Hrs.]:

Configuration Verification: rcc (pre-SDN) - Data-Plane Verification: Veriflow - Header Space Analysis - Control-Plane Verification: Kinetic - Quality of Service : Q0S issues in SDN - QoS oriented design of SDN – Multimedia on SDN -Traffic Classification – SDN in Optical Networks – Security issues - Anycast Implementation

References:

1. Paul Goransson, Chunk Black, “Software Defined Networking- A Comprehensive Approach”, Morgan Kauffman, 1st edition, 2014
2. Ken Gray, “ Software Defined Networking”, Oreilly, 2013
3. Patricia A Morrealle, James M Anderson, “Software Defined Networking-Design and Deployment”, CRC Press, 2014
4. Fei Hu, “Network Innovation through OpenFlow and SDN”, CRC press, 2014
5. Vishal Shukla, “Introduction to Software Defined Networking: OpenFlow & VxLAN”, CreateSpace Independent Publishing Platform, 2013
6. Course Notes on SDN by Nick Feamster, School of Computer Science, Georgia Institute of Technology
7. Mininet.org https://github.com/mininet/mininet/wiki/Documentation
8. Tennenhouse, David L., et. al., “ A survey of active network research”, Communication Magazine IEEE 35.1 (1997), 80-86
9. Van der Merwe et. al., “ The tempest – a practical framework for network programmability”, Network, IEEE 12.3, (1998): 20-28
10. Bavier Andy et. al., “In VINI veritas: ralistic and controlled network expertimentation”, ACM SIGCOMM Computer Communication Review, Vol 36, No.4, ACM 2006
11. Nick Feamster., et al., “How to lease the internet in your spare time”, ACM SIGCOMM Computer Communication Review, 37.1, (2007): 61-64.
12. Feamster et. al. “The case of separating routing from routers”, Proceeding os SIGCOMM, ACM 2004
13. Albert Greenberg, “ A clean slate 4D approach to network control and a management”, ACM SIGCOMM Communication Review 2005.
14. www. noxrepo.org
15. http://osrg.github.io/ryu
16. http://www.projectfloodlight.org/
17. http://opendaylight.org
18. http://www.opennetworking.org
19. Koponen Teemu, “Network virtualization in multi-tenant Data center”, NSDI April 2014.

20. Mihai Dobrescu, et. al. “RouteBricks: exploiting the parallelism to scale software routers”, 22nd ACM SIGOPS, 2009

21. Foster Nateet. al., “Frenetic: A network programming language”, ACM SIGPLAN Notices 46.9 (2011)

22. Mosanto Christphper et. al., “Composing Software defined networks”, NSDI 2013.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(J) : INTERNET OF THINGS

3 hours per week	L-3	T-0	P-0	C-3

Module 1 – Introduction to Internet of Things[8 Hrs.]: Introduction – Definition - phases – Foundations – Policy - Challenges and Issues – identification - security – privacy;

Components in internet of things: Control Units -Sensors -Communication modules - Power Sources - Communication Technologies - RFID - Bluetooth – Zigbee – Wifi – RF links - Mobile Internet - Wired Communication.

Module 2 – Programming the Microcontroller for IoT[9 Hrs.]: Basics of Sensors and actuators - examples and working principles of sensors and actuators - Cloud computing and lOT - Arduino/Equivalent Microcontroller platform- Setting up the board - Programming for lOT- Reading from Sensors;

Communication: Connecting microcontroller with mobile devices - communication through Bluetooth and USB - connection with the internet using wifi / Ethernet.

Module 3 – Resource Management in the Internet of Things[11 Hrs.]: Introduction - Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines - Software Agents for Object - Data Synchronization - Types of Network Architectures - Fundamental Concepts of Agility and Autonomy - Enabling Autonomy and Agility by the Internet of Things - Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things - Agents for the Behavior of Objects.

Module 4 – Business Models for the Internet of Things[11 Hrs.]: The Meaning of DiY in the Network Society - Sensor-actuator technologies and Middleware as a basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY Internet of Things - Semantic Interoperability as a Requirement for DiY Creation – Ontology - Value Creation in the Internet of Things - Application of Ontology Engineering in the Internet of Things - Semantic Web-Ontology - The Internet of Things in Context of EURIDICE Business Impact.

Module 5 – Internet of Things, Web of Things[11 hrs]: Resource-oriented Architecture and Best Practices - Designing REST ful Smart Things - Web-enabling Constrained Devices - The Future Web of Things - Setting up cloud environment - send data from

microcontroller to cloud - Case studies - Open Source e-Health sensor platform - **BeClose,** a monitoring based Safety System for Elderly people - Other recent projects.

References:

1. Charalampos Doukas, Building Internet of Things with the Arduino, Create space, April 2002

2. Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011

3. Luigi Atzor et.al, The Internet of Things: A survey, Journal on Networks, Elsevier Publications, October, 2010

4. http://postscapes.com/

5. http://www.theinternetofthings.eu/what-is-the-internet-of-things

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 207(P) : SECURE COMPUTING LABORATORY

2 hours per week	L-0	T-0	P-2	C-2

The experiments included in this syllabus broadly serves the following purpose:

Case studies in Security to understand the following points

1) Using IPTABLES on linux for filtering rules
2) Using NMAP for ports monitoring
3) Understanding Firewalls
4) Ethical hacking
5) Using open ssl for web-browser communication
6) Configuring S/MIME for email communication
7) Distributed denial of service attack

Experiments in Security to gain experience in programming/evaluating/trouble-shooting solutions to problems in security

8) Programs using AES algorithm for 128 bit key
9) Elliptic curve cryptography algorithm
10) Digital signature algorithm
11) RSA algorithm
12) Secure hash algorithm
13) Working with sniffers for monitoring network communication
14) Performance evaluation of various cryptographic algorithms
15) Bluetooth attacks
16) Secure Password storage

Following is the actual list of experiments

1) Java/C Program to calculate MD5 and SHA hash values in java.

2) Java Code Implementation to generate a public key in an elliptic curve algorithm using a given private key.

3) Implementation of digital signature using RSA algorithm

4) Implement a protocol for authenticated delivery of data by Considering the Encryption and decryption using AES 128 bit key.

5) Implementation of web-browser communication using SSL by ensuring strong encryption, authentication and data integrity.

6) Java program to sign messages which confirm to the S/MIME standard and verify its digital signatures based on certificates containing RSA keys.

7) Implementation of sniffer for monitoring network communication.

8) Implement java program to send an encrypted string via Bluetooth from a PC as client to a mobile as server.

9) Java program for secure password storage

10) Java program for distributed Denial of service

11) Implement a technique using Java/C to extract the database information through web application(SQL Injection)

12) Performance Evaluation of Cryptographic Algorithms: AES and DES

13) Using IPTABLES/NETFILTER on linux for

Displaying the status of the firewall
Stop/start/restart the firewall
Delete/insert firewall rules
Drop private network address on public interface
Block incoming port request/IP address
Drop or accept traffic from MAC address
Block or allow ICMP ping request
Block or open common ports
Restrict the no: of parallel connections to a server per client IP.

14) Using NMAP for ports montitoring

Scan ports consecutively.
Scan for specific port
Scan a TCP port

Scan a UDP port
Scan multiple ports
Scan ports by network range
Scan remote host for specific ports with TCP ACK
Scan remote host for specific ports with TCP SYN
Check most commonly used ports with TCP syn

Mapping of experiments to purpose is provided to understand scope/usage/compliance of each experiments listed above

Exp No	IPTABLES	NMAP	Firewalls	Ethical Hacking	Open SSL	S/MIME	DDOS	AES	ECC	Digital Signatures	RSA	Secure Hash	Sniffers	Performance eval.	Bluetooth	Password security
1												Y				
2									Y							
3										Y	Y					
4								Y								
5					Y											
6						Y					Y					
7													Y			
8															Y	
9																Y
10							Y									
11				Y												
12								Y						Y		
13	Y		Y													
14		Y	Y													

References:

https://www.suse.com/documentation/sles11/book_sle_admin/data/sec_apache2_ssl.html

http://linuxconfig.org/apache-web-server-ssl-authentication

http://www.tomcatexpert.com/knowledge-base/using-openssl-configure-ssl-certificates-tomcat

http://linuxcommand.org/man_pages/openssl1.html

https://www.owasp.org/index.php/Digital_Signature_Implementation_in_Java

https://www.openssl.org/docs/apps/smime.html

http://fedoraproject.org/wiki/How_to_edit_iptables_rules

https://www.frozentux.net/iptables-tutorial/iptables-tutorial.html

https://www.frozentux.net/iptables-tutorial/iptables-tutorial.html

http://nmap.org/bennieston-tutorial/

CNS 208(P) : TERM PAPER

2 hours per week	L-0	T-0	P-2	C-2

Prerequisite:

Knowledege on leading magazines, journals and conferences on networks and security and the habit of reading technical magazines, conference proceedings and journals.

Objective:

To develop the skill of technical presentation, documentation and to give motivation for doing research work.

The student is expected to present a report on the literature survey conducted as a prior requirement for their thesis. Thesis preliminary will commence soon after the presentation of the term paper. The students should execute the project work using the facilities of the institute. However, external projects can be taken up, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work. Project evaluation committee should study the feasibility of each project work before giving consent. A paper should be prepared based on the project for possible publication in refereed Conferences/Journals. Grades will be awarded on the basis of contents of the paper and the presentation.

Sessional work assessment:

Presentation (Evaluation committee) : 25 marks

Report (Guide) : 25 marks

Total marks : 50 marks

CNS 301(P) : THESIS PRELIMINARY

22 hours per week	L-0	T-0	P-22	C-8

This shall comprise of two seminars and submission of an interim thesis report. This report shall be evaluated by the evaluation committee. The fourth semester Thesis(final) shall be an extension of this work in the same area. The first seminar would highlight the topic, objectives, methodology and expected results. The first seminar shall be conducted in the first half of this semester. The second seminar is presentation of the interim thesis report of the work completed and scope of the work which is to be accomplished in the fourth semester.

Weightages for the 8 credits allotted to Thesis-Preliminary:

Evaluation of the Thesis-Preliminary work: by the guide - 50% (200 Marks)

Evaluation of the Thesis–Preliminary work: by the Eval. Committee - 50% (200 Marks)

CNS 401(P) : THESIS

22 hours per week	L-0	T-0	P-22	C-12

Towards the middle of the semester there shall be a pre-submission seminar to assess the quality and quantum of the work by the evaluation committee. This shall consist of a brief presentation of Third semester interim thesis report and the work done during the fourth semester. The comments of the examiners should be incorporated in the work and at least one technical paper is to be prepared for possible publication in journals / conferences. The final evaluation of the thesis shall be an external evaluation.

Weightage for the 12 credits allotted to thesis:

Internal Evaluation of the Thesis work:

by the guide - 200 Marks

by the Evaluation Committee - 200 Marks

Final Evaluation of the Thesis work by the Internal and External Examiners:

in the pattern Evaluation of Thesis + Viva Voce : 100 + 100 Marks

MODEL QUESTION PAPERS

M.TECH. COMPUTER SCIENCE & ENGINEERING(NETWORK & SECURITY)

CNS 101 : MATHEMATICAL FOUNDATIONS

5 MODULE COURSE

PART – A

[Answer all 5 questions, each with 4 marks : 4*5=20]

1. Prove that if $(a,b)=1$ then b/ac implies b/c

2. Explain about non- Markovian queue model

3. Explain any four rules of inference in statement calculus

4. Explain Floyd- Warshall algorithm to determine shortest distance between all pairs of vertices in a graph

5. Prove that intersection of two subgroups of a group G is again a subgroup of G

PART B

(Answer any five questions, each carry 16 marks)

6.

(a) State and prove Euler's theorem (6 marks)

(b) Find x and y such that $GCD(42823,6409)=42823x+6409y$ (5 marks)

(c) Find the least positive integer that satisfy $x\equiv 5(mod\,7)$ and $x\equiv 11(mod\,17)$ (5 marks)

7.

(a) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the following:

i) The mean queue size.

ii) The probability that the queue size exceeds 10.

iii) If the input of trains increases to an average 33 per day, what will be the changes in (i) & (ii)?

(6 Marks)

(b) State and prove Burkes Theorem. (6 marks)

(c) Explain about M/G/ 1 queuing system. (4 marks)

8.

- Obtain the prenex conjunctive normal form of
  $\forall x \forall y(p(x,y) \rightarrow \exists z(p(x,y) \wedge p(y,z)))$

  (5 marks)

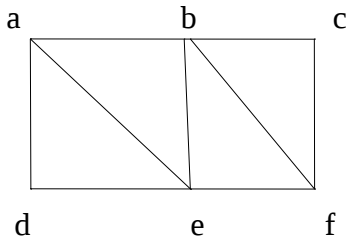
- Check the validity: From $\begin{matrix} M(y) \rightarrow W(y) \\ \exists x(F(x) \wedge S(x)) \rightarrow \forall y \text{¿} \end{matrix}$ and $\exists y(M(y) \wedge \neg W(y))$ the conclusion $\begin{matrix} F(x) \rightarrow \neg S(x) \\ \forall \text{¿} \end{matrix}$) follows . (5 marks)

- Explain any three methods of proof (6 marks)

9.

(a) State and prove Euler's theorem on planar graphs. (5 marks)

(b) Apply DFS algorithm to determine the spanning tree of the following graph



(4 marks)

(c) Let G=(V,E) be a loop free connected undirected graph with T=(V,E') a DFS spanning tree for G. Let r be the root of T and let $v \in V, v \neq r$. Then show that v is an articulation point of G iff there exists a child c of v with no back edge relative to T in G from a vertex in T_C , the sub tree rooted at c, to an ancestor of v.
(7 marks)

10.

(a) State an prove Lagrange's theorem (6 marks)

(b) Prove that in a group identity and inverse are unique (5 marks)

(c) Prove that the set of all integers under the operations defined by $x \oplus y = x + y - 1$ and $x \otimes y = x + y - xy$ is a ring (5 marks)

11

a) Find the GCD of the polynomials x^4+x^2+1 and x^2+1 over F_2 (6 marks)

b) Construct a syndrome look up table for the code defined by the check matrix

$$\begin{bmatrix} 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \end{bmatrix} .$$ (6 marks)

c) Explain with examples: i) Irreducible polynomials ii)Cyclic codes(4 marks)

CNS 102 : ADVANCED ALGORITHMS AND ANALYZES

4 MODULE COURSE

PART – A

[Answer all 4 questions, each with 5 marks : 4*5=20]

1. Solve the recurrence

   $T(n)=2\ T(n/3)+n \log n$

   $T(n)=T(n/2)+1$

   $T(n)=4\ T(n/2)+n^3$

   $T(n)=T(\text{sqrt}(n))+(\lg \lg n)$

2. State Cook's theorem and explain with an example.

3. State Chinese Remainder Theorem and explain with an example.

4. Briefly explain Distributed Algorithms.

PART – B

[Answer any 4 questions, each with 20 marks : 4*20=80]

5. a. Write a short note about Asymptotic Notations & State the properties used for the comparison of asymptotic functions. 7

   b. Take the following list of functions and arrange them in ascending order of growth rate. That is, if it is the case that f(n) is O(g(n)), then, function g(n) should follows function f(n) in your list. 5

   $f_1(n) = 10^n$
   $f_2(n) = n^{(1/3)}$
   $f_3(n) = n^n$
   $f_4(n) = \log_2 n$
   $f_5(n) = 2(\text{sqrt}(\log_2 n))$

   n is sufficiently large in size.

   c. Explain Recurrence Analysis in Algorithm Analysis Techniques with example. 8

6. a. Explain B-Trees with Example. 5

	b.	Write and explain an algorithm to delete a key from B-Tree.	7
	c.	Construct a B-Tree and perform the delete operations in it, considering all cases in the textbook.	8
7.	a.	Explain Randomized Algorithm Analysis Techniques with Example.	6
	b.	Explain Randomized Divide and Conquer Approach with appropriate example and perform its complexity analysis.	8
	c.	Prove that Independent Set reduces to Vertex Cover problem.	6
8	a.	State and Prove GCD Recursion Theorem.	8
	b.	Write Euclid recursive algorithm and Explain with an Example.	6
	c.	Compute the values (d,x,y) that the call EXTENDED-EUCLID (899,493) returns.	6
9.	a.	What are P-class, NP-class and NP-Complete problems?	5
	b.	Explain Vertex Cover problems and write Approx-Vertex-Cover algorithm.	6
	c.	Prove that Approx-Vertex-Cover is a polynomial-time 2–approximation algorithm.	9

CNS 103 : TOPICS IN NETWORKING

5 MODULE COURSE

PART A

(Answer all questions, each carry 4 marks)

1. Explain the various communication protocol development methods.
2. How is IP addressing done in IPv6?
3. Explain how RED prevents the congestion with the help of algorithm.
4. State the requirements for remote monitoring.
5. State the network issues in doing audio/video conferencing over internet.

PART B

(Answer any five questions, each carry 16 marks)

1 a) Explain various Protocol validation approaches **[8 marks]**
b) What is service specification? Explain service specification for reliable data transfer using any formal approach **[8 marks]**

2 a) How troubleshooting can be done in IPV6 connection? **[8 marks]**
b) Explain briefly about
I) Routing information protocol **[4 marks]**
ii) Network address translation **[4 marks]**

3 a) Write a short note on Link level flow and error control **[6 marks]**
b) Explain the Evaluation criteria for both effective and fair resource allocation **[10 marks]**

4 a) Explain briefly about any two applications of network management? **[8 marks]**
b) Write a brief description about the following concepts of Network Management tools
i) NMS Design
ii) Network management systems **[8 marks]**

5 a) Explain the multimedia applications in WWW and multimedia transport across ATM networks. **[10 marks]**
b) Give a brief description about IPv4/IPv6 Interoperability of networks in multimedia communications? **[6 marks]**

6 a) Give a brief description of Integrated services and differentiated services of QOS in IP networks. **[8 marks]**
Briefly explain the issues in resource allocation **[8 marks]**

CNS 104 : NETWORK DESIGN AND PERFORMANCE EVALUATION

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. Differentiate service requests and service offerings.

2. Given an MTBCF requirement of 8000 hours and an MTTR requirement of 4 hours. Calculate an availability requirement

3. Explain ***flowspec*** algorithms.

4. Explain convolution algorithm

PART B

(Answer any four questions, each carry 20 marks)

5. a) Explain the tactical and strategically significance of network analysis architecture and design. (12)

b) How system methodology is applicable to network design? (8)

6. a) Explain application types with respect to service metrics. (12)

b) Show how performance boundaries and thresholds could be used in the following Scenarios.

(i) An application has a service requirement for round-trip delay to be less than 100 ms. If delay is greater than 100 ms, notify the network administrator.

(ii) A user requires capacity of up to 512 Kb/s but may not exceed 1.5 Mb/s. You want to keep track of how much time the user's capacity is between 512 Kb/s and 1.5 Mb/s (8)

7. a) Explain in detail different network architectural models (11)

b) For each requirement mentioned below, which one do you prefer from options DiffServ, IntServ? Give reasons

(9)

Requirement 1. Two clearly different sets of network performance requirements: one high RMA, the other low RMA (for that network)

Requirement 2. A requirement to bill subscribers for network service, and to provide accounting of subscriber billing information

Requirement 3. Combining a customer's voice and data traffic over a common network.

8. a) Which are the different queuing models for networks (12)

b) Explain queuing of a space division packet switching network. (8)

9. a) explain the significance of hierarchy and interconnectivity in networks (12)

b) What is the significance of modelling behaviour of components in networks? How it could be explained from system approach
(8)

CNS 105(A) : LAWS AND ETHICS IN COMPUTING

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. Explain moral and legal issues in computing?

2. Discuss the need for data protection in India.

3. What is computer forensics? Explain the steps taken by computer forensic specialists?

4. Explain about E-Governance under Indian Perspective.

PART B

(Answer any four questions, each carry 10+10=20 marks)

5. a) Explain characteristics of professional ethics and how it see computing as professional relationship

b) Provide a sample code of ethics and professional conducts, pertaining to this area

6. a) Examine the scope of copyright protection to computer programs in the light of the provisions of the Copyright Act, 1957.

b) Discuss in detail the provisions of TRIPS Agreement for trademarks and patent protection of Cyber World Technologies.

7. a) Explain the types of business computer forensic technology

b) Discuss about collecting the evidence in private-sector incident scenes.

8. a) How and in what manner is users protected from computer misuse and computer crimes under the Information Technology Law?

b) Discuss the history and evolution of cyber space.

9. a) Discuss the protection of software copyright

b) Explain the system of obtaining patents to designs and protection of semi-conductors chips with reference to the Patents Act, 1970.

CNS 105(B) : CYBER LEGISLATION AND SECURITY POLICIES

4 MODULE COURSE

PART A

(Answer all questions each carry 5 marks)

1. How to keep track of authorized users using directory services?
2. A tort is a civil injury but all civil injuries are not torts. Discuss?
3. Explain the different tools for information security.
4. Explain about web Policies

PART B

(Answer any four questions, each carry 20 marks)

5. a) Explain Computer Security mandates and legislation. **[10 marks]**

   b) What are the needs for Security? Explain threats to security. **[10 marks]**

6. a) Explain importance of security goals and illustrate the points you present by using one such goal as an example **[4 + 8 marks]**

   b) Give a note on Information Protection and need for Access Controls. Give one example to access control and show how is it useful to protection of information. **[4 + 4 marks]**

7. a) Discuss the need for legal protection against the programs and data. State two such provisions. **[5 + 6 marks]**

   b) Write note on employee responsibilities in implementing the legal protection for program and data. **[9 marks]**

8. a) What are the advantages of Asset classification policy? Explain with the help of one example to such policy **[5+5 marks]**

   b) Explain different steps required for Planning and preparation of policies **[10 marks]**

9. a) Describe the Corporate security policies in detail, ensuring proper implementation of digital infrastructure **[10 marks]**

   b) Show how to write security polices for an organization, taking any two security requirements as example **[10 marks]**

CNS 106(C) : ETHICAL HACKING

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. What do you mean by banner grabbing? Discuss the importance of banner grabbing in Ethical Hacking?

2. What is social engineering? Explain in detail any two social engineering attack and it's Implication on an organization?

3. What is DoS attack? What are the types of DoS attacks?

4. What is the difference between Session Hijacking and Back Doors?

PART B

(Answer any four questions, each carry 20 marks)

5. a. Define the seven-step information gathering process in foot printing? (8)

   b. How to find open ports and access points using port scanning in detail? (12)

6. a. What is war-dialing and what are the tools used for war-dialing? (8)

   b. What do you mean by Voice over IP (VoIP) and state one attack of VoIP? (12)

7. a. Explain the difference between wireless foot printing and wireless scanning? (8)

   b. How to exploit WEP Weakness? (12)

8. a. Explain about Web server hacking and web application hacking? (8)

   b. Discuss the various modes of Ethical Hacking in detail? (12)

9. a. What do you mean by Metasploit? Explain some of the features and advantages of using framework like MSF? (8)

   b. Explain SMTP enumeration in detail? (12)

CNS 106(D) : WIRELESS NETWORKS

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. Explain about the carrier sensor mechanism in ieee802.11 WLAN?

2. In what way hand-off and mobility support achieved in wireless network?

3. How does WSN differ from mobile Adhoc network?

4. Explain about the components and characteristics of WSAN?

PART B

(Answer any four questions, each carry 20 marks)

5. a. WiMax may be the alternative solution of fixed broadband services in real time application. Comment on the issue? (8)

   b. Explain in detail about the architecture and reference model of HIPERLAN? (12)

6. a. Explain the following protocols in brief

   i. AODV routing protocol (12)

   ii. DSDV (8)

7. a. Write briefly about the applications of WSN? (8)

   b. Explain flat routing and hierarchical routing protocol in WSN? (12)

8. a. What are the different types of WSAN network architecture? Distinguish between them? (8)

   b. Explain in detail about the communication architecture of UWSN? (12)

9. a. State the importance of QoS in Adhoc network. Explain with example? (12)

   b. With a neat diagram explain about the network architecture of WMSN? (8)

CNS 106(I) : VIRTUALIZATION TECHNIQUES

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. What are the benefits of using virtualization

2. How to backup virtual guest operating system

3. Write a short note on WAN virtualization

4. What is the role of Hypervisor. Give example

PART B

(Answer any 4 questions, each carry 20 marks)

5. a) Explain different types of virtualization techniques. Name the hypervisor used in each technique (12)

   b) Explain type 1 and type 2 hypervisor with neat diagram and compare their performance (8)

6. a) Differentiate between Para virtualization , Container Virtualization and Full Virtualization. Name the hypervisor used in each case. Which one is faster and why? (12)

   b) How to avoid the "all your eggs in one basket" syndrome (8)

7. a) Explain Virtual Enterprise Transport virtualization (12)

   b) Design a Virtual lab for your college. Explain in detail the components and tools you are going to use for this purpose(Type of virtualization technology, which hypervisor, number of servers and clients)
(8)

8. a) Describe the SNIA shared storage model. (12)

   b) How many classes of services are available in fibre channel (8)

9. a) Give a brief overview of Hardware Virtualization. (12)

   b) What are the points to be considered when integrating virtualization into computing environment (8)

CNS 202 : TOPICS IN SECURITY

6 MODULE COURSE

PART – A

[Answer all questions, 2 marks + 4 marks*5=22 marks]

1. Show the relationship between Security services and Security Mechanism in a tabular form. [2 marks]

2. Brief the security of Hash functions and MAC.

3. What are OS Security Violations

4. Differentiate DES and AES algorithm

5. State the applications of PKI

6. Briefly explain RFID

PART B

(Answer any six questions, each carry 13 marks)

7. a. What do you mean by Security Service? Brief the Security Services defined in X.800. [7 marks]

b. Brief the Security Mechanism defined in X.800. [6 marks]

8. a. What is MAC? With a neat diagram brief the uses of MAC and state its requirements. [4 marks]

b. Explain HMAC [6 marks]

c. Suppose H(m) is a collision-resistant hash function that maps a message of arbitrary bit length into an n-bit hash value. Is it true that, for all messages x, x' with $x \neq x'$, we have $H(x) \neq H(x')$? Explain your answer. [3 marks]

9. a. Brief OS Security Violations and Techniques to Prevent Them [8 marks]

b. Brief Secure Programming Techniques [5 marks]

10.a. Explain Group Key Establishment Protocols [7 marks]

b. Consider a Diffie-Hellman scheme with a common prime q=11, a primitive root $\alpha = 2$.

i) If use A has public key Y_A =9, what is A's Private Key X_A ?

ii) If use B has public key Y_B =3, what is the shared secret key K? [6 marks]

11a. Explain X.509 Authentication Service. [7 marks]

b. In ElGammal given the prime *p*=31:

i) Choose an appropriate e_1 and *d*. Then calculate e_2 .

ii) Encrypt message 'HELLO'; use 00 to 25 for encoding. Use different blocks to make P<*p*.

iii) Decrypt the cipher text to obtain the plain text. [6 marks]

12a. What are the Security issues in Electronic Voting? Explain. [7 marks]

b. Brief VoIP [6 marks]

13a. What are the security issues in Databases [8 marks]

b. Create a linear feedback shift register with 5 cells in which $b_5 = b_4 \oplus b_2 \oplus b_0$. Draw its diagrammatic representation. [5 marks]

CNS 203 : INTERNET INFORMATION AND APPLICATION SECURITY

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. How hidden contents within an application can be discovered?

2. Explain the concept of locking down the application data?

3. Explain briefly the concept of HTTP fingerprinting?

4. Explain the concept of web crawling and source code disclosure?

PART B

(Answer any four questions, each carry 20 marks)

5. a. Describe the various design flaws commonly employed in web applications which is relevant for authentication? [10 marks]

b. Compare and contrast the basic spidering approach with user directed spidering and make an analysis on how burp spider can be used to map part of an application? [10 marks]

6. a. Explain the term SQL injection and explain how ModSecurity prevents SQL injection?

[10 marks]

b. Explain briefly about

i) Dynamic String Binding [5 marks]

ii) Web server Filters [5 marks]

7. a. Write a short note on directory traversal attacks and null byte attack? [10 marks]

b. How can you detect the real IP address of an attacker, stating also the context? [10 marks]

8. a. How can you detect an attacker who is hacking a web server? [8 marks]

b. Write a brief description about the following [6+6 marks]

i) Canonicalization attacks

ii) Database vulnerabilities

9. a. How can you analyze an application's functionality, behaviour, and technologies employed in order to identify the key attack surface that it exposes? [10 marks]

b. Briefly explain the architecture of database-driven web architecture? [10 marks]

CNS 204(A) : RESEARCH METHODS AND TECHNIQUES

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. Define research and discuss the objectives of research.

2. Suggest a research strategy for identifying the employee motivating factors in an MNC

3. State the difference between Null and Alternate hypothesis

4. Describe, in brief, the layout of a research report, covering all relev ant points

PART B

(Answer any four questions, each carry 20 marks)

5. a) There are various steps involved in research process and they vary based on the research problem. Explain the steps involved in the research process keeping in mind the contexts of the research problem. [10 marks]

b) Explain the Limitations of test of significance. [10 marks]

6. a) How will we examine a research proposal? [10 marks]

b) "The first stage in research is discovering where to look for information and opinions on your topic" Discuss [10 marks]

7. a) "Ethics in research is the need of the hour". Justify the statement. [11 marks]

b) The heights in inches of 30 students are as follows: 66, 68, 65, 70, 67, 64, 68, 64, 66, 64, 70, 72, 71, 69, 69, 64, 67, 63, 70, 71, 63, 68, 67, 65, 69, 65, 67, 66, 69, 67 Prepare a frequency distribution table showing relative frequency, cumulative frequency and percent frequencies.
[9 marks]

8. a) What are the different steps for writing final research report? [8 marks]

b) Mention the different types of reports, particularly pointing out the difference between a technical report and a popular report. [12 marks]

9. a) What is meant by measurement in research ? What difference does it make whether we measure in terms of nominal, ordinal, interval or ratio scale ? Explain giving examples. [8 marks]

b) i) If you are conducting an interview survey of around 500 respondents in Hyderabad, what type of probability sampling you choose and why? [6 marks]

ii) What is Likert's Scale ? Why it is used? How to construct it ? Explain [6 marks]

CNS 206(H) : MACHINE LEARNING TECHNIQUES

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. What assumptions does Naive Bayesian method make about the attributes and the classification? Give an example where this assumption is not justified.

2. In most learning algorithms, the computation time required for training is large and the time required to apply the classifier is short. The reverse is true of the nearest neighbor's algorithm. How can the computation time required for queries be reduced?

3. What is the difficulty with evaluating learning methods that do not address classification, such as association rules and clusters?

4. How to programming a robot by physically moving it through the trajectory?

PART B

(Answer any four questions, each carry 20 marks)

5. a) What is learning?. Write any four learning techniques and in each case give the expression for weight- updating [12 marks]

b) What is the difference between "supervised" and unsupervised" learning scheme.[8 marks]

6. a) What is the intuitive relationship between SVD and PCA, Explain? [10 marks]

b) What are the different models of artificial neurons? [10 marks]

7. a) How can a decision tree be converted into a rule set? Illustrate with an example. What are the advantages of the rule set representation over the decision tree representation? [12 marks]

b) Explain classification by Decision tree induction? [8 marks]

8. a) Explain the importance of Markov decision process in dynamic programming? [12 marks]

b) What is a task environment? How it is specified? [8 marks]

9. a) Explain the method of ID3 decision tree classification algorithm with an example . Explain tree pruning with an example. [12 marks]

b) Give an example of decision tree induction. [8 marks]