Department of Computer Science & Engineering
Tripura University
(A Central University)
Suryamaninagar
Phone: 0381-23792224, email: HOD_CSE@tripurauniv.in

Date: 14.05.15

A copy of Proceedings of the 5th Meeting of Board of Post Graduate Studies of Computer Science & Engineering held on 22nd April 2015 at 2 P.M. in the chamber of the Head (i/c) of the Department of Computer Science & Engineering is enclosed for favor of kind information and necessary action please.

Enclo: As stated

with new-2015 M.Tech Syllabus

(ABHISHEK MAJUMDER)
Chairman
Board of Post Graduate Studies
Department of Computer Science & Engineering
Tripura University

Copy to:
1. The Dean of Science, Tripura University, Suryamaninagar
2. Prof. S.K Basu, Professor, Department of Electronice & Telecommunication Engineering, IITG
3. Prof. P. Datta, Professor, Department of Computer & System Sciences, Visva Bharati University
4. Prof. U. Maulik, Professor, Department of Computer Science & Engineering, Jadavpur University.
5. Prof. B.K.De, Professor, Professor, Department of Physics, Tripura University.
6. All members of Department of Computer Science & Engineering, Tripura University *Dr. M. K. Bhowmik*
7. The Controller of Examination, Tripura University
8. P.S. to the Vice-Chancellor, Tripura University for his kind information.

PROCEEDINGS OF THE FIFTH MEETING OF BOARD OF POST GRADUATE STUDIES IN COMPUTER SCIENCE & ENGINEERING HELD IN THE CHAMBER OF HEAD – IN – CHARGE OF THE DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING , TRIPURA UNIVERSITY, SURYAMANINAGAR, WEST TRIPURA ON 22nd April, 2014 AT 3:00 PM.

Members present:

1. Prof. Paramartha Dutta, Department of Computer & System Sciences, Visva-Bharati University
   - External Member
2. Prof. Ujjwal Maulik, Department of Computer & Engineering, Jadavpur University
   - External Member
3. Prof. Barin Kumar De, Head of Physics Department, Tripura University
   - Member

4. Dr. Mrinal Kanti Bhowmik, Department of Comp. Sc. Engg., Tripura University
   - Member
5. Mr. Abhishek Majumder, Department of Comp. Sc. & Engg. , Tripura University
   - Chairman

At the outset, Mr. Abhishek Majumder, Chairman, Board of Post Graduate Studies (B. P. G. S.), Department of Computer Science & Engineering, extended a warm welcome to all the members and particularly thanked the External Members, Prof. P. Dutta, Department of Computer & System Sciences, and Prof. Ujjwal Maulik, Department of Computer & Engineering for their active participation and co-operation. Thereafter, agenda wise discussion started.

Agenda :
Agenda 01/05/15 : To confirm the proceedings of 4th meeting of BPGS on 09.09.2014.
Confirmed

Agenda 02/05/15 : To prepare the M.Tech Syallabus as per CBCS guidelines.
It has been resolved that computer skills III be offered in M.Tech First Semester as compulsory foundation course.
Total credits for M.Tech in Computer Science & Engineering curriculum shall be 72 credit out of which credits for theoretical and practical papers shall be 44 and 28 respectively.
In first semester, there will be 4 core theoretical papers each of 100 marks and 4 credits and 2 laboratory papers each of 100 marks and 2 credits. The detail syllabus is enclosed as **Annexure-1**

Mrinal Kanti Bhowmik .
22.4.15.

In second semester, 2 core theoretical papers each of 100 marks and 4 credits and 2 optional papers out of 4 choices each with 100 marks and 4 credits. Apart from this there will be 2 laboratory papers each of 100 marks and 2 credits. Optional papers will be offered subject to availability of experts willing to give lectures. The detail syllabus is enclosed as Annexure-1A .

In third semester, there will be 4 practical papers named Thesis Report Interim (CSE -1101C) , Thesis Seminar Interim (Presentation & Viva-Voce) (CSE -1102C), Technical Communication(CSE- 1103C) and Workshop and Seminars (CSE -1104C) having 4,4,2 and 1 credits respectively. Apart from this there will be 1 elective paper out of 5 choices each with 100 marks and 4 credits. Optional papers will be offered subject to availability of experts willing to give lectures. The detail syllabus is enclosed as Annexure-1.

In fourth semester, there will be 3 practical papers named Thesis Report Final (CSE -1201C) and Thesis Seminar Final (Presentation & Viva-Voce) (CSE -1202) having 4 credits each. Apart from this there will be 1 elective paper out of 4 choices each with 100 marks and 4 credits. Optional papers will be offered subject to availability of experts willing to give lectures. There will also be 1 elective foundation paper having 2 credits in this semester The detail syllabus is enclosed as Annexure-1.

It has also been resolved that 2 elective papers having 4 credits be offered to other departments in odd semesters. The papers are named as Basics of wireless communication and Image processing Principals.
The detail syllabus is enclosed as Annexure-1.

Agenda 03/05/15 : To consider the recommended list of paper setters, examiners and moderator of M.Tech 2nd & 4th semester examinations.
Approved with post fecto effect.
The details is enclosed as Annexure-2.

Agenda 04/05/15 : To consider the formation of RAC for registered PhD Scholars under the supervision of Prof. Barin Kumar De.
When the agenda item was placed in the meeting professor Barin Kumar De chaired the BPGS meeting. The board recommended the research advisory committee (RAC) for Mrs. Priya Saha, Registered (Vide No.F/TU/COE/Ph.D/10/CSE/02/14) . The committee may have the following members:
(i) Dr. Syed Arshad Hussain, Assistant Professor, Dept. of Physics......... Member
(ii) Dr. Shyamal Debnath, Assistant Professor, Dept. of Mathematics......Member
(iii) Dr. Priyaranjan Dash, Assistant Professor, Dept. of Statistics..... ......Member
(iv) Prof. Mita Nasipuri, Professor, Dept. of Computer Science & Engineering, Jadavpur University,Co-Guide and Member
(v) Prof. Barin Kumar De, Professor, Dept. of Physics...........Guide and Convenor
(vi) External Member
    (a) Dr. Amlan Chakrabarti, A. K. Choudhury School of Information Technology, University of Calcutta
    (b) Prof. Ujjwal Maulik, Professor, Dept. of Computer Science & Engineering, Jadavpur University
    (One external member will be invited at a time as per availibility)
The board recommended the research advisory committee (RAC) for Kankan Saha (Vide No.F/TU/COE/Ph.D/10/CSE/01/14)

Mainal Kanti Bhowmik.
29. 4. 15.

22/4/15

22/4/15

2/4/15

P-2

(i) Dr. Ratan Das, Assistant Professor, Dept. of Physics..................................Member
(ii) Dr. Mrinal Kanti Bhowmik, Dept. of Computer Science & Engineering..... Member
(iii) Dr. Shyamal Debnath, Assistant Professor Dept. of Mathematics...............Member
(iv) Dr. Debotosh Bhattacharjee, Associate Professor, Dept. of Computer Science & Engineering, Jadavpur University... Co-Guide and Member
(v) Prof. Barin Kumar De, Professor, Dept. of Physics..................... Guide and Convenor
(vi) External Member

    (a) Dr. Amlan Chakrabarti, A. K. Choudhury School of Information Technology, University of Calcutta

    (b) Prof. Ujjwal Maulik, Professor, Dept. of Computer Science & Engineering, Jadavpur University

    (One external member will be invited at a time as per availibility)

The meeting ended with vote of thanks to the Chair.

(Sri Abhishek Majumder)
Chaiman, B. P. G. S. ,
Department of Computer Science & Engineering
Tripura University

Mrinal Kanti Bhowmik.
22.4.15

P-3.
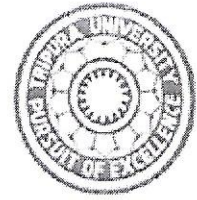
Date: 01/11/2019

Notice

The 20th meeting of Board of Post Graduate Studies in Computer Science & Engineering will be held on 27.11.2019. The meeting will commence on 27.11.2019 at 2.00 P.M onwards in the chamber of Head, Department of Computer Science & Engineering, to discuss the following agenda.

Agenda:

1. To confirm the proceedings of the 19th meeting of Board of Post Graduate Studies (BPGS) held on 27th May 2019.
2. Formation of RAC of Mr. Joy Lala Sarkar and Mrs. Sudhesna Das, PhD scholars, Department of Computer Science & Engineering working under supervision of Dr. Abhishek Majumder, Assistant Professor, Department of Computer Science & Engineering, Tripura university.
3. Consider the open two elective papers offered by Department of Computer Science and Engineering.
4. Consideration the name of Dr. Abhishek Majumder, Assistant Professor, Computer Science and Engineering Department as a RAC member of Ph.D scholar Mr. Anu Singha.
5. Miscellaneous if any

All members are cordially invited to attend the meeting.

(Prof. Sukanta Banik)
Chairman, Board of Post Graduate Studies
Department of Computer Science & Engineering

Copy to:

1. Dean, Faculty of Science, Tripura University (A Central University), for kind information
2. Prof. Anjan Mukherjee, Member of Board of Post Graduate Studies, Department of Mathematics, Tripura University (A Central University).
3. Dr. Mrinal Kanti Bhowmik, Member of Board of Post Graduate Studies, Department of Computer Science and Engineering, Tripura University (A Central University).
4. Dr. Abhishek Majumder, Member of Board of Post Graduate Studies, Department of Computer Science and Engineering, Tripura University (A Central University).
5. Dr. Shyamal Debnath, Member of Board of Post Graduate Studies, Department of Mathematics, Tripura University (A Central University).
6. Prof. Amlan Chakrabarti, External Member of Board of Post Graduate Studies, Dean of Faculty Council for Post-Graduate Studies in Engineering & Technology, University of Calcutta.
7. Prof. Sudipta Roy, External Member of Board of Post Graduate Studies, Department of Computer Science and Engineering, Assam University.
8. Prof. Ratnajit Bhattacherjee, External Member of Board of Post Graduate Studies, Department of EEE, IIT-Guwahati.

partment of Computer Science & Engineering
ripura University (A Central University)
Suryamaninagar-799022, Tripura (W), India.
Phone: 0381-2379224, email: HOD_CSE@tripurauniv.in

Date: 27.11.19

A copy of proceedings of the 20th meeting of Board of Post Graduate Studies (BPGS) of Computer Science & Engineering held on 27th November, 2019 at 2:00 PM in the chamber of Head, Department of Computer Science & Engineering is enclosed for favour of kind information.

Enclosed: As stated

(Prof. Sukanta Banik)
Chairman, Board of Post Graduate Studies (BPGS)
Department of Computer Science & Engineering
Tripura University (A Central University)

Copy to:
1. Vice-Chancellor, Tripura University (A Central University)
2. Dean of Faculty of Science, Tripura University, Suryamaninagar.
3. All members of Department of Computer Science & Engineering, Tripura University.
4. The Controller of Examination, Tripura University
5. P.S to the Vice-Chancellor, Tripura University for his kind information.

partment of Computer Science & Engineering
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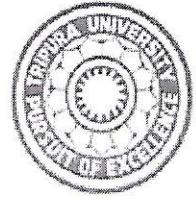
RAC for Joy Lal Sarkar

1. Dr. Mrinal Kanti Bhowmik, Assistant professor, Department of Computer Science and Engineering, Tripura University ....Member
2. Dr. Bishanka Brata Bhowmik, Assistant professor, Department of Electronics & Communication Engineering, Tripura University ....Member
3. Dr. Ratan Das, Assistant professor, Department of Physics, Tripura University ....Member
4. Dr. Mrinal Kanti Debbarma, Associate professor, Department of Computer Science and Engineering, NIT Agartala ....External Member
5. Dr. Abhishek Majumder, Assistant professor, Department of Computer Science and Engineering, Tripura University ....Convenor

RAC for Sudesna Das

1. Dr. Mrinal Kanti Bhowmik, Assistant professor, Department of Computer Science and Engineering, Tripura University ....Member
2. Dr. Anirban Karmakar, Assistant professor, Department of Electronics & Communication Engineering, Tripura University ....Member
3. Dr. Shouvik Bhattacharya, Assistant professor, Department of Mathematics, Tripura University ....Member
4. Dr. Mrinal Kanti Debbarma, Associate professor, Department of Computer Science and Engineering, NIT Agartala ....External Member
5. Dr. Abhishek Majumder, Assistant professor, Department of Computer Science and Engineering, Tripura University ....Convenor

The matter was discussed and **approved** for further consideration.

Agenda 03/20/2019:

Introduction of two new courses named "IOT Applications and Communication Protocols" and "Object Detection under Adverse Weather Conditions in Computer Vision" as elective papers in the M.Tech 3rd Semester.

The matter was **approved** for consideration.

Mrinal kanti Bhowmik
27.11.19

Abhijit
27.11.19

27/11/19

27.11.2019

S. Debnath
27.11.19

Date: 7th June, 2018

A copy of proceedings of the 15th meeting of Board of Post Graduate Studies (BPGS) of Computer Science & Engineering held on 7th June, 2018 at 3:30 PM in the chamber of Head, Department of Computer Science & Engineering is enclosed for favour of kind information.

Enclosed: As stated

S. N. Karmakar
07.06.18
(Prof. Sachindra Nath Karmakar)
Chairman, Board of Post Graduate Studies (BPGS)
Department of Computer Science & Engineering
Tripura University (A Central University)

Copy to:
1. Pro-Vice-Chancellor, Tripura University (A Central University)
2. Dean of Science, Tripura University, Suryamaninagar.
3. Prof. Barin Kumar De, Head, Physics Department, Tripura University
4. All members of Department of Computer Science & Engineering, Tripura University.
5. The Controller of Examination, Tripura University
6. P.S to the Vice-Chancellor, Tripura University for his kind information.

Agenda 04/15/2018:

The matter regarding the change of Ph.D title of Smt. Kakali Das with Registration Number: F/TU/COE/Ph.D/10/CSE/03/15, dated: 18th November, 2015 was placed in the meeting which was approved in the RAC meeting dated: 28/05/2018. The matter was discussed. The change of Ph.D title was **approved** for further action:

Old Ph.D Title: Prediction of Performance of Health Abnormality Detection Systems (HADSs) Based on Thermal Images.

New Ph.D Title: Prediction of Health Abnormality Using Thermal Images.

Agenda 05/15/2018:

The matter regarding the adoption of **one new elective papers** in M.Tech, Computer Science and Engineering Course which would be offered in 3rd Semester by the Department of Computer Science & Engineering was placed in the meeting by the Head. The matter was discussed and **approved** for consideration.

Paper No	Paper Title	Course Offered By
	Fluid Mechanics	Department of Computer Science & Engineering, TU

Agenda 06/15/2018:

The members unanimously recommended the name of Prof. S.N. Karmakar, Head, Computer Science and Engineering Department as a RAC member of the following Ph.D scholars:

Sl. No.	Name of Ph.D Scholars	Name of Supervisor(s)
1	Smt. Usha Rani Gogoi Registration Number: F/TU/COE/Ph.D/10/CSE/06/16 Dated: 21st March, 2016	Dr. Mrinal Kanti Bhowmik, (Guide) Prof. Anjan Kumar Ghosh, (Co-Guide)
2	Smt. Shawli Bardhan Registration Number: F/TU/COE/Ph.D/10/CSE/05/15 Dated: 18th November, 2015	Dr. Mrinal Kanti Bhowmik, (Guide)
3	Smt. Kakali Das Registration Number: F/TU/COE/Ph.D/10/CSE/03/15 Dated: 18th November, 2015	Prof. Barin Kumar De, (Guide) Dr. Mrinal Kanti Bhowmik, (Co-Guide)
4	Smt. Tannistha Pal Registration Number: F/TU/COE/Ph.D/10/CSE/04/15 Dated: 18th November, 2015	Dr. Mrinal Kanti Bhowmik, (Guide)
5	Sri Rajib Debnath Registration Number: Ph.D/10/CSE/07/16 Dated: 26th September, 2016	Dr. Mrinal Kanti Bhowmik, (Guide) Prof. Anjan Kumar Ghosh, (Co – Guide)

Date: 01.02.18

A copy of proceedings of the 12th meeting of Board of Post Graduate Studies (BPGS) of Computer Science & Engineering held on 1st February, 2018 at 2:00 PM in the chamber of Head, Department of Computer Science & Engineering is enclosed for favour of kind information.

Enclosed: As stated

S. N. Karmakar
1.2.2018
(Prof. Sachindra Nath Karmakar)
Chairman, Board of Post Graduate Studies (BPGS)
Department of Computer Science & Engineering
Tripura University (A Central University)

Copy to:
1. Pro-Vice-Chancellor, Tripura University (A Central University)
2. Dean of Science, Tripura University, Suryamaninagar.
3. Prof. Barin Kumar De, Physics Department, Tripura University
4. All members of Department of Computer Science & Engineering, Tripura University.
5. The controller of Examination, Tripura University
6. P.S to the Vice-Chancellor, Tripura University for kind information.
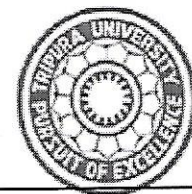
Agenda 04/12/2018:

The matter regarding the change of member of RAC External Expert of Smt. Kakali Das with Registration Number: F/TU/COE/Ph.D/10/CSE/03/15, dated: 18th November, 2015 was placed in the meeting which was approved in the RAC meeting dated: 31/01/2018. The matter was discussed and the change of RAC External Expert was **approved** for further action:

Old RAC External Expert: Prof. Debotosh Bhattacharjee,
Department of Computer Science & Engineering,
Jadavpur University, Kolkata.

New RAC External Expert: Prof. Amlan Chakrabarti,
A.K. Choudhury School of Information Technology,
University of Calcutta, Kolkata

Agenda 05/12/2018:

The matter regarding the change   of Ph.D title and external expert of RAC of Sri Rajib Debnath with Registration Number: F/TU/COE/Ph.D/10/CSE/07/16, dated: 26th September, 2016 was placed in the meeting which was approved in the RAC meeting dated: 31/01/2018. The matter was discussed. The change of Ph.D title and RAC External Expert was **approved** for further action:

Old Ph.D Title: Image Processing Based Surface Plasmon Resonance (SPR) System to Measure the Refractive Index of Bio-Chemicals
New Ph.D Title: Detection of Weapon along with Profile in Video
Old RAC External Expert: Prof. Utpal Das,
Department of Electrical Engineering,
IIT Kanpur, Kanpur, Uttar Pradesh 208016.

New RAC External Expert: Prof. Amlan Chakrabarti,
A.K. Choudhury School of Information Technology,
University of Calcutta, Kolkata-700009, India

Agenda 06/12/2018:

The matter regarding the adoption of **two new elective papers** in M.Tech, Computer Science and Engineering Course which would be offered by the Department of Physics and Department of Mathematics was placed in the meeting by the Head. The matter was discussed and **approved** for consideration.

Paper No	Paper Title	Course Offered By
	Fuzzy Topology	Department of Mathematics, TU
	Microprocessor	Department of Physics, TU

Agenda 07/12/2018:

The member unanimously recommended the name of Prof. S.N. Karmakar, Head, Computer Science and Engineering Department as a RAC member of Smt. Priya Saha instead of Dr. Priyaranjan Das, Assistant Professor, Department of Statistics as at present the member has left the job. The other RAC members for Smt. Priya Saha remain same.

S. N. Karmakar
01.02.2018
(Prof. Sachindra Nath Karmakar)
Chairman, Board of Post Graduate Studies (BPGS)
Department of Computer Science & Engineering

SYLLABUS FOR M.TECH IN COMPUTER SCIENCE AND ENGINEERING FOR THE SESSION 2015-2016

Course Structure (Computer Science & Engineering)

1ˢᵗSemester: 600

Theoretical Courses	SubjectCode	Subject Name	Marks	L	T	P	C	Core/Optional/Elective
Paper-I	CSE 901C TH	Design & Analysis of Algorithms	100 *(80+20)	04	0	0	04	CF
Paper-II	CSE 902C TH	Wireless Communication & Mobile Computing	100 *(80+20)	04	0	0	04	C
Paper-III	CSE 903C TH	Image Processing	100 *(80+20)	04	0	0	04	C
Paper-IV	CSE 904C TH	Probability and Random Process	100 *(80+20)	04	0	0	04	C (Offered by Department of Statistics)
Paper-V		Computer Skills 3	(As per University Norms) Compulsory Foundation					
Sessional Courses	**Subject Code**	**Subject Name**	**Marks**					
Sessional 1	CSE 905C PR	Image Processing Lab	100	0	0	04	02	C
Sessional 2	CSE 906C PR	Mobile Computing Lab	100	0	0	04	02	C
Total				16	0	08	20	

*80(Theory)+20(Internal Assessment)

2ⁿᵈ Semester: 600

Theoretical Courses	SubjectCode	Subject Name	Marks	L	T	P	C	Core/Optional/Elective
Paper-VI	CSE 101E TH	Elective Papers :	100 *(80+20)	04	0	0	04	E
	CSE 1001 E1	Pattern Recognition						

	CSE 1001 E2	Optical Communication & Network						
	CSE 1001 E3	Software Engineering						
	CSE 1001 E4	VLSI & Microprocessor						
Paper-VII	CSE 1002C TH	Theory of Computation	100 *(80+20)	04	0	0	04	C
Paper-VIII	CSE 1003C TH	Network Security & Cryptography	100 *(80+20)	04	0	0	04	C
Paper-IX	CSE 1004E TH	Elective Papers :	100 *(80+20)	04	0	0	04	E
	CSE 1004 E1	Optical Information Processing						
	CSE 1004 E2	Distributed Computing						
	CSE 1004 E3	Soft Computing						
	CSE 1004 E4	Introduction of Quantum Computing						
Sessional Courses	**Subject Code**	**Subject Name**	**Marks**					
Sessional 1	CSE 1005C PR	Term Paper Leading to Thesis	100	0	0	04	02	C
Sessional 2	CSE 1006C PR	Design project	100	0	0	04	02	C
Total				16	0	08	20	

*80(Theory) + 20(Internal Assessment)

3rd Semester: 600 Marks

Thesis Identification, Literature Survey and Plan of Work (Thesis: Phase-I)

SubjectCode	Subject Name	Marks	L	T	P	C	Core/Optional/Elective
CSE 1101C PR/CSE 1101E PR	Thesis Report Interim	100	0	0	04	04	Open Elective
CSE 1102C PR/CSE 1102E PR	Thesis Seminar Interim (Presentation & VIVAVOCE)	200	0	0	04	04	Open Elective
CSE 1103C PR	Technical Communication	100	0	0	04	02	C
CSE 1104C PR	Workshop and Seminars	100	0	0	02	01	C
CSE1105E TH	Elective Papers:	100 *(80+20)	04			04	E
CSE 1105 E1	Business Ethics						E (Offered by Deptt. of MBA)
CSE 1105 E2	Fuzzy Set Theory						E (Offered by Deptt. of MBA)
CSE 1105 E3	Financial Management						E (Offered by Deptt. of MBA)
CSE 1105 E4	Modern Control Systems						E (Offered by Deptt. of MBA)
CSE 1105 E6	Big Data and Data Science				0	0	E
CSE 1105 E7	IOT Applications and Communication Protocols						E
CSE 1105 E8	Object Detection under Adverse Weather Conditions in Computer Vision						E

SubjectCode	Subject Name						Core/Optional/Elective
CSE 1105 E9	Fluid Mechanics						E
	Total		04	0	14	15	

*80(Theory) + 20(Internal Assessment)

4thSemester: 600 Marks

Thesis Implementation (Thesis: Phase-II)

SubjectCode	Subject Name	Marks	L	T	P	C	Core/Optional/Elective
CSE 1201C PR/CSE 1201E PR	Thesis Report Final	200	0	0	08	04	Open Elective
CSE 1202C PR/CSE 1202E PR	Thesis Seminar Final (Presentation &VIVAVOCE)	200	0	0	08	08	Open Elective
CSE 1203C PR	Workshop and Seminars	100	0	0	02	01	C
CSE 1204E TH	Elective Papers:	100 *(80+20)	04			04	E
CSE 1204 E1	Fundamentals of Management						E (Offered by Deptt. of MBA)
CSE 1204 E2	Bioinformatics: Sequence analysis						E (Offered by Deptt. of Molecular Biology & Bioinformatics)
CSE 1204 E3	Advanced Imaging Techniques						E
CSE 1204 E4	Web Technology						E (Offered by Deptt. of IT)
CSE 1204 E5	Fuzzy Topology						E (Offered by Deptt. of Mathematics)
CSE 1204 E6	Microprocessor						E (Offered by Deptt. of Physics)

CSE 1204EF	Elective Foundation	100 *(80+20)	0	0	0	02	EF
CSE 1204EF1	Communicative English						Department of English
CSE 1204EF2	Yoga						Department of Physical Education
CSE 1204EF3	NSS and Social Services						
Total			04	0	18	19	

*80(Theory) + 20(Internal Assessment)

Total Credits: 72

Elective offered to other Departments in odd semesters:

Basics of Wireless Communication Credit: 4   Marks: 100

Fundamentals of Image Processing Credit: 4   Marks: 100

SYLLABUS FOR M.TECH IN COMPUTER SCIENCE AND ENGINEERING FOR THE SESSION 2014-2015

First Semester: 600

Theoretical Courses

Paper-I

CSE 901C TH: Design & Analysis of Algorithms   **Credit:4**

Introduction: What is Algorithm? Algorithm and its specification. **Time Complexity:** Asymptotic Notation, Standard Notation and Common Functions, Asymptotic Analysis (Best, Worst, Average Case). Different cases of Time Complexity of Binary Search and Linear Search, Bubble Sort, Quick Sort, Merge Sort, Tournament Sort, Bucket Sort or Radix Sort, Insertion Sort, Selection Sort.**Greedy Algorithm:** Activity Selection Problem, Elements of the Greedy Policy, Hoffman Coding, Task Scheduling Problem, Coin Changing Problem/Algorithm, Prim's Algorithm And Kruskal's Algorithm And Comparisons. Knapsack Problem. Scheduling with Minimizing Time in the System.**Shortest Path Algorithm:** Dijkstra Algorithm, **Divide And Conquer Method:** Multiplying large integers. Strassen Matrix Multiplication. **Dynamic Programming:** Elements of Dynamic Programming, Making Change, Knapsack Problem, Shortest Path (Floyd Algorithm), Matrix Chained Multiplication, Assembly Line Scheduling. **Exploring Graphs:** Introduction, **Traversing Trees:** Pre order, Post order Numbering. DFS, BFS, Acyclic Graphs. **Backtracking:** Knapsack Problem, Eight Queen's Problem **Branch and Bound:** Assignment Problem. **Graph Algorithms: Single Source Shortest Path:** Bellman Ford Algorithm, Dijkstra Algorithm. **All Pairs Shortest Path:** Short Path of Floyd Warshall Algorithm, Johnson's Algorithm. **Computational Complexity:** Introduction to NP completeness, The Classes P and NP, Polynomial Reduction, NP Cook's Therom Complete Problems NP-completeness; Redurndancy . Approximation algorithms; Randomized algorithms;

Linear programming; Special topics: Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations),

References:

1. T. Cormen, C. Leiserson, R. Rivest, and C. Stein. Introduction to Algorithms (2nd edition). MIT Press / McGraw-Hill
2. Michael T. Goodrich and Roberto Tamassia. Algorithm Design: Foundations, Analysis, and Internet Examples. John Wiley & Sons
3. J. Kleinberg and É. Tardos. Algorithm Design. Addison-Wesley, 2005
4. Hovwitt and Sahani, " Fundamental of Algorithm.

Paper-II

CSE 902C TH: Wireless Communication & Mobile Computing   **Credit:4**

Wireless Communication - Wired and wireless, Mobility of users and equipments, Overview of Electromagnetic Spectrum, Radio and Microwave communication, Infrared and Millimeter waves, Lightwave Transmission. Overview of Satellite Networks. Concepts of Spread Spectrum, CDMA System. Wireless LANs -MACA and MACAW protocols. Concepts of Cellular Network and related technologies like GSM, GPRS etc.

Mobile Computing – Characteristics, Infrastructure vs Infrastructureless Networks, Routing Protocols in Mobile Adhoc Network (MANET), Overview of Bluetooth Technology. Overview of Sensor Networks. Concepts of Mobile IP, Wireless Application Protocols and others. Overall security requirements and considerations in wireless and mobile computing systems. Concepts of fault tolerance.

References:

1. V.K.Garg & J.E.Wilks:Wireless and Personal Communication Systems: Fundamentals and Applications, IEEE Press and Prentice Hall,1996.
2. T.S.Rappaport, B.D.Woerner and J.H. Reed:Wireless Personal Communications: The Evolution of PCS,Dkyener Academic,1996.
3. G.I. Stuber: Principles of Mobile Communication,Kluener Academic,1996.
4. U.Black:Mobile and Wireless Networks, Prentice Hall PTR,1996.
5. Charles Parkins – Mobile Adhoc Ntworks
6. Wireless Communication- W. Stallings
7. Mobile Communication – J. Schiller
8. Reseach Papers of International Journals, Proceedings of Conferences.

Paper-III

CSE 903 TH: Image Processing   **Credit:4**

Introduction, image definition and its representation, neighborhood. Orthogonal transformations like DFT, DCT, Wavelet.

Enhancement: contrast enhancement, smoothing and sharpening, filtering and restoration

Segmentation: pixel classification, global/local gray level thresholding, region growing, split/merge techniques, edge detection operators, Hough transform. Image feature/primitive extraction, component labeling, medial axis transform, skeletonization/thinning, shape properties, textural features – moments, gray level co occurrence matrix, structural features, Fourier descriptor, polygonal approximation. Compression: coding, quantization, spatial and transform domain based compression. Color image processing: color model, enhancement, and segmentation.

Mathematical morphology: basic concepts, erosion, dilation, opening, closing. Advanced applications like biomedical image processing, digital watermarking, etc

References:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, California, 1993.
2. Rosenfeld and A. C. Kak, Digital Picture Processing, Vol. 1 & 2, 2nd ed. Academic Press, Inc. 1982.
3. Chanda and D. Dutta Mazumdar, Digital Image Processing and Analysis, Prentice Hall of India, New Delhi, 2000.

Paper-IV

CSE 904C TH: Probability and Random Processes   **Credit:4**

1. Sample space and events, Probability axioms, conditional probability, independence of events, Bayes' rule.   [3 lectures]
2. Random variables -discrete and continuous. Expectations, Moments, Tchebyshev's inequality, Characteristic function. Functions of one random variable.   [6 lectures]
3. Discrete distributions: Binomial, Poisson, and continuous distributions: uniform, normal, exponential, gamma, Weibull etc.   [7 lectures]
4. Stochastic convergence and limit theorems.   [4 lectures]
5. Mean Square Estimation - linear regression.   [3 lectures]
6. General concepts of stochastic processes, Markov chains, Markov processes [5 lectures]
7. Power spectrum, spectral representation, basic spectral estimation,   [3 lectures]
8. Entropy   [2 lectures]
9. Random walks, shot noise, deterministic signals in noise,   [3 lectures]
10. Queuing theory (M/M/1 and M/M/C).   [4 lectures]

Books:

1. Probability, Random Variables and Stochastic Processes - fourth Edition" by A. Papoulis and S. U. Pillai, McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Probability & Statistics with Reliability, Queuing and Computer Science Applications. Kishore S. Trivedi. Eastern Economy Edition, PHI.
3. Stochastic Processes. J. Medhi. 3rd Edition, New Age. International, 2009.
4. *Fundamentals* of *Mathematical Statistics*: A Modern Approach. S. C.*Gupta* (Prof.), Dr. V. K. *Kapoor*. Edition, 10.Publisher, Sultan Chand, 2000.

Paper V: Computer Skills

Sessional Courses

Sessional 1

CSE 905 PR: Image Processing Lab   **Credit:2**

Understanding about different types of Digital images; Conversion between image data types; Basics of image display; Arithmetic Operations; Histogram Analysis; Neighborhood Processing; Image Geometry; The Fourier Transform of an image; Image Segmentation, Edge Detection; Morphological Operation; Color Image Processing; Image Compression; Wavelet Analysis

References Book:

1. "Digital Image Processing using Matlab", Rafael C. Gonzalez, Richard E. Woods, Steven Eddins.
2. "Mastering in Matlab", Duane C. Hanselman. Pearson Education.

Sessional 2

CSE 906 PR: Mobile Computing Lab   **Credit:2**

Implementation of Code Division Multiple Access (CDMA); Write a program to divide a given area into equal hexagon and divide the given frequency range into the cells to create clusters; Study of NS2; Implementation of scenario files for AODV, DSR and other routing protocols in NS2; Implementation of OLSR protocol in NS2 and its study; Study of wireless sensor network in NS2; Study assignment on: Bluetooth and Wireless Application Protocol (WAP).

References:

1. Mobile Communication – J. Schiller.
2. Mobile Computing – Raj Kamal.

3. The ns Manual – Kevin Fall, Kannan Varadhan

Second Semester: 600

Theoretical Courses

Paper-VI

CSE 101E TH: Elective Papers   Credit:4

CSE 101E1: Pattern Recognition

Introduction to pattern recognition and learning (supervised, unsupervised), training and test sets, feature selection.
Supervised learning and classification: Discriminant functions and decision boundaries Linear discriminant functions, relaxation procedure, non-separable behaviour Minimum distance classifier. Bayesian decision theory.Maximum likelihood classification. Parameter estimation, sufficient statistics, component analysis and discriminants (PCA, Fisher's) Nonparametric techniques. Density estimation, Parzen window, K-NN estimation, Decision Tree, SVM.
Unsupervised learning and clustering: Data description and clustering –similarity measures, criterion for clustering, Methods of clustering – partitional: KMean, KMode, KMedian, FCN, hierarchical, graph theoretic, density based, Cluster validity
Feature extraction and feature selection: Problems of dimensionality- Feature extraction --PCA- Feature selection –Karhunen Loeve, stochastic approximation, kernel approximation, divergence measures
References:
1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification and Scene Analysis, 2nd ed., Wiley, New York, 2000.
2. J. T. Tou and R. C. Gonzalez, Pattern Recognition Principles, Addison-Wesley, London, 1974.

CSE 1001 E2: Optical Communication & Networking

Abstract:
>   The main objective of this course is to introduce the students to the basics of modern optics and free-space optical communication systems. Free-space optical communication systems has been developed for providing high-data rate optical communication in situations where laying of optical fiber cables in ground is expensive or impossible. Examples are: installing new optical lines in built-up urban areas, communications between ships at sea or between satellites orbiting in space. Free-space optical communication systems also provide viable solutions to last-mile distribution of optical channels in PONs and high security communications. This course introduces a student to fundamental issues of free space optical communications including generation and modulation of laser beams, transmission of laser beams through atmosphere, reception of optical signals, coherent optical communications. Current research topics are also discussed towards the end of the course.

Detailed Contents:

Topic Name	Content	No of lectures
Introduction	Advantages of free-space optical communications, overview of the technology	1
Basic topics for Optics and Electromagnetic theory	Propagation of Plane and Spherical waves, Gaussian beams from lasers, Power and Intensity of a beam, Coherence of light, Temporal and Spatial coherence, Interference, Diffraction theory, Fraunhofer diffraction formulas.	4
Optical Transmitter	Transmitter design, Wavelength Selection, Eye Safety, Optical Sources, LED, Laser Diodes, Electro-optic Modulators, Acousto-Optic Modulators and Beam deflectors, Lens formulas, Gaussian Beam through a Lens, Launching light beams directly from Optical Fibers, Optical Amplifiers.	6
IM-DD Receiver design	Collecting light, Diffraction limited spot, Photodiodes – p-i-n and APD, Poisson statistics, Time Constant and Receiver Circuit, Transimpedance amplifiers (TIA), Random Noise in Receivers, Noise at the output of a p-i-n+TIA Receiver, Receivers with APD, Excess noise, Optimum APD gain, BER Calculation, Quantum Limit, Timing Jitter and BER Degradation, Effects of Misalignment.	12
Effects of Atmosphere	Absorption, Scattering, Scintillation from Turbulence, Fading	6
Free-space optical communication systems	Beam pointing, Beam acquisition and tracking, Power Budget of an Ideal FSO Link, Realistic FSO Link Design, Coherent Optical Receivers, Heterodyne and Homodyne Receivers, SNR and BER Calculations for various Modulation formats, PPM, Non-line-of sight optical communication	10
Conclusion	Overview, research issues	1

Prerequisites: Knowledge of Communication Systems, Signals and Systems, Electromagnetic theory.

Suggested Text/s:
     (a) Optical Communication - Gagliardi and Karp
     (b) Photonics - Saleh and Teich
     (c) Laser Communication - Majumdar and Ricklin
     (d) Free-Space Optical Communication – Willebrand and Ghuman

Outcomes and Objectives:
     (a) Ability to understand photonic components and subsystems required for free-spac optical communications.
     (b) Ability to understand the effects of atmosphere on the propagation of laser beams.
     (c) Apply the basic principles of optical communications to design free-space optical systems

Comments:

At present, simple demonstrations will be carried out during lectures using laser pointers and a few gratings and lenses. However, a teaching lab on modern optics and free-space optical communications should be developed in future for this course and other courses on optics/photonics/RF applications in modern ICT.

The lab will contain optical components such as diode lasers, lenses, and photodiodes, and optical measuring instruments so that students can make short distance optical communication links and networks. The lab will also contain optical CAD software packages so that students can design and simulate the behavior of complex laser communication systems needed for future generations.

CSE 101 E3: Software Engineering

Introduction and Brief Overview - Software process, modeling and analysis, software architecture, software design.
Software Modeling, Analysis, Testing - Analysis modeling and best practices, traditional practice diagrams such as DFDs and ERDs etc, Traditional Testing techniques – white box and black box testing.
Object-Oriented Software Engineering - Concept of OO Software – Design and Analysis, Overview of various UML diagrams and UML analysis modeling, analysis case studies, analysis tools, analysis patterns, OO software testing. Case study with complete examples
Software Architecture - Architectural styles, architectural patterns, analysis of architectures, formal descriptions of software architectures, architectural description languages and tools, scalability and interoperability issues, web application architectures, case studies.
Software Design - Design best practices, design patterns, extreme programming, refactoring, design case studies, component technology, object oriented frameworks, distributed objects, object request brokers, case studies.
Web Engineering, Clean room Engineering and other recent topics

References:
1. G. Booch, J. Rumbaugh, and I. Jacobson, I. The Unified Modeling Language User Guide. Addison-Wesley, 1999
2. E. Gamma, R. Helm, R. Johnson, and J. Vlissides. Design Patterns: Elements of Reusable Object-Oriented Software. Addison-Wesley, 1995
3. M. Shaw and D. Garlan. Software Architecture: Perspectives on an Emerging Discipline. Prentice-Hall, 1996
4. L. Bass, P. Clements, and R. Kazman. Software Architecture in Practice, Addison-Wesley, 1998.
5. J. Rumbaugh, I. Jacobson, and G.Booch. The Unified Modeling Language Reference Manual. Addison Wesley Longman, 1999.
6. I. Jacobson, G. Booch, and J. Rumbaugh, and I. Jacobson. The Unified Software Development Process. Addison Wesley Longman, 1999.
13
7. J. Rumbaugh, M. Blaha, W. Premerlani, F. Eddy, and W. Lorenson. Object-oriented Modeling and Design. PHI, EEE, 1997.

8. G. Booch. Object-Oriented Analysis and Design with Applications. Second Edition. Benjamin Cummings, 1994.
9. Jim Conallen. Building Web Applications with UML. Addison-Wesley, 2000.
10. K. Beck. Extreme Programming Explained. Pearson Education Asia, 2000.
11. Software engineering – design, reliability and management – Schuman Mar.
12. Software engineering – Pressman.

CSE 101 E4: VLSI &Microprocessor

Introduction to VLSI Design, Design Styles and parameters, popular technologies. Logic implementation with nMOS, CMOS. DCVS and PLAs. Pass vs.transistor logic,transit time, clocking, scaling, PLA minimization and folding, SIMPLIFY, ESPRESSO. Testability Issues. Physical Design algorithms: Partitioning, Floor planning and placement, Routing, compaction, gate arrays, FPGAs, MCMs. Data structures for layout desing -MAGIC. Design Rule checking, Expert systems, symbolic layout, complexity of layout algorithms.

Intel 8085 Microprocessor Architecture and its operation; Interfacing Devices; Introduction to Interfacing Memory and Input/output devices.Instruction Classification and Format, Instruction timings and operation status, Introduction to 8085 instruction set; Data transfer instructions, Arithmetic and logical operations, Branch operations, Advanced Instructions.Machine Language Programming, Assembly Language Programming, Debugging a Program,Programming Techniques viz Counting, Looping, Indexing, Stack operations andsubroutines.Intel 8085 interrupts, Different types of Interrupts, Interrupt Service Routines, Enabling and disabling Interrupts, Interrupt Vectors, Typical Interrupt Acknowledgment & Response .Basic Interfacing Concepts, Types of I/O, Interfacing Output Displays and Input Keyboards,Memory Mapped I/O and Interfacing Memory.Basics in Programmable I/Os, Intel 8255 Programmable Peripheral Interface, Intel 8253 Programmable Interval Timer, Intel 8155 and Intel 8755 Multipurpose Programmable Devices; Interfacing, Initialization, Programming typical Applications of all the devices.Interfacing Intel 8279 Programmable Keyboard/Display; Intel 8259 Programmable Interrupt Controller, modes; Intel 8257 DMA Controller, modes; Interfacing, Initialization,Programming typical Applications of all the devices.Serial I/O, Software Controlled Asynchronous Serial I/O, Hardware Controlled Serial I/O;Synchronous Serial Communication;

References:
1. C.Mead & L.Conway: Introduction to VLSI Systems, Addison Wesley.
2. A.Mukherjee: Introduction to CMOS VLSI, Prentice Hall.
3. Fabricius: Introduction to VLSI Design, TMH.
4. T.Ohtsuki: Layout Design and Verification, North Holland.
5. N.Sherwani: Algorithms for VLSI Physical Design Automation, Kluwer Academic.
6. M.Sarrafzadeh & C.K.Wong:An Introduction to VLSI Physical Design, MH.
7. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming & Applications with 8085", 5/E, Penram International Publishing (India) Pvt. Ltd., Reprint 2006.
8. R. Theagarajan, S. Dhanasekaran, S. Dhanapal, "MicroProcessor & It's Applications", New Age International Publishers, Reprint 2007. "
9. Introduction to Microprocessors: Software, Hardware, Programming, Leventhal; PHI

Paper-VII

CSE 1002C TH: Language Translator   **Credit:4**

Introduction: Introduction to language theory, tokens. Alphabets, definition of grammar Production rules, sentences, sentential forms, language definitions, derivations. **Regular languages:** Pumping Lemma of regular sets, Minimization of finite automata. Chomsky Hierarchy of languages. **Finite Automata :** Finite automaton, Deterministic, Non-Deterministic and equivalence. Transition diagrams, epsilon transitions, Equivalence of regular expressions and FA. Moore and Mealy machines. **Context Free Language:** Relations between classes of languages, Context Free Grammar, Derivation trees, ambiguity simplification, Normal forms, applications. **Lexical Analysis:** Interface with input, parser and symbol table, token, lexeme and patterns, difficulties in lexical analysis, error reporting, and implementation. Regular definition, Transition diagrams,LEX. **Syntax analysis:** context free grammars, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, Bottom up parsing, operator precedence grammars, LR parsers (SLR,LALR, LR), YACC.**Pushdown Automata :** Pushdown automata, definitions, context free languages, construction of PDA for simple CFLs, Linear bounded automata. **Turing machines:**Turing machines , Introduction to computability , Universal Turing Machines , Types of Turing Machines , Techniques for construction of Turing machines , Halting problem.
Assembler, Loader, Linker: basic concept; absolute and Relocatable,assemblers and macroprocessors Linkers- concept and design; loaders,different types. Editors and debuggers. Interpreters. Compilers: - Various phases; lexical analyzers- design. Parsing top down (L.L. (1) and recursive descent), bottom- up , (Shift – reduce concept to L.R. (1) symbol tables,error handling. Syntax – directed Translation – attributes and intermediate codes. Optimization concepts and machine code. Generation Use of LEX andYACC.

References:
1. John C. Martin: Introduction to languages and the theory of computation, 2nd Ed., McGraw Hill.
2. D.P. Bovet & P. Gescenzi: Introduction to Theory of Complexity, PH.
3. Rozenberg & Salomaa: Handbook of Formal languages, Vol. I&II.

Paper-VIII

CSE 1003C TH: Network Security & Cryptography   **Credit:4**

Network Security: Introduction – Basic Security Concepts - Threats, Vulnerabilities, and Attacks - Encryption, Digital Signatures, and Certification Authorities - Kerberos Key Exchange - Encryption on the World Wide Web - E-Mail Security - Operating System Security - LAN Security - Media and Protocols - Routers and SNMP - Virtual Private Networks – Firewalls –

Biometrics - Policies and Procedures - Auditing, Monitoring, and Intrusion Detection - Crisis Management – Cookies and Cache – Security of Web-based Systems

Suggested Text:
1. John E. Canavan, "Fundamentals of Network Security", Artech House, 2001.
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, 2006.

References:
1. Matt Bishop and Sathyanarayana S.Venkatramanayya, "Introduction to Computer Security", Pearson Education, 2005.
2. Matt Bishop, "Computer Security: Art and Science", Pearson Education, 2003.
3. Nitesh Dhanjani and Justin Clarke, "Network Security Tools", O'Reilly, 2005.

Cryptography: Extended Euclidean Algorithm, Congruence, Chinese Remainder Theorem, Euler's Theorem, Primitive elements and conjugates in finite fields, Quadratic Reciprocity Law, Jacobi and Legendre's symbols, Gaussian Integers, Carmichael Numbers and strong pseudo-primes, Addition Chain Problems.
• Factorization schemes of Solovay-Strassen, Miller-Rabin, Pollard, Factor bases and Continued Fraction methods.
• Classical Cyphers and one time pad, Public Key Cryptography-Diffie Hellmann, RSA, Massey O'Mara, EI Gamal Schemes, Kbapsacj based schemes, Mental Poker, Linear Feedback Shift Registers-Threshold schemes for Key Management, Access Control, Inference Control-Security of Statistical Databases.
• Elliptic curve Cryptosystems and Factorization-Lenstra's Algorithm.
• Packing and Covering radii of codes, Golay Code, Reed-Mueller Code, BCH Code, Reed Solomon Code, Quadratic Residue Code, Alternant Code, Goppa Code, Justine Code, MDS Codes, Invariant theory and self-dual codes, Concatenated codes, Bounds of Singleton, Johnson, Plotkin and Elias.
• Group Algebra, Weight Enumerators and Krawtchouk Polynomials, Automorphism groups of codes, Designs and codes-intersection numbers of t-designs.

References:
1. Neal Koblitz: A Course in Number Theory and Cryptography, Springer.
2. Itrlsnf & Rosen: Second Course in Number Theory, Springer.
3. Evangels Kramakis: Primality & Cryptography, John Wiley.
4. Mc Williams & Sloanne: Theory of Error Correcting Codes, Vol. I & II, Elsevier.
5. Steven Roman: Coding and Information Theory, Springer.

Paper-IX

CSE 1004E TH: Elective Papers   **Credit:4**

 CSE 1004 E1: Optical Information Processing

Objectives: To introduce the student to the basics of modern optics and photonic devices that can be used for high information processing and computing. The student will learn about 2-dimentional signals and systems and rudimentary image processing, optical physics related to the

propagation of laser beams and passage of the optical beams through two-dimensional phase objects such as lenses and prisms. The student will learn about interference, holography and acousto-optic interactions. Combining these ideas the student will learn how to calculate 2-D Fourier transform of images through diffraction of light, optical spectral analysis, holographic pattern recognition, image processing, cross-connect and switch design, optical neural networks and other computing systems.

Prerequisites: Knowledge of Signals and systems, Electromagnetic theory
Introduction: Image Processing: 2D signals, 2D Fourier transform**,** Properties of 2D Fourier transform,2D systems theory**,** Spatial filtering,2 class pattern recognition.
Optics: Propagation of plane waves, Gaussian beams**,** Diffraction analysis, Near and far field Diffraction Calculations, Coherence of light, Interference and Interferometers**,** Principles of Holography, Reconstruction from holograms**,** Applications of holography.
Optical Devices: Transparent phase objects, Prisms, Lenses, Spatial light Modulators, Gratings, Acousto-optic Devices.
Optical Signal Processing and Computing: Lens for 2D Fourier transform, Imaging and image processing, Spatial filtering with lens, Use of gratings in spatial spectrum analysis,
Acousto-optic based signal processing, Fourier transform holography, Optical pattern recognition, Joint transform correlator systems, Photorefractive effect, Optical bistability,Nonlinear optics, Optical switches, Optical computing, Optical neural networks, Review and Discussion

Possible Textbooks:
      (1) Introduction to Fourier Optics – J.W. Goodman
      (2) Optical Information Processing – F.T.S. Yu and S. Jutamulia
      (3) Photonics – B. Saleh and M. Teich

CSE 1004 E2: Distributed Computing

Introduction: Important Issues. Models of Distributed Systems - Shared Memory Systems, Message Passing Systems. High level Nets Program Representation - Non-determinism - Guarded Commands - Atomicity-Fairness Central and Distributed Schedulers. Correctness Criteria - proving safety and liveness properties. Distributed Multual Excusion Distributed Shapshot Global State Collection Synchronous Message Passing -CSP-Client Server Computing. Fault Tolerant Systems-Fault Classification. Distributed Consensus-Byzantine Generals problem-Atomic Broadcast. Leader Election Clock Sunchronization.
References:
1. N.A.Lynch: Distributed Algorithms, Morgan Kayfmann Publishing Inc., CA,1996.
2. Tel: Introduction to Distributed Algorithms.
3. A.S. Tanenbaum: Distributed Operating Systems. Prentice Hall, N.J.,1995.

CSE 1004 E3: Soft Computing

Fuzzy logic: Conventional and fuzzy sets, operations on fuzzy sets, fuzzy numbers, crisp relations and fuzzy relations, realization of fuzzy systems using fuzzy relations, application of fuzzy logic in optimization, vision, pattern recognition.

Neurocomputing: Introduction to neural networks, threshold logic

Models of neurocomputing: Perceptron,. Adaline, Multi-layer perceptron, backpropagation learning, RBF network, Hopfield networks, ART –I and II, SOFM. Applications in pattern recognition and image processing.

Evolutionary computing: Introduction to Evolutionary Computation: Genetic algorithms, Genetic programming, Evolutionary strategies, Evolutionary programming.

Genetic algorithms – Chromosome representation, encoding, decoding, Genetic operators: Selection, Crossover, Mutation, Elitism, Schema Theorem, EGA, Convergence theorem, real-coded GA, Ordered GA, Steady-state GA, Multi-objective evolutionary algorithms, applications in search and optimization. Recent advances in Evolutionary Computing (Particle Swarm Optimization, Ant Colony Optimization).

Hybridizations: Different types of integrations, merits. Neuron-fuzzy, Neuro-GA, Fuzzy-GA, Neuro-fuzzy-GA

References:

1. G. J. Klir and B. Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.
2. K. H. Lee, First Course on Fuzzy Theory and Applications, Springer, 2005.
3. S. Haykin, Neural Networks: A Comprehensive Foundation, 2nd ed., Prentice Hall, New Jersey, 1999.
4. J. M. Zurada, Introduction to Artificial Neural Systems, West Publishing Co., St. Paul, Minnesota, 1992.
5. J. Hertz, A. Krogh, and R. G. Palmer, Introduction to the Theory of Neural Computation, Addison Wesley, California, 1991.
12
6. B. Yegananarayanan, Artificial Neural Networks, Prentice Hall of India, New Delhi, 1999.
7. C. M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
8. D.E. Goldberg, Genetic algorithms in search, optimization and machine learning, Addison Wesley, 1989.
9. Z. Michalewicz, Genetic algorithms + data structures = evolutionary programs, Springer-Verlag, 1994.
10. J.S.R Jang, C.T Sun and E Mizutani, Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, Pearson Education, 1996.
11. S. Rajasekharan, G. A. V. Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms, PHI, 2003.
12. M. Dorigo aand T. Stutzle, Ant Colony Optimization, PHI, 2005.
13. J. Kennedy and R. C. Eberhart, Swarm Intelligence, Morgan Kaufmann Publishers Inc,US, 2001.

CSE 1004 E4: Introduction of Quantum Computing

Mathematical foundations and quantum mechanical principles [8 lectures]

a. Finite dimensional inner product spaces, Hermitian and unitary operators, projection operators, commutators
b. Hilbert space as state space, Schrodinger equation and time evolution, measurement, Heisenberg uncertainty relation, Dirac notation, density operators, quantum entanglement

Qubits, quantum gates and quantum circuits [20 lectures]

c. Concept of qubit, representation of qubit in Bloch Sphere, Multi qubit quantum state representation
d. Single, Two and Multi-qubit quantum gates, Matrix representation of gates, universal gates for quantum computing
e. Quantum Circuit, Reversible Computation using quantum circuits, quantum parallelism, quantum circuit representation, quantum computing language (QCL) for quantum process description, Quantum Circuit description languages
f. Quantum Adder Circuits, Quantum Fourier transform Circuit, Quantum Multiplier, Quantum Shift register.
g. Quantum Physical Machine Description, Quantum Circuit Cost.
h. Synthesis techniques for quantum circuit

Quantum algorithms [12 lectures]

i. Elements of quantum automata and quantum complexity theory.
j. Deutsch's algorithm, Deutsch-Jozsa Algorithm and the Bernstein-Vazirani Algorithm, Simon's algorithm
k. Quantum Fourier transform, Shor's Algorithm and its applications.
l. Grover's algorithm for searching and its applications.

Books:
1. Quantum Computation and Quantum Information by Michael Nielsen and Isaac Chuang, Cambridge Univ. Press.
2. P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press

Good lecture notes:

John Preskill's lecture notes-http://www.theory.caltech.edu/people/preskill/ph229/

David Mermin's lecture notes-http://people.ccmr.cornell.edu/mermin/qcomp/CS483.html

Sessional Courses

Sessional 1

CSE 1005C PR: Term Paper Leading to Thesis   **Credit:2**
Sessional 2

CSE 1006C PR: Design Project   **Credit:2**

Third Semester: 500

Thesis Identification, Literature Survey and Plan of Work (Thesis: Phase-I)

CSE 1101C PR: Thesis Report Interim   **Credit:4**

CSE 1102C PR: Thesis Seminar Interim (Presentation & Viva-Voce)   **Credit:4**

CSE 1103C PR: Technical Communication   **Credit:2**

CSE 1104C PR: Workshop and Seminars   **Credit:1**

CSE 1105 E TH: Elective Papers   **Credit:4**

CSE 1105 E1: Business Ethics

CSE 1105 E2: Fuzzy Set Theory

CSE 1105 E3: Financial Management

CSE 1105 E4: Modern Control System

CSE 1105 E5: Big Data and Data Science

Data Science History; Pioneers; and Modern Trends, Taxonomy, The Curse of Big Data, New Types of Metrics, Three Classes of Metrics, Relationship among Metrics, 5V of Data Science   6L
Introduction to Big data Platform, Traits of Big data, Challenges of Conventional Systems, Evolution Of Analytic Scalability, Analytic Processes and Tools, Analysis vs. Reporting   6L
Modern Data Analytic Tools, Data Structure, Overview of R language, Data Types, Accessing Data, Cleaning Data   6L
Basic Statistical Concepts: Sampling Distributions; Re-Sampling; Statistical Inference; Prediction Error, Hash Joins, Model-Free Confidence Intervals, K-means Clustering, Independent Sample Tests, Basic Association Analysis, Association Rule Speedup   8L
Linear regression part 1, Linear regression part 2, Logistic regression, Naïve Bayes, Decision trees part 1, Decision trees part 2, Correlation and R-Squared for

Big Data, Monte Carlo Simulations   6L
Introduction to Hadoop/MapReduce, The MapReduce paradigm & Hadoop and HDFS overview, When to Use MapReduce, What MapReduce Can't Do, Comparison between SQL and NoSQL DBs, Overview on BigTable; Hive and Pig, Visualization tools   8L

Fourth Semester: 500

Thesis Implementation (Thesis: Phase-II)

CSE 1201C PR: Thesis Report Final   **Credit:4**

CSE 1202C PR: Thesis Seminar Final (Presentation & Viva-Voce)   **Credit:4**

CSE 1203C PR: Workshop and Seminars   **Credit:1**

CSE 1204E TH: Elective Papers   **Credit:4**

CSE 1204E1: Fundamentals of Management

CSE 1204E2: Bioinformatics: Sequence analysis

CSE 1204E3: Advanced Imaging Techniques

Basics of digital imaging-Prerequisite   4L
Significance of imaging in biomedical application   1L
Various imaging techniques used in biomedical imaging

- Principle and functionality of X-ray
- Principle and functionality of CT
- Principle and functionality of MRI
- Principle and functionality of PET
- Principle and functionality of SPECT   15L
- Principle and functionality of DTMRI
- Principle and functionality of EEG
- Principle and functionality of FRET
- Principle and functionality of FMRI
- Principle and functionality of MEG

Issues and challenges in thermal imaging. Technical details, application of thermal imaging in medical science.   5L
 Fundamentals of infrared imaging, its use in remote sensing/GIS, issues in hyperspectral imaging.   10L
Principles and functioning of satellite imaging. Challenges pertaining to transmission/communication.   5L

CSE 1204E4: Web Technology

CSE 1204EF: Elective Foundation   **Credit:2**

CSE 1204EF1: Communicative English

CSE 1204EF2: Yoga

CSE 1204EF3: NSS and Social Services

Basics of Wireless Communication   Credit: 4

Wired and wireless, Mobility of users and equipments, Overview of Electromagnetic Spectrum, Radio and Microwave communication, Infrared and Millimeter waves, Lightwave Transmission. Overview of Satellite Networks. Concepts of Spread Spectrum, CDMA System. Wireless LANs -MACA and MACAW protocols. Concepts of Cellular Network and related technologies like GSM, GPRS etc.

Characteristics, Infrastructure vs Infrastructureless Networks, Routing Protocols in Mobile Adhoc Network (MANET).

References:
1. V.K.Garg & J.E.Wilks:Wireless and Personal Communication Systems: Fundamentals and Applications, IEEE Press and Prentice Hall,1996.
2. T.S.Rappaport, B.D.Woerner and J.H. Reed:Wireless Personal Communications: The Evolution of PCS,Dkyener Academic,1996.
3. G.I. Stuber: Principles of Mobile Communication,Kluener Academic,1996.
4. U.Black:Mobile and Wireless Networks, Prentice Hall PTR,1996.
5. Charles Parkins – Mobile Adhoc Ntworks
6. Wireless Communication- W. Stallings
7. Mobile Communication – J. Schiller
8. Reseach Papers of International Journals, Proceedings of Conferences

Fundamentals of Image Processing   Credit: 4

Introduction, image definition and its representation, neighborhood. Orthogonal transformations like DFT, DCT, fog correction and convolution
Enhancement: contrast enhancement, smoothing and sharpening, filtering and restoration
Segmentation: pixel classification, global/local gray level thresholding, region growing, split/merge techniques, edge detection operators, Hough transform. Image feature/primitive extraction, component labeling, medial axis transform, skeletonization/thinning, shape properties, textural features – moments, gray level co occurrence matrix, structural features, Fourier descriptor, polygonal approximation. Compression: coding, quantization, spatial and transform domain based compression.

References:
1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, California, 1993.
2. Rosenfeld and A. C. Kak, Digital Picture Processing, Vol. 1 & 2, 2nd ed. Academic Press, Inc. 1982.

3. Chanda and D. Dutta Mazumdar, Digital Image Processing and Analysis, Prentice Hall of India, New Delhi, 2000.

Proposed detail syllabus for Ph. D. coursework in the Department of Computer Science and Engineering, Tripura University.

Image Processing and Computer Vision

Digital Images, Fundamental steps in Digital Image Processing, Components of Digital Image Processing system. Digital Image Fundamentals-Neighbourhood, Connectivity, boundaries, Relations, Distance Measures, Arithmetic/Logic Operations,

Image Acquisition and Representation: Fundamental of visual perception, Image acquisition, Fundamentals of CCD Camera, Scanner, visual and other domains. Image sampling and quantization. Representation in different file formats. Different image categories.

Image Enhancement: Gray Level transformations, Histogram processing

Spatial Domain Methods- Mean and median filters, Image Sharpening.

Enhancements in the frequency domain – Fourier transform, Low pass filtering, High pass filtering, Ideal, Butterworth, and Gaussian Filters.

Image Restoration: Differences in noise removal and restoration, noise models, degradation Model, Different spatial and frequency domain filters, Estimation of degradation function, Inverse filters; Wiener Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.

Image Segmentation: Point Detection, Line Detection, Edge detection- first order and second order gradients. Thresholding – Global and/or optimal thresholding techniques; Region-based segmentation, Region Growing, Region Splitting and Merging.

Colour Image Processing: Colour models, Colour transformations, Smoothing and sharpening of colour images, colour image segmentation.

Morphological Image Processing: Dilation, Erosion, Opening, Closing, Hit-or-miss transformation, Boundary extraction, thinning, Descriptors for binary regions. Extension of these operators to gray level images with applications.

Image Compression: Concept of redundancy, different redundancies, Fidelity criteria, Image compression models.

Lossless compressions: Huffman coding, Arithmetic coding, LZW coding, Lossless Predictive coding.

Lossy compressions: Lossy predictive coding, Transform coding, wavelet coding etc Compression standards.

Shape detection: Least Mean Square error line fitting, Eigenvector line fitting, Straight line Hough Transform, Generalized Hough Transform.

Image Understanding: Feature extraction techniques. Statistical Decision making techniques, Nearest Neighbour Clustering, Maxi-min Clustering, Discriminant functions, Artificial Neural Networks.

Books:
1. Digital Image Processing, Gonzalez and Woods, Pearson
2. Digital Image Processing, Castleman, Pearson
3. Digital Image Processing, Jahne, Springer India
4. Digital Image Processing & Analysis, Chanda & Majumder, PHI
5. Fundamentals of Digital Image Processing, A. K. Jain, PHI
6. Pattern Recognition and Image Analysis: E. Gose, R. Johnsonbaugh, Steve Jost, Prentice Hall India.

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Pattern Recognition and Machine Learning

Basics of pattern recognition, Problems in Pattern Recognition, Pattern Recognition System Design, Template Matching, Decision Functions, Hyperplane and its Properties, Curse of Dimensionality, Dimensionality Reduction, Accuracy, Error Surface, Error Rate and Error Bound, Computational Complexity, Examples and Applications

Feature Generation: Basic Concepts, Basis Vectors, Principal Component Analysis, Singular Value Decomposition, Discrete Cosine and Sine Transform, Discrete Fourier Transform, Discrete Wavelet Transform, Regional Features, Features for Shape and Size Characterization.

Feature Selection: Preprocessing, Data Normalization, Feature Selection Based on Statistical Hypothesis Testing, Class Separability Measure, Feature Subset Selection.

Bayesian decision theory: Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, Discrete features

Parameter estimation methods: Maximum-Likelihood estimation, Bayesian estimation

Non-parametric techniques for density estimation: Parzen-window method, K-Nearest Neighbour method.

Linear Classifiers: Perceptron, Least Square Method, Support Vector Machines

Nonlinear Classifier: Multilayer Perceptron, Backpropagation Algorithm, Polynomial Classifier, Radial Basis Function Networks, Nonlinear Support Vector Machines.

Context-Dependent Classification: Bayes Classifier, Markov Chain Models, Hidden Markov Model.

Clustering: Sequential and Hierarchical Clustering, k-means, c-means Algorithms, Vector Quantization, Cluster Validity

Syntactic Pattern Recognition: Grammar Based Approach and Applications, CYK Parsing Algorithm, Graphical Approaches, Learning Via Grammatical Inference

Machine learning concepts and limitations: Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, PAC learning, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.

Machine learning assessment: Statistical model selection, structural risk minimization

Ensemble learning methods: Voting, bagging, boosting.

Decision tree learning algorithms:

Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples, entropy, mutual information, ID3 algorithm, handling continuous and missing attributes, confidence, overfitting, pruning, learning with incomplete data

Support Vector Machines:

Margin of a classifier, dual perceptron algorithm, learning non-linear hypotheses with perceptron kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier.

Assessing and comparing learning algorithms: bootstrapping, K-fold cross validation, hypothesis testing

Mili Nampui

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Reinforcement Learning: Control learning, Q-learning, Convergence.

Books:

1. R. O. Duda, P. E. Hart and D. G. Stork, "Pattern Classification," John Wiley, 2001
2. S. Theodoridis and K. Koutroumbas, "Pattern Recognition," 4th Ed., Academic Press, 2009
3. C. M. Bishop, "Pattern Recognition and Machine Learning," Springer, 2006
4. R. Schalkoff, "Pattern Recognition," Wiley, 2007.
5. K. Fukunaga, "Introduction to Statistical Pattern Recognition," Academic Press, 1990
6. T. M. Mitchell, Machine Learning, McGraw-Hill, 1997.
7. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2006.
8. Vladimir N. Vapnik, Statistical Learning Theory, John Wiley and Sons, 1998.
9. Shawe-Taylor J. and Cristianini N., Cambridge, Introduction to Support Vector Machines, University Press, 2000.

Biometric Systems

Introduction to Biometric Systems: History, Definition, Characteristics, Applications.
Signal processing and Pattern recognition Fundamentals: Acquisition of biometric samples, Representational formats, Dimensionality reduction, Classification, Matching.
Biometric Systems Performance Terminology: Performance assessment terminology, Testing methods used in biometrics, Graphical analysis of system performance.
Face Recognition: Anatomy and discussion of face features, Feature extraction, Classification & Recognition, Evaluation.
Iris Recognition: Anatomy and discussion of iris features, Feature extraction, Classification & Recognition, Evaluation.
Fingerprint Recognition: Anatomy and discussion of fingerprint features, Feature extraction; discussion of fingerprint features, Classification & Recognition, Evaluation.
Signature Recognition: Discussion of signature features, Feature extraction, Classification & Recognition, Evaluation.
Multi-biometric Systems: Introduction to multi-biometric systems, Types of multi-biometric systems, levels of fusion in multi-biometric systems.
Biometric Standards: Introduction to biometric standards, importance of biometric standards, privacy, interoperability of data, systems and applications.

Books:

1. Biometrics: Theory, Methods & Applications, N. V. Boulgouris, K. N. Plataniotis, E. Micheli-Tzanakou, IEEE Press, 2009.
2. Biometric Systems: Technology, Design & Performance Evaluation, J. Wayman, A. K. Jain, D. Maltoni, D. Maio, Springer Verlag, 2004.
3. Handbook of Biometrics, Springer Verlag, 2008, A. K. Jain, P. Flynn and A. A. Ross.

Prepared by:

4. Samir Nanavati, Michael Thieme, Raj Nanavati, "Biometrics – Identity Verification in a Networked World," WILEY- Dreamtech
5. Paul Reid, "Biometrics for Network Security," Pearson Education.
6. John D. Woodward, Jr. "Biometrics- The Ultimate Reference," Wiley Dreamtech.

Sensors and systems

Universal Sensors and Transducers Interface (USTI), Optoelectronic Digital Sensors and Sensor Systems, Digital Temperature Sensors and Sensor Systems, Digital Pressure Sensors and Transducers, Digital Humidity, Dew Point and Moisture Sensors, Digital Accelerometers, Inclinometers and Gyroscopes, Rotational Speed Sensors, Chemical Sensors and Biosensors, Capacitive Sensors Interfacing, Resistive Sensors Interfacing, Resistive-Bridge Sensors Interfacing, DAQ Systems for Quasi-Digital Sensors and Transducers, Intelligent Sensor Systems, IEEE 1451 Standard Extension and Adaptation for Quasi-Digital Transducers, Self-Adaptive Sensors and Sensor Systems

Emerging Sensors: High speed imaging, 3D range sensors, Femto-second concepts, Front/back illumination, Diffraction issues.

Beyond Visible Spectrum: Multispectral imaging and Thermal sensors, Fluorescent imaging.

Image Reconstruction Techniques, Deconvolution, Motion and Defocus Deblurring, Tomography, Heterodyned Photography, Compressive Sensing.

Cameras for Human Computer Interaction (HCI): 0-D and 1-D sensors, Spatio-temporal coding, Frustrated TIR, Camera-display fusion.

Useful techniques in Scientific and Medical Imaging: CT-scans, Strobing, Endoscopes, Astronomy and Long range imaging.

Case study: Microsoft Kinect, Nintendo 3DS, NVIDIA 3D Vision, Dual-stacked LCDs, 3D medical imaging displays, Range cameras, Retinal imaging devices, Thermal IR cameras, Light field cameras (5x5 camera array)

Books:
1. Habib F. Rashvand and Jose M. Alcaraz Calero, Distributed Sensor Systems: Practice and Applications, John Wiley & Sons Ltd.
2. Sergey Y. Yurish, Digital Sensors and Sensor Systems: Practical Design, International Frequency Sensor Association (IFSA) Publishing
3. Jon S. Wilson, Sensor Technology Handbook

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Paper III.C: VLSI/FPGA

Introduction to VLSI Design, MOS transistor theory and CMOS logic and fabrication; CMOS Combinational and Sequential Circuit Design: Inverters, Tri-State Logic, Pass Transistor, Multiplexer, Latches and Flip Flops; Low Power VLSI Design: Static and Dynamic Power Components, Circuit Design Strategies for Low Power, Architectural Strategies For Lower; Introduction to VLSI CAD: ASIC and FPGA Flow; VLSI Physical Design: Layout, Placement, Floorplanning, Global and Detailed Routing; Testing and Design for Testability: Fault Models, Test Pattern Generation, Built in Self Test.

Books:

1. Weste and Harris, CMOS VLSI Design
2. Mead and Conway, Introduction to VLSI Systems
3. N. Sherwani, Algorithms for VLSI Physical Design Automation
4. G. DeMicheli, Synthesis and Optimization of Digital Circuits
5. B. Preas & M. Lorenzetti, Physical, Design Automation of VLSI Systems
6. M. Abramovici, M. A. Breuer, and A. D. Friedman, Digital Systems Testing and Testable Design
7. J. D. Ullman, Computational Aspects of VLSI
8. Breuer and Friedman, Diagnosis & Reliable Design of Digital Systems

Amlan Chakrabarti

13/5/2013.

Amlan Chakrabarti
Associate Professor & Coordinator
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Advanced Computer Networks and Communications

Group-A

*Fundamentals of Networks, wireless networks, Satellite networks with basic communication principles. * Protocols and Standards: OSI Models, TCP/IP suit, X 25 protocol suit and their applications. * Sockets: Fundamentals of socket and socket based communications; Interposes communication in distributed and cloud environment. * Services: Flow Control, Congestions and error control in distributed and cloud environment. * Client Server Model: Client Server Computing in distributed and cloud environment, Concurrency Control, Process management, System calls in TCP and UDP. * Web Administration and Management

Group-B

*Wireless Network WLAN-architecture and Applications, * Sensor Networks-architecture, protocols and applications, * RFID based Communication and Management, * Wireless Ad-hoc Network: MANET architecture protocols in MANET-DSR, AODV, DSDV, TORA etc, * Mobile Agent, * Network Simulators: NS2 , OMNET, QUALNET, * Case study of an wireless Network Simulator- performance metrics, * VNC Services: Principles of VNC Services, Updating of Servers through VNC services in cloud environment, * VPN: Principles of VPN, Setting up wireless LAN, APN setting, * Internet Connectivity through APN Mobile Internet, APN as hotspot, SIM based Internet, * Architecture and Application of Social Networks

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