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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Minutes of 19th Board of Studies Meeting

June 30th, 2018

19th BoS meeting of Computer Science and Engineering Department was held on June 30th, 2018, from 9:30 AM to 5:00 PM in Rose Hall.

The following members were present:

1. Dr.K. Thirupathi Rao, Professor, Chairman

2. Dr.Pranveer Singh Satvat, Dean Academics, Patron

3. Dr.V. Hari Kiran, Assoc. Professor, Member

4. Dr. L.S.S. Reddy, Vice Chancellor ,Member

5. Dr. Siba Kumar Udgata, Professor, External Member

6. Dr. D. V. L. N. Somayajulu, Professor, External Member

7. Dr.Dr. Venkata Ramana Badarla, Assoc. Professor, External Member

8. Dr.Madhu Muthyam, Professor, External Member

9. Mr. M. Muni Reddy,Sr. Manager, External Member

10. Dr. Amaralingeswara Rao Kaka, Program Director, External Member

11. Mr.Jagan Mohan Chevvakula, Sr. Qa Manager ,External Member

12. Mr. Pratap Reddy, Data Scientist, External Member

13. Mr.Kosiganti Srinivas, Senior Consultant, External Member

14. Dr.V. Srikanth, Professor, Member

15. Dr.K. Vinuthna, Assoc. Professor, CSE-Hod, Member

16. Dr.J. Chandra Shekar, Assoc. Professor, Member

17. Dr.R. Radha, Professor, Member

18. Dr.B. V. Appa Rao, Professor, Department of Maths, Member

19. Dr.Sabitha, Professor, Department of English, Member

20. Dr.Shanmukh Kumar, Professor, Department of Chemistry, Member

21. Dr.M. Kameswara Rao, Assoc. Professor, Department of ECM, Member

22. Dr.Dr. B. T. P. Madhav, Professor, Department of ECE, Member

23. Dr.M. V. V. K. Srinivas Prasad, Professor, Department of Physics, Member

24. Dr.V. Chandra Prakash, Professor, Member

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25. Dr.Dr.S.Venkateswarulu, Professor, Member

26. Dr.K. Subrahmanyam, Professor, Member

27. Dr.M. R. Narsinga Rao, Professor, Member

28. Dr.D. Rajeswara Rao , Professor, Member

29. Dr.M. S. R. Prasad, Professor, Member

30. Dr.K. V. V.Satyanarayana, Professor, Member

31. Dr.Gandharba Swain, Professor, Member

32. Dr.Dr.M.Sreedevi, Professor, Member

33. Dr.G. Krishna Mohan, Professor, Member

34. Dr.S. Satyanarayana, Professor, Member

35. Mr.B. Tirupathi Reddy, Assoc. Professor, Member

36. Dr.K. Bhagavan, Assoc. Professor, Member

37. Mr.M. Vishnuvardhan, Assoc. Professor, Member

38. Mrs. Ch. Radhika Rani, Asst. Professor, Member

39. Mrs.V. Divya,Asst. Professor, Member

40. Mrs.A. Roshini, Asst. Professor, Member

41. Mrp. Srikar (150030666), Student, Student Member

42. Ms.D.Ramya (150030232), Student, Student Member

43. Ms.R.Nandana Priyanka (150030250), Student, Student Member

44. Ms.N.Geeta (150030278), Student, Student Member

45. Mr.V. Sandeep (14003136), Student, Student Member

Members Absent: ---NIL---

The Chairman, BoS welcomed all the members to the BoS meeting and started the meeting by highlighting the Vision & Mission statements of Department and University. He also spoke about PEOs, POs and PSOs of the program.

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AGENDA and RESOLUTIONS

AGENDA ITEM-1

Consider and approve DAC minutes held on 26th June,2018 and 27th June, 2018	Resolution: Approved DACminutes and recommended the Academic Council for approval

- Chairman of BoS opened the meeting by welcoming and introducing the external members, to the internal and co-opted members and thanked them for accepting to become the members of the Board of Studies.

- Chairman of the BoS informed all the members about the Department Academic Committee (DAC) meeting held on 26th June,2018 and 27th June 2018 (Agenda Item No:1) and highlighted the major resolutions of discussion.

  It is resolved to approve the recommendations made by DAC. **Annexure-1 DAC minutes(Dt: 26-06-2018 and 27-06-2018)**

AGENDA ITEM-2A

Proposed to introduce courses for B.Tech CSE 2018-19 admitted Batch based on the feedback received from stakeholders.	Resolution: Approved the introduced courses for B.Tech CSE 2018-19 admitted Batch students and the same is recommended to the Academic Council for approval

To consider and approve the introduced courses for 2018-19 admitted batch students based on the stake holder's feedback.

- ✓ Mr.Mahendranath.N, Alumni, Gayatri Educational Society, Director, strongly recommended the inclusion of courses that improve students' communication skills into the curriculum. It is resolved and approved to introduce new courses "Professional Communication Skills" and "English Proficiency" to 2018-19 admitted batch students.

- ✓ Dr. Vivek S Deshpande, Academic peer, recommended to include "Quantum Physics for engineers" course under basic science category. It is resolved to introduce "Quantum Physics for engineers" course as new course to 2018- 19 admitted batch students.

- ✓ Mr. Poothabalan Somasundaram, Software Architect, Honeywell Technology

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advised including courses which improve coding skills related to Technical Skilling. It is resolved to introduce the new courses "Technical Skilling – 1 and Technical Skilling - 2"to 2018-19 B.Tech admitted batch students.

✓ Mr.CH.RAMAIAH, Faculty suggested introducing a new course, Microprocessors, that gives a basic knowledge to learn IOT specialization courses. It is resolved to approve introducing new course "Microprocessors" to 2018-19 admitted batch students.

✓ Mr. B. Srikanth industry person, recommended including placement training so that studentscan be equipped with skills necessary for placements. It is resolved and approved to introduce new courses on Placement training in the curriculum of 2018-19 admitted batch students.

✓ Vijay Krishna Pala Industry person suggested Data Science to equipping students with cutting-edge skills vital for navigating the data-driven landscape. It is resolved and approved to introduce a new course "Data Science" to offer for 2018-19 admitted batch students.

✓ Dr.V Murali Mohan, Associate Professor, Faculty suggested including any Full Stack Development Courses into the Curriculum under Skill Development. It is resolved to introduce a new course "Technical Skilling (PFSD + Comp. Coding)" to 2018- 19 B. Tech admitted batch students under the SDC category.

✓ Prof.A.S.N.Chakravarthy, Academic Peer suggested to introduce new course on Big Data Analytics which helps student to grow significantly in data-driven decision-making and providing students with essential skills for navigating and analyzing large-scale datasets. It is resolved to introduce "Big data Analytics" course as new course to 2018-19 admitted batch students.

✓ Mr.Sagireddy Pulla Reddy, SP Software, Industry Person suggested to include "Internet ofThings (IoT): Architectures and Protocols" which helps to prepare students for the evolvingtechnological landscape. It is resolved to introduce the new course "Internet of Things (IoT): Architectures and Protocols" to 2018-19 B.Tech admitted batch students.

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S.No	Course Code	Course Title	Course Type	Credits	Remarks
1	18UC1202	English Proficiency	Humanities & Social Sciences	2	Introduced in place of Building Blocks for Communication Skills course
2	18UC2103	Professional communication skills	Humanities & Social Sciences	2	Introduced in place of Corporate Communication Skills course
3	18PH4101	Quantum Physics for Engineers	Basic Science	3	Introduced in place of Engineering Materials course
4	18SC1106	Technical Skilling - 1 (Coding)	Engineering Science	1.5	Introduced in place of Introduction to Computer Science and Engineering course and Skilling for Engineers – 1 course to improve the coding skillset for students.
5	18SC1207	Technical Skilling - 2 (Coding)	Engineering Science	1.5	
6	18CS2111	Microprocessors	Engineering Science	4	Introduced in place of Basic engineering measurements course to offer basic knowledge on microprocessors
7	18TS307	Placement Training	Engineering Science	1.5	Introduced in place of Engineering mechanics to equip the students with skills necessary for placements.
8	18TS303	Placement Training	Engineering Science	2.5	
9	18CS3211	Data Science	Professional Core	4	Introduced as new course to equip students with cutting- edge skills
10	18TS309	Technical Skilling (PFSD+ Comp. Coding)	Professional Core	2	Introduced in place of Coding skills for Engineers course
11	18CS3065S	Big Data Analytics	Professional Elective	4	Introduced as an Elective course

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12	18EM4108	Internet of Things: Architectures and Protocols	Professional Elective	3	Introduced as an Elective course

The detailed syllabus for the list of proposed courses is given in Annexure-2(a)

AGENDA ITEM-2B

Proposed to revise the syllabus for the B.Tech 2018-19 admitted Batch courses based on the feedback received from stakeholders	Resolution: Approved the syllabus revision on selected set of courses for B.Tech 2018-19 admitted Batch and the same is recommended to Academic Council for approval

- ✓ Dr. Rajya Lakshmi, Assistant Professor, Faculty suggested including topics Gauss-SeidelSeidel iteration methods, orthogonal, symmetric, skew-symmetric, Hermitian, Skew-Hermitian,and unitary matrices in "Single Variable calculus and Matrix Algebra" course under CO4 to impart knowledge of numerical analysis in solving differential equations. It is resolved and approved to add suggested topics in "Single Variable Calculus and Matrix Algebra" for 2018-19 admitted batch students.

- ✓ Mr.Digallinte Sreenivasulu, Academic Peer suggested to add Hands on practice on casting and machine shop in Workshop practice for Computer Engineers course to provide overviewon Casting and Machine shop that helps students to gain practical experience. It is resolved and approved to add hands on practice experiments on Casting and Machine Shop in "Workshop practice for Computer Engineers" for 2018-19 admitted batch students.

- ✓ K. Devi Prasanna (14003464) Alumni, strongly suggested to include topics like permutations and combinations, linear recurrence relations to the syllabus of Discrete Mathematics course. It is resolved and approved to revise syllabus for "Discrete Mathematics" for 2018-19 batch students.

- ✓ Dr. P. V. VARA PRASAD, Faculty suggested to include topics Mathematical Background, Model, Analyze, Running Time Calculations, Red black trees, Rehashing, Hash Tables in the Standard Library, Extendible Hashing in Data structures to help students in Acquiring knowledge on basic mathematical tools and techniques of algorithm analysis and to gain knowledge on problem solving in

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the most efficient ways for finding and storing data. It is resolved to approve the revision of syllabus in "Data Structures" course to 2018-19 admitted batch students.

✓ Vishnu Teja (2006-2010 batch) Alumni, strongly recommend including virtualization concepts in detail in "Cloud Computing " course. Addressing Contemporary Needs, recognizing its relevance and importance in today's technological landscape. It is resolved and approved to revise syllabus for "Cloud Computing" for 2018-19 batch students.

✓ Mr.CH.M.H.SAI BABA, Faculty recommended revising the course "Soft Computing" as it would significantly enrich the curriculum by encompassing cutting-edge topics incomputational intelligence. It is resolved to approve the revision of "Soft Computing" Course for 2018-19 admitted batchStudents.

✓ Mr. Mohannad Gouse, Faculty suggested to revise syllabus of Natural Language Processing by adding feature extraction concepts to meet global industry requirements. It is resolved and approved to add hidden feature extraction concepts in Natural Language Processing course to offer for 2018-19 admitted batch students.

✓ Prof A.S.N. Chakravarthy, Academic peer suggested to revise syllabus of Big Data optimization to meet global needs. It is resolved and approved by all BOS members to add Particle Swarm Optimization, Estimation of Distribution Algorithm, Comparison of Population Based Methods, Bag Prices with Constraint in CO3 to solve various problems by more powerful optimization techniques, PSO and EDA concepts in "Big Data Optimization" to offer for 2018-19 admitted batch students.

✓ Dr.B.VIJAYA BABU, Faculty suggested adding more Email security related concepts in Network Security course to offer for 2018-19 admitted batch students for building careers in security, Electronic Mail Security. It is resolved and approved to include Electronic Mail Security: Pretty Good Privacy, S/MIME, Domain Keys Identified Mail IP Security: IP Security Overview. IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites concepts in Network Security course to offer for 2018-19 admitted batch students.

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S.No	Course Code	Course Title	Course Type	Revision Percentage	Remarks
1	18SC1103	Single Variable calculus and Matrix Algebra	Basic Science	10	Based on Faculty Feedback
2	18CS1003	Workshop practice for Computer Engineers	Basic Science	15	Based on Academic Peer Feedback
3	18SC2008	Discrete Mathematics	Basic Science	30	Based on Alumni Feedback
4	18SC1202	Data Structures	Engineering Science	26	Based on Faculty Feedback
5	18CS3251S	Cloud Computing	Professional Elective	30	Based on Alumni Feedback
6	18CS3270	Soft Computing	Professional Elective	30	Based on Faculty Feedback
7	18CS3167	Natural Language Processing	Professional Elective	27	Based on Faculty Feedback
8	18CS3064	Big Data Optimization	Professional Elective	30	Based on Academic Peer Feedback
9	18CS3279	NetworkSecurity	Professional Elective	26	Based on Faculty Feedback

The detailed comparison of old syllabus and revised syllabus is given in Annexure-2(b)

The detailed feedback and action taken report is presented in Annexure-2(c)

AGENDA ITEM-3

Consider and approve the curriculum of B.Tech & M.Tech-CSE programs offered for 2018-19 admitted batch students	Resolution: Approved 2018-19 structure and recommended to Academic Council for approval

The BoS members discussed the proposed course structure of B.Tech and M.Tech 2018-19admitted batches of Computer Science and Engineering.

✓ Dr. K Thirupathi Rao, Chairman BOS proposed changes to the Course structure of

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B.TechCSE that 2018-19 admitted batch of students requires a minimum of 160.5 credits to acquire Regular Degree.

✓ For 2018-19 admitted batch of students requires extra 20 credits to acquire Honor Degree.

✓ Dr. K Thirupathi Rao responded to the question raised by Dr. Siba Kumar Udgata about acquiring extra 20 credits to get Honors degree and clarified that these extra credits by taking the courses in advance or peer mentor mode from the courses offered though thecategories Engineering Science, Professional Core, Professional Electives and Project categories.

✓ The courses recommended to be offered in advance and Peer mentor mode for 2018-19 admitted batch B.Tech Students is given in **Annexure-3(c).**

✓ He also stated that the credits for both Advanced and Peer Mentor are same, but the evaluation pattern is different. The variation of credits is 2 for Regular and Advanced,ced,r mentors. Thedetailed evaluation plan is discussed and approved.

✓ The Bos members approved the proposed changes and agreed that these changes are necessary for B.Tech Computer Science and Engineering students to be ready as per contemporary requirements and industry needs.

✓ Dr K. Thirupathi Rao proposed the curriculum of the ch-CSE course structure and all the BOS members agree that it is well designed and covers a wide range of topics.

The detailed Course Structure of B.Tech 2018-19 admitted batch is given in Annexure-3(a)

The detailed Course Structure of M.Tech-CSE 2018-19 admitted batch is given in Annexure-3(b)

AGENDA ITEM-4

Consider and approve new PG programs – M.Tech in Digital Forensics and Cyber security and M.Tech in MachineLearning and Computing	Resolution: Approved new PG programs – M.Tech in Digital Forensics and Cyber security and M.Tech in Machine Learning and Computing and recommended to Academic Council for approval

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✓ Based on the identified local, regional, national and global needs a new program M.Tech- Digital Forensics and Cyber security and M.Tech- Machine Learning and Computing are suggested by the stakeholders-Faculty, with 8 Core courses, 4 Electives, One term paper and one seminar in first year and Dissertation in second year with a total of 84 and 81 credits respectively.

✓ It is resolved to approve new Programs M.Tech- Digital Forensics and Cyber security and M.Tech- Machine Learning and Computing with the proposed structure & syllabus for 2018-19 admitted PG students and recommend the same to Academic Council for approval. (**Annexure-4(a): M.Tech- Digital Forensics and Cyber** Security 2018-19 Course Structure, Annexure-5(c) M.Tech- Digital Forensics and Cyber Security 2018-19 Syllabus) (**Annexure-4(b): M.Tech- Machine Learning and Computing 2018-19 Course Structure, Annexure-5(d) M.Tech- Machine Learning and Computing2018-19 Syllabus**)

AGENDA ITEM-5

Consider and approve the Program Development Document for syllabus of B.Tech & M.Tech programs offered for 2018-19 admitted batch students	Resolution: Approved the PDD for syllabus of B.Tech & M.Tech programs offered for 2018-19 admitted batch students

✓ By considering all the changes in curriculum PDDs for 2018-19 B.Tech and M.Tech admitted batches are proposed

✓ It is resolved to approve the PDDs for syllabus of B.Tech and M.Tech programs of 2018-19 batches

The detailed Program Development Document for B.Tech Computer Science and Engineering Program is given in Annexure-5(a).

The detailed Program Development Document for M.Tech Computer Science andEngineering Program is given in Annexure-5(b).

The detailed Program Development Document for M.Tech Digital Forensics and CyberSecurity Program is given in Annexure-5(c).

The detailed Program Development Document for M.Tech Machine Learning andComputing Program is given in Annexure-5(d).

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AGENDA ITEM-6

To consider and approve the list of MOOCscourses offering to 2018-19 admitted batch students	Resolution: Resolution for MOOC'sCourses is approved and recommended to Academic Council for approval

It is proposed to offer Open Electives, Management Electives, Foreign Languages through MOOC's Courses to provide academic flexibility and to develop more effective learning experiences for the students.

It is resolved to offer proposed list of MOOCS courses for the students of 2018-19 B.Tech admitted batch. The resolution is recommended to the Academic Council for approval.

The detailed list of MOOCs Courses is given in Annexure-6

AGENDA ITEM-7

Consider and approve the list of Value-Added courses offering to 2018-19 admitted batch students.	Resolution: Resolution for Value-Added courses is approved and recommended to Academic Council for approval

To enrich the curriculum and to provide students with the skills they need to succeed in the workforce, all the Bos members recommended to offer value-added courses to 2018-19 admitted batch students as detailed in the Annexure-7. It is resolved to offer the proposed list of value-added courses to 2018-19 B.Tech admitted batch students. The resolution is recommended to the Academic Council for approval.

The detailed list of Value-Added Courses is given in Annexure-7

AGENDA ITEM-8

Consider and approve Pre Ph.D courses and syllabi to be implemented from 15th batch (2018-19 June admitted batch)	Resolution: Approved Pre Ph.D courses and syllabi to be implemented from 15th batch

It is resolved to offer proposed list of Pre Ph.D. courses and syllabi to be implemented from 15thbatch (2018-19 June admitted batch). The resolution is recommended to the Academic Council for approval.

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The detailed list of Pre Ph.D.-Courses and syllabi given in Annexure-8

AGENDA ITEM-9

Consider and approve the Minor changes proposed for curriculum structure and syllabus of 2015 admitted B.Tech. Computer Science and Engineering students	Resolution: Approved the course revision and syllabus for 2015-16 admitted batch students and recommended for Academic Council

- To consider the revisions proposed in Curriculum Structure and Syllabus of the Platform Based Development Course for the 2015 admitted B.Tech. Computer Science and Engineering students according to the recommendations of the Department Academic Committee (DAC) and Meenakshi Sharma Industry person feedback, and the same are approved to be put up and implemented as it is for that of 2016 admitted B.Tech. It is resolved to approve the revision of "Platform Based Development" Course for2015 admitted batch onwards.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-1

DEPARTMENT ACADEMIC COMMITTEE MEETING MINUTES

The Department Academic Committee Meeting of Computer Science and Engineering was conducted in ROSE HALL, on 26th June 2018 and 27th June 2018 from 1:30 P.M to 4.30 PM.

Head of the department welcomed DAC members and started the meeting by highlighting the vision & mission statements of university and department, also PEOs and PO statements of the programs.

The following Agenda Items are discussed, and the resolutions passed are marked against them:

Agenda:

1. To discuss on proposal of syllabus and course structure of B.Tech-CSE 2018-19 admitting batch
2. To discuss on proposed syllabus and course structure for M.Tech-CSE 2018-19 admitting batch
3. To discuss feedback obtained from various stake holders (students, Academic Peers, Parents, Course Coordinators, Alumni, industry)
4. To discussion on 2017-2018 Even Semester Course Closure Minutes
5. To discuss on CO-PO Attainment of courses in 2017-2018 Even Semester
6. To discuss on Gap Analysis report on CO-PO Attainment and Teaching Pedagogy
7. To discuss on introduction of new PG programs
8. To discuss proposed Pre-Ph.D. Courses and syllabus for 2018 batch.
9. To discuss on Result analysis on following courses:

    1. B.Tech Semester End Exam
    2. M.Tech Semester End Exam
    3. Certificate courses

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The following members were present:

1. Dr. K. THIRUPATHI RAO
2. Dr.V.. HARI KIRAN VEGE
3. Dr. V SRIKANTH
4. Dr. D. HARITHA
5. Dr. V CHANDRA PRAKASH
6. Dr. SUBRAHMANYAM
7. Dr. M. R. NARSINGA RAO
8. Dr. B. VIJAYA BABU
9. Dr. D.RAJESWARA RAO
10. Dr. M.S.R. PRASAD
11. Dr. K.V.V. SATYANARAYANA
12. Dr. TIRUMALA RAO
13. Dr. V. KRISHNA REDDY
14. Dr. Y. PRASANTH
15. Dr. K. RAJASHEKAR
16. Dr. P. SAI KIRAN
17. Dr. GANDHARBA SWAIN
18. Dr. M. SREE DEVI
19. Dr. N. SRINIVASU
20. Dr. G. PRADEEPNI
21. Dr. RAJARAJESWARI
22. Dr. T. PAVAN KUMAR
23. Dr. G. KRISHNA MOHAN
24. Dr. SRINIVAS PRASAD
25. Dr. MD. ISMAIL
26. Dr. M. SRINIVAS
27. Dr. S. SATYANARAYANA
28. Dr. P.V.R.D PRASAD
29. MR. B. TIRUPATHI REDDY
30. Dr. K. BAGHAVAN
31. Dr. B. CHAITANYA KRISHNA
32. MR. M. VISHNUVARDHAN
33. MR. A.V.PRAVEEN KRISHNA
34. MRS. V.DIVYA
35. MRS. A. ROSHINI

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36. MR. J. SURYA KIRAN
37. MR. K. YELLASWAMY
38. MRS. M. PRAVEENA
39. MS. Y. SAHITHI(14004147)
40. MS. S.PRAVALLIKA(14003620)
41. MR.T.MANOJ(14003720)
42. MS. D. PRIYANKA(14003707)
43. MR. M.ESHWAR(14003357)
44. MR. V. LOHIT(14004555)
45. MR.B. NIKHIL(14004092)
46. MR. V. SRIHARSHA(14004640)
47. MR. R. NANDANA PRIYANKA(150030250)
48. MS. D. RAMYA(150030232)
49. MR. N. GEETA(150030278)
50. MR.K. VENKATA BHARATH(150030418)
51. MR.P. SRIKAR(150030666)
52. MR.B. ESHWAR CHAND(150030254)

The following members were absent for meeting:

   ---NIL---

The following points were discussed and resolved:

i) From student's placements point of view, it is better to have English courses in all semesters and these courses are mapped to Cambridge solutions.

ii) It is resolved that the course 'Problem solving and computer programming" course is based on C-Language.

iii) It is suggested to have 1 hour for counselling and co-curricular activities in all semesters.

iv) It is suggested to conduct 'Data Structures' in Second Semester and 'Object Oriented Programming' in Third semester.

v) It is suggested to maintain difference among regular, optional and advanced level oflearning the core subjects. It is better to have different Course codes for following levels:

  a) Regular level courses are to be assigned as 18CSXXXXR.

  b) Optional level courses are to be assigned as 18CSXXXXO.

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   c) Advanced level courses are to be assigned as 18CSXXXXA.

vi) Based on the feedback from 2017-18 Course Coordinators The following points werediscussed and resolved

   a) Mr.CH.RAMAIAH, Faculty suggested including Microprocessors that gives a basic knowledge to learn IOT specialization courses.

   b) Dr. P. V. VARA PRASAD, Faculty suggested to include topics Mathematical Background, Model, Analyze, Running Time Calculations, Red black trees, Rehashing, Hash Tables in the Standard Library, Extendible Hashing in Data structures to help students in Acquiring knowledge on basic mathematical tools and techniques of algorithm analysis and to gainknowledge on problem solving in the most efficient ways for finding and storing data.

   c) Dr. Rajya Lakshmi, Faculty suggested to include topics Gauss Seidal iteration methods, orthogonal, symmetric, skew-symmetric, Hermitian, Skew-Hermitian, and unitarymatrices in Single Variable calculus and Matrix Algebra course under C04 to impart knowledge of numerical analysis in solving differential equations.

   d) Mr. Digallinte Sreenivasulu, Academic Peer suggested adding Hands on practice on casting and machine shop in Workshop practice for Computer Engineers course to provide overview on Casting and Machine shop that helps students to gain practical experience.

   e) Dr.V Murali Mohan, Associate Professor, Faculty suggested including any Full Stack Development Courses into the Curriculum under Skill Development.

   f) Mr. Mohammad Gouse suggested to revise syllabus of Natural Language Processing by adding feature extraction concepts to meet global industry requirements.

   g) Mr.CH.M.H.SAI BABA, Faculty recommended to revise the course "Soft Computing" as they would significantly enrich the curriculum by encompassing cutting-edge topics in computational intelligence

vii) Based on the feedback from stakeholders, The following points were discussed and resolved

   a) Mr. Mahendranath.N, Alumni strongly recommend the inclusion of courses which improve students' communication skills into the curriculum.

   b) Prof A.S.N. Chakravarthy, Academic peer suggested to revise syllabus of Engineering optimization to meet global needs.

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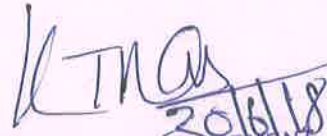Phone No. 0863 - 2399999; www.klef.ac.in, www.klef.edu.in; www.kluniversity.in
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c) Mr. Poothabalan Somasundaram, Software Architect, Honeywell Technologies advised including courses which improve coding skills related to Technical Skilling.

d) Dr.B.VIJAYA BABU, Course Coordinator suggested adding more Email security related concepts in Network Security course to offer for 2018-19 admitted batch students for building career in cybersecurity Electronic Mail Security concept.

e) Vijay Krishna Pala Industry person suggested Data Science to equipping students with cutting-edge skills vital for navigating the data-driven landscape.

f) Mr. B. Srikanth industry person recommended including placement training so that students can be equipped with skills necessary for placements.

g) Dr. Vivek S Deshpande, Academic peer recommended to include "Quantum Physics for engineers" course under basic science category.

h) Mr.Sagireddy Pulla Reddy, SP Software, Industry Person suggested to include "Internet ofThings (IoT): Architectures and Protocols" which helps to prepare students for the evolving technological landscape.

i) Prof.A.S.N.Chakravarthy, Academic Peer suggested to introduce new course on Big Data Analytics which helps student to grow significantly in data-driven decision-making and providing students with essential skills for navigating and analysing large-scale datasets.

j) Vishnu Teja (2006-2010 batch) Alumni, strongly recommend including virtualization concepts in detail in "Cloud Computing " course. Addressing Contemporary Needs, recognizing its relevance and importance in today's technological landscape.

k) Meenakshi Sharma, Industry person suggested for revision of "Platform Based Development" Course for 2015 admitted batch onwards.

l) K. Devi Prasanna(14003464) Alumni, strongly suggested to include topics like permutations and combinations, linear recurrence relations to the syllabus of Discrete Mathematics course.

viii) DAC members discussed and resolved to recommend two new programs M.Tech-DigitalForensics and Cyber security and M.Tech- Machine Learning and Computing.

ix) DAC members discussed and resolved to recommend the B.Tech and M.Tech-CSE program structures for 2018 admitted batch students.

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All programs for 2018-19 has been framed to be in relevance to Human Resources

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Development Policy, Govt. of India, National Skill Development Corporation, Govt. of India, Confederation of Indian Industries, ABET, NBA norms, O*NET and AICTE statutory norms.

Thus, framed curriculum has been developed through framing of Program Educational Objectives (PEO's) which are mapped to the university Vision and Mission, which are there by disseminated into Student Outcomes (SO's) which thereby have been developed into relevant Course Outcomes (CO's).

The resolutions are forwarded to the BoS committee for approval.

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Annexure-2(a)

Course Code: 18CS2111　　　　　　　　　**Course Name: Microprocessors**
L-T-P-S: 3-0-2-0　　　　　**Credits: 4**　　　　**Prerequisite: NIL**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understanding 8086 architecture and concepts	PSO1, PO1, PO2	2
CO2	Apply 8086 instruction set to write ALP	PSO1, PO1, PO2	3
CO3	Understand 80x86 microprocessors concepts	PSO1, PO1, PO2	2
CO4	Understand Pentium architecture and microcontrollers	PO2, PSO1, PO1	2
CO5	Students will be able to apply and analyse 8086 Assembly language programs	PSO1, PO1, PO2	4

Syllabus:

Introduction to 16-bit microprocessors, 8086 architectures, 8086 pin functions, Segments, Flags, Minimum and maximum mode operations, Memory banks, and Interrupts.truction Set, Assembly language programming on 8086 using assembler, writing interruptions, service routines, Debugging programs, ALP programming. 80286/386/486 Register set, Data types, Overview of instruction set, Memory segmentation with descriptor tables including LDT and GDT, Privilege levels, changing privilege levels, Paging including address translation, Page level protection, MMU cache, Virtual memory, Paging and segmentation, Multitasking with TSS, Context switching, Task scheduling, Extension and I/O permission, Managing interrupts with IDT, Gates and exception handlers. Technical overview (only features) of the Pentium architecture including Pentium-Pro, MMX, Hyper Threading, Core-2-duo, Concepts of RISC, RISC vs CISC, Microcontrollers.

Textbooks:

1. D. V. Hall "Microprocessor and Interfacing", 2nd Edition Tata McGraw Hill Publication Company,2006.
2. Mazidi & Mckinley "The 8051 Micro controller and Embedded systems: using assembly and C", 2nd edition, 2007.

Reference Books:

1. James Turley "Advanced 80386 Programming Techniques", TMH.
2. Deniel Tubak "Advance Microprocessor", TWH.
3. Barry B. Bray "The Intel Microprocessors (Light Edition) " , Pub-Pearson (Prentice Hall).
4. Kenneth Ayala "The 8086 Microprocessor" , Cengage Learning.
5. Triebel & Singh "The 8088 and 8086 Microprocessors", Pearson Education. Peter Abel "IBM PCAssembly Language & Programming"

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Course Code: 18CS3211 **Course Name: Data Science**
L-T-P-S: 2-0-2-4   **Credits: 4**   **Prerequisite: NIL**

CO #	Course Outcome (CO)	PO / PSO	BTL
CO 1	Understand Data science, Exploratory Data Analysis, DataExtraction, Wrangling	PO1,PO3	2
CO 2	Understanding Probability and Probability distribution,	PO5,PO4	2
CO 3	Analyse the linear and logistic regression solutions for real worldproblems	PO4,PO5	3
CO 4	Applying classification and clustering algorithms on select open source data sets	PO4,PO5	3
CO 5	Implementing Data science algorithms using Python	PO11	3

Syllabus:
Introduction to data science, Big Data Overview, State of the Practice of Analytics, Big Data Analytics in Industry Verticals. Overview of Data Analytics Lifecycle, Discovery, Data Preparation, Model Planning, Model Building, Communicating Results and Findings, Operationalizing. Introduction to Probability & Random Variables: Probability and Random variables: Definitions of probability, Sample space, Axioms of probability, Conditional probability, Addition, Multiplication, Baye's theorem and Naïve Bayes. Probability distributions: Binomial, Poisson, Exponential and Normal distributions, Applications of the above distributions. Correlation & Regression: Concept of correlation, Correlation vs Regression, Univariate and multivariate linear regression, Model assessment using R2value, adjusted R2, estimating error, Cost function of linear regression. Supervised and unsupervised Learning: Importance of Machine learning, types of learning, classification algorithms (Naive Bayes, Decision tree) and clustering algorithm (K meansclustering, KNN).

Textbooks:
1.   Data Science and Big Data Analytics, EMC, Willey publisher
2.   Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Sharon L. Myers andKeying Ye, 8th Edition, Pearson

Reference Books:
1.   Python Data Science Handbook Essential Tools for Working with Data, Jake VanderPlas, Oreally
2.   Data Science from Scratch: FIRST PRINCIPLES WITH PYTHON, Joel Grus, Oreally

MOOCS/Web Links:
1.   https://nptel.ac.in/courses/106106179/
2.   https://www.udemy.com/course/complete-python-bootcamp/

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Course Code: 18PH4101 **Course Name: Quantum Physics for Engineers**

L-T-P-S: 3-0-0-0 **Credits: 3** **Prerequisite: NIL**

CO#	Course Outcome (CO)	PO / PSO	BT L
CO1	Able to understandthe structure of crystalline solids, semiconductors physics and properties of light in Engineeringapplication of Lasers.	PO1	2
CO2	Able to understands the behavior of electrons on the microscopic level by using different quantum models	PO1	2
CO3	Able to solve the time-independent Schrodinger wave equation asan intermediate step to solve the time-dependent Schrodinger wave equation.	PO2	3
CO4	Able to explain the meaning and significance of the postulates of the special theory of relativity	PO1	2

Syllabus:

CO1: Elements of solid-state Physics: Crystal structure, Band theory, Semiconductors, Principles of lasers: Spontaneous and induced emission – Lasing action – Ruby laser – Semiconductor laser- applications. CO2: Quantum concepts: Bohr model, Black body radiation, particle nature of light, photoelectric effect, Compton effect, matter waves, wave packets, phase and group velocity, Davisson Germer experiment, Heisenberg uncertainty principle. CO3: Schrödinger wave Mechanics: Schrodinger wave equation, probabilistic interpretation of wave function, superposition principle, Hermitian operators. One dimensional problem: particle in a box, potential well, potential barrier, and tunneling. CO4: Special theory of relativity: Frame of reference - Galilean and Lorentz transformation, Postulates of the special theory of relativity - space-time viewpoints, a variation of mass with velocity - energy-momentum conservation.

Textbooks:

1. Kleppner. D., Kolenkow. R. J., An introduction to Mechanics, McGraw-Hill 1978, ISBN 0-07-035048-5
2. Resnick. R., Introduction to Special Relativity, John Wiley & Sons 1968., ISBN: 978-0-471-71725-6.
3. Krane. K., Modern Physics, John Wiley & Sons 1996, ISBN 978-1-118-06114-5
4. Patil. S. H., Elements of Modern Physics, Tata McGraw-Hill 1983, ISBN 10: 087933326X

Reference Books:

1. Arthur Beiser, Perspectives of Modern Physics - McGraw-Hill, 1968- Science. ISBN 0-07-115096-X
2. Mani. H. S., Mehta. G. K., Introduction to Modern Physics, East-West Books Pvt. Ltd. 2003, ISBN 13:9788185095738.
3. Quantum Mechanics by G.S. Chaddha, New Age International (P) Ltd., Publishers, First Edition:2003, Reprint 2010.
4. Quantum Mechanics - Gupta, Kumar and Sharma

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 18TS309   Course Name: Technical Skilling (PFSD+ Comp.Coding)
L-T-P-S: 0-0-0-8   Credits: 2   Prerequisite: NIL

CO#	Course Outcome (CO)	PO / PSO	BTL
CO5	Analyse and apply suitable design technique to solve given real world problems	PSO2, PO3	4

Syllabus:

PYTHON Attributes, Properties, Methods and their Types. NameSpaces Constructors, OOps Concepts- Inheritance, Abstraction, Encapsulation, Polymorphism. Collections, Exception Handling. Basic Modules- Date Time, OS, Random, RE. File Handling. GIT- Git Integration with PYcharm IDE, PyTests- Introduction, Installation, Integrating pytest to Pycharm IDE, Assertions, running subset of tests from test suite, Run tests in parallel, fixtures, parameterized tests. Python connectivity with Databases MYSQL, MongoDB CRUD operations. Flask Introduction: Introduction to Web Key features and key terms in Web Client-Server Architecture About Flask framework Characteristics of Flask framework Installation in Virtual Environment Flask application structure Phases in Flask Application Creation Routing App Settings URL Building HTTP methods Templates Working with Static, Media Files Request Objects Sending Form Data to Template Advanced Features of Flask Pagination Database connectivity Sqlite3,MySQL Page Restrictions using decorators Cookies Sessions Handling Exceptions and Errors Flash Message Working with Mails App Deployment. Introduction to Web Key features and key terms in Web Client-Server Architecture Features of Django framework Characteristics of Django framework Installation in Virtual Environment Django commands Phases in Django Project Creation Create a Project Creation of Apps and their Structure Working with ADMIN Console Creating Views URL Mapping Template System Working with Models Page Re- directions Set-up E-Mails Types of Views Form Processing static, media files handling. Advanced Features of Django Pagination Database connectivity Sqlite3,MySQL Page Restrictions using decorators Cookies Sessions Caching, Migrations Deployment Free Web Hosting Domains Tree, DFS, BFS, Hash Table, Heap, Union Find, Segment Tree, Trie, MATH, DYNAMIC PROGRAMMING, BACKTRACKING

Textbooks:

1. Flask Web Development Oreilly Miguel Grinberg Mastering Django NigelGeorge Django for Beginers William S Vincent

MOOCS/Web Links:

1. https://www.linkedin.com/learning/paths/become-a-python-developer
2. https://www.linkedin.com/learning/paths/advance-your-skills-in-python

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Course Code: 18UC2103	**Course Name: Professional Communication Skills**
L-T-P-S: 0-0-4-0	**Credits: 2** **Prerequisite: NIL**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Identify the structure of sentences with the techniques of Etymology and apply in everyday conversations. Able to write Paragraphs, Letters, have the knowledge of Sentence completion and the Creativity	PO10	2
CO2	Identify and Develop Inter-personal Communication skills and Cultural Sensitivity and apply them in the corporate world to secure the best jobs in the industry	PO8, PO9	3
CO3	Apply the Arithmetic concepts Time & Work and Time & Distance	PO3	3
CO4	Understand the techniques used to take decision making based on data, understanding the logical connectives and implications, data analysis of by using Venn diagrams	PO3	3

Syllabus:

Grammar and Usage: Error Analysis Writing Skills: Topic Sentence, Linkers, Connectors and Transition, Paragraph Writing, Letter Writing Reading Comprehension: Techniques, Skimming and Scanning, Vertical Reading, Reading Perception Tests (RPT): (Graphic) Reading Perception Tests (RPT), Semantic Interpretation of the Text, Reading Speed Enhancement Soft Skills: Interpersonal Skills, Adjusting your Attitude, Arrogance has no place in the workplace, Cultural Sensitivity in the work place, Corporate Culture: Learning How to fit in Language Laboratory Interactive: Tell me Why, Mock Press, Listen for the difference, Public Speaking (Premeditated) Quantitative Aptitude: Time & Work, Time & Distance. Reasoning: Deductions, Logical Connectives, Venn Diagrams.

Textbooks:

1. R.S. Aggarwal, Quantitative Aptitude: S. Chand publication, Third edition
2. Abhijit Guha, Quantitative Aptitude: Tata Mc-Graw Hill co. Third edition
1. 3 A modern approach to verbal & non-verbal reasoning, R. S. AGARWAL,S. CHAND Publications
3. Test of Reasoning for competitive examinations, Edgar Thorpe, Tata Mc Graw hills
4. Analytical Reasoning By M.k.Pandey, Banking services chronicle

Reference Books:

1. Gajendra Singh Chauhan and Smita Kashiramka, Technical Communication. Delhi : Central Learning India 2018
   http://www.misd.net/languageart/grammarinAction/501SentenceCompQuestions.pdf
2. Andrea Penruddocke and Christopher &A.Warnash English for the Real World. USA: Living Language 2004
   https://elearning.shisu.edu.cn/pluginfile.php/36509/mod_resource/content/1/ANANT LOGIES.pdf
3. Gerald Alfred, Charles.T. Brusaw and Walter E.Oliu. Hand Book of Technical Writing USA: Betford.2000 http://elibrary.bsu.az/books_250/N_16.pdf

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Course Code: 18CS3065S   Course Name: BIG DATA
ANALYTICSL-T-P-S: 2-0-2-4   Credits: 4   Prerequisite: NIL

CO #	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand the concepts of big data, Initial exploration of analysis ofdata and Data visualization.	PO1	2
CO2	Understand Initial exploration of data and advanced data analytics byusing R	PO2	2
CO3	Apply advanced algorithms & Statistical modeling for big data usingHDFS, HIVE, and PIG.	PO5	3
CO4	Apply advanced SQL functions for in-database analytics by MADlib, Greenplum along with common deliverables of analytics life cycleproject	PO5	3
CO5	Build and Evaluate the Big Data Analytical problems using R, Hadoop,HIVE Programming concepts.	PO5	5

Syllabus:

Introduction to Big Data Analytics: Big Data Overview, State of the Practice of Analytics, Big Data Analytics in Industry Verticals. It also covers Overview of Data Analytics Lifecycle, Discovery, Data Preparation, Model Planning, Model Building, Communicating Results and Findings, Operationalizing. Initial Analysis ofthe Data: Initial Exploration and Analysis of the Data, Basic Data Visualization. Basic data analytics,reporting, and apply basic data visualization techniques to your data. Apply basic analytics methods such as distributions, statistical tests and summary operations, and differentiate between results that are statistically sound vs. statistically significant. Identify a model for your data and define the null andalternative hypothesis. Experimentation and demonstration of initial analysis of data using R. Advanced Analytics and Statistical Modeling for Big Data — Theory and Methods: Need of analytic and select anappropriate technique based on business objectives; initial hypotheses; and the data's structure andvolume. Apply some of the more methods in Analytics solutions, algorithms and the technical foundations for the methods. The environment (use case) in which each technique can provide the most value.Use appropriate diagnostic methods to validate the models created Use R and in-database analytical functions to fit, score and evaluate models. Advanced Analytics and Statistical Modeling for Big Data — Technology & Tools: Tool to Perform Analytics on Unstructured data using MapReduce Programming paradigm. UseHadoop, HDFS, HIVE, PIG and other products in the Hadoop ecosystem for unstructured data analytics, Effectively. use advanced SQL functions and Greenplum extensions for in-database analytics. Use MADlib to solve analytics problems in-database. Endgame - Operationalizing an Analytics Project: Tasks needed to operationalize an analytics project. Four common deliverables of an analytics lifecycle project meet the needs of key stakeholders. Use a framework for creating final presentations for sponsors and analysts. Evaluate data visualization and identify ways to improve it. Apply these concepts to a big data analytics

Textbooks:
1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting

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Data by EMC

Education Services 2014

2. EMC Material/Courseware : https://education.emc.com/

Reference Books:

1. MapReduce Design Patterns, Author: Donald Miner, O'Reilly (2012), ISBN-13:- 9789350239810
2. Practical Data Science with R-Nina Zumel, John Mount-Manning Publications-2014
3. R for Business Analytics-A. Ohri-Springer-2012.
4. Agile data science: building data analytics applications with Hadoop-Russell Journey- O'Reilly Media-2013
5. An Introduction to Applied Multivariate Analysis with R -Brian Everitt, Torsten Hothorn- Springer-2011

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Course Code: 18EM4108   **Course Name: Internet of Things: Architectures and ProtocolsL-T-P-S: 2-0-2-0**   **Credits: 3**   **Prerequisite: NIL**

CO #	Course Outcome (CO)	PO / PSO	BT L
CO 1	Understand the Architectural Overview of IoT	PSO1, PO7	2
CO 2	Understand the IoT Reference Architecture and Real World DesignConstraints	PO7, PSO1	2
CO 3	Apply the various IoT Protocols in Datalink and Network layers	PSO1, PO7	3
CO 4	Apply the various IoT Protocols in Transport and Session Layers	PSO1, PO7	3
CO 5	Create IoT based applications using IoT protocols	PSO1, PO7	5

Syllabus:

Internet of Things: An overview: IOT conceptual framework, IoT architectural view, Technology behind IoT, sources of IoT, M2M Communication. Design Principle for connected Devices: IoT/M2M system layer and design standardization, communication technologies, data enrichment, data consolidation, and device management at the gateway. IoT Architecture -State of the Art: Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. IoT Link Layer & Network Layer Protocols: PHY/MAC Layer protocols, Z- Wave, Bluetooth Low Energy, ZigBee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP. Internet Connectivity Protocols: Transport Layer: TCP, UDP, DCCP– Session Layer- CoAP, XMPP, AMQP, MQTT. Layer Protocols: Service Layer - oneM2M, ETSI M2M, OMA, BBF

Textbooks:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-toMachine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Thing," PACKT publishing, BIRMINGHAM – MUMBAI.

Reference Books:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things," ISBN 978-3-642-19156- 5 e-ISBN 978- 3-642-19157-2, Springer.
2. ArshdeepBahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6".

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Course Code: 18SC1106 **Course Name: Technical Skill - 1 (Coding)**
L-T-P-S: 0-0-0-6 **Credits: 1.5** **Prerequisite: NIL**

CO #	Course Outcome (CO)	PO / PSO	BTL
CO 1	Introduction to Servelets: Lifecycle of a Serverlet, JSDK The Servelet API, The javax.servelet Package, Reading Servelet parameters,Reading Initialization parameters.	PO1, PO2, PSO1	3
CO 2	The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, servlet chaining-Security Issues.Common Gateway Interface (CGI), Lifecycle of a Servlet,deploying a servlet,	PO1, PSO1	3
CO 3	Introduction to JSP The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat	PO1, PO2, PSO1	3
CO 4	JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations.	PO1, PO2	3

Syllabus:

Introduction to Servelets: Lifecycle of a Serverlet, JSDK The Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, servlet chaining-Security Issues.Common Gateway Interface (CGI), Lifecycle of a Servlet,deploying a servlet, Introduction to JSP The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects,Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users PassingControl and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations. Database Access Database Programming using JDBC Studying Javax.sql. package Accessing a Database from a JSP Page Application – Specific Database Actions Deploying JAVA Beans in a JSP Page. Introduction to struts framework.

Textbooks:

1. The complete reference Java –2: V Edition By Herbert Schildt Publ. TMH.

Reference Books:

1. Programming with Java, by E. Balagurusamy, McGraw Hill Education

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

2. SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. PearsonEducation.

Web Links:

1. https://www.javatpoint.com/java-jdbc
2. https://www.javatpoint.com/jdbc-driver
3. https://www.javatpoint.com/steps-to-connect-to-the-database-in-java
4. https://www.javatpoint.com/Statement-interface
5. https://www.javatpoint.com/ResultSet-interface

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course code: 18SC1207   **Course Name: Technical Skill - 2**

(Coding)L-T-P-S: 0-0-0-6   **Credits: 1.5**   **Prerequisite: NIL**

CO#	Course outcome	PO/PSO	BTL
CO1	Apply the concepts of basic programming to solve the basicproblems, pattern-based problems	PO1, PO2, PSO1	3
CO2	Build solutions for problems on Numbers and array-basedproblems, functions, recursion	PO1, PO2, PSO1	3
CO3	Solve problems solutions for character/string based problemsand pointers	PO1, PO2, PSO1	3
CO4	Build solutions to programs on Data structures concepts.	PO1, PO2, PSO1	3

Syllabus:

Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension.Illustrative programs: selection sort, Insertion sort, merge sort, histogram.

Text Books:

1. Allen B. Downey, ‖Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3,Shroff/O'Reilly Publishers, 2016 http://greenteapress.com/wp/thinkpython/)

2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated forPython 3.2, Network Theory Ltd., 2011.

Reference Books:

1. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

2. John V Guttag, ―Introduction to Computation and Programming Using Python", Revised Andexpanded Edition, MIT Press, 2013

3. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 18UC1202 **Course Name: English**

Proficiency L-T-P-S: 0-0-4-0 **Credits: 2** **Prerequisite: NIL**

CO #	Course Outcome (CO)	PO / PSO	BTL
CO 1	Identify the structure and usage of phrases, clauses and sentences along with the techniques of learning vocabulary, concord and sentence equivalence and apply the strategies in different contexts.	PO7, PO10	2
CO 2	Identify formats and parameters of writing skills and apply in product and process descriptions.	PO9	3
CO 3	Apply the methods of fundamental concepts of tabulation, line-graphs, bar-graphs and pie charts in Data Interpretation and statements in Data Sufficiency	PO1, PO2	3
CO 4	Identify the basic symbols and notations to find out the hidden analogy to solve sequences	PO1	3

Syllabus:

Advanced Grammar Skills: Transformation of Sentences, Phrases, Clauses, Sentences—Simple, Compound, Complex Sentences, Concord, Lexis 1: Synonyms, Antonyms, Analogies, Sentence Equivalence-One-Word Substitutes. Writing Skills: How to Write a Definition, Defining Technical Terms, Product and Process Description. Language Laboratory Interactive: Debate, Blind-fold, Role Play, Situation Reaction Test--Build an Island nation Quantitative Aptitude: Data Interpretation and Data Sufficiency Reasoning: Symbols and Notations, Clocks and Calendars, Analytical Reasoning-II

Textbooks:

1. R.S. Aggarwal, Quantitative Aptitude: S. Chand publication, Third edition
2. Abhijit Guha, Quantitative Aptitude: Tata Mc-Graw Hill co. Third edition
3. R.S. Aggarwal, Verbal and Non-verbal Reasoning: Tata Mc-Graw Hill co. Third edition
4. B.S. Sijwali and Indu Sijwali, Reasoning: Verbal, Non-verbal and Analytical: Third edition

Reference Books:

1. Kerry Patterson, Joseph Grenny Switzler, Ron McMillan: Crucial Conversation: Tools for Talking When Stakes Are High.: Paperback- Animated, September 9, 2011
2. R.K. Bansal, J.B. Harrison: Spoken English. Orient Black Swan. Delhi:2009
3. Language Laboratory Teacher Manual: KLEFU
4. Arun Sharma, Quantitative Aptitude for CAT; Tata Mc-Graw-Hill publications, Sixth edition
5. Gautam Puri, Data interpretation for CAT; GK publishers, third edition
6. Arun Sharma, Logical Reasoning by, Tata Mc-Graw-Hill publications, Fourth edition

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 18CS3064
OptimizationL-T-P-S: 2-0-2-0   **Credits: 3**

Course Name: Big Data
Prerequisite : DBMS

CO #	Course Outcome (CO)	PO / PSO	BT L
CO 1	Understand optimization methods and analytics using Rprogramming	PSO1, PO2	2
CO 2	Apply blind search and local search methods for solvingoptimization problems	PO2, PSO1	3
CO 3	Analyze and compare population-based search methods forsolving real world problems	PSO2, PO4	4
CO 4	Analyze applications of genetic programming to solve problemslike Travelling Salesman Problem	PSO1, PO4	4
CO 5	Implement optimization algorithms using R Programming	PSO2, PO5	5

Syllabus: Introduction: Motivation, Why R, Representation of a Solution, Evaluation Function, Constraints
, Optimization Methods , Demonstrative Problems Foundation of r -R Basics: Introduction Basic Objects and Functions, data structures, about usage, understanding data structures, functions, list, arrays, control structures, data manipulations, date and string manipulations Blind Search: Introduction, Full Blind Search, Grid Search , Monte Carlo Search , Local Search: Introduction , Hill Climbing, Simulated Annealing Tabu Search, Comparison of Local Search Methods, Population Based Search: Introduction, Genetic and Evolutionary Algorithms ,Differential Evolution ,Particle Swarm Optimization, Estimation of Distribution Algorithm ,Comparison of Population Based Methods, Bag Prices with Constraint Genetic Programming Applications: Introduction, Travelling Salesman Problem , Time Series Forecasting , Wine Quality Classification Implementing R programming on various problems.

Text Books :

1. Paulo Cortez, "Modern Optimization with R " Springer, (2014).
2. Nicholas J. Horton & Ken Klein man, " Using R and R Studio for Data Management, Statistical Analysis,and Graphics", Second Edition , CRC Press, (2015).

Reference Books :

1. Carlo Zaniolo, "Advanced database systems", Morgan Kaufmann, Elsevier, (1997).
2. Jan L. Harrington, "Relational Database Design", Morgan Kaufmann, Elsevier, (2009)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure 2(b)

B.Tech - Computer Science and Engineering 2018-19 Syllabus Revision

Course Code	Course Name	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
18SC1202	Data Structures	ES	Algorithm Analysis:Lists. Stacks and Queues: Abstract Data Types (ADTs), The List ADT, The Stack ADT, The Queue ADT. Trees: Preliminaries, Binary Trees, The Search Tree ADT— Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals (Revisited), B-Trees. Hashing: General Idea, Hash Function, Separate Chaining, Hash Tables without Linked Lists. Priority Queues (Heaps): Model, Simple Implementations, Binary Heap, Applications of Priority Queues. Sorting: Preliminaries, Insertion Sort, A Lower Bound for Simple Sorting Algorithms, Shell sort, Heap sort, Merge sort, Quick sort, Indirect Sorting, A General Lower Bound for Sorting.	Algorithm Analysis: Mathematical Background, Model, Analyze, Running Time Calculations, Lists. Stacks and Queues: Abstract Data Types (ADTs), The List ADT, The Stack ADT, The Queue ADT. Trees: Preliminaries, Binary Trees, The Search Tree ADT— Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals (Revisited), B-Trees, Red black trees. Hashing: General Idea, Hash Function, Separate Chaining, Hash Tables without Linked Lists, Rehashing, Hash Tables in the Standard Library, Extendible Hashing. Priority Queues (Heaps): Model, Simple Implementations, Binary Heap, Applications of Priority Queues. Sorting: Preliminaries, Insertion Sort, A Lower Bound for	Added: CO1:Added: Mathematical Background, Model, Analyze, Running Time Calculations, Red black trees CO3:Rehashing, Hash Tables in the Standard Library, Extendible Hashing.	CO1, CO3	1. Acquire some basic mathematical tools and techniques of algorithm analysis. 2. To gain knowledge on problem solving in the most efficient ways for finding and storing data.	26%

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Course Code	Course Name	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
			Bucket Sort, External Sorting. Graph Algorithms: Definitions, Topological Sort, Shortest- Path Algorithms, Minimum Spanning Tree.	Simple Sorting Algorithms, Shell sort, Heap sort, Merge sort, Quick sort, Indirect Sorting, A General Lower Bound for Sorting, Bucket Sort, External Sorting. Graph Algorithms: Definitions, Topological Sort, Shortest-Path Algorithms, Minimum Spanning Tree.				
18SC2008	Discrete Mathematics	BS	Sets and Sequences : Data Models. Finite Sets, Power Set, Cardinality of finite sets, Cartesian Product, Properties of Sets, Vector Implementations of Sets, Cardinality of Sets, Matrices Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction , normal forms(conjunctive and disjunctive), modus ponens and modus	Sets and Sequences : Data Models. Finite Sets, Power Set, Cardinality of finite sets, Cartesian Product, Properties of Sets, Vector Implementations of Sets, Cardinality of Sets, Matrices Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction , normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential	Added: CO2: Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Generalized, Permutations and Combinations, Generating Permutations and Combinations, Binomial Coefficients and Identities. CO3:Advanced Counting Techniques: Applications of Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations,	CO2, CO3	1.To solve complicated applications involving permutations and combinations. 2. To solve linear recurrence relations by recognizing homogeneity linearity	30%

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			tollens, validity, predicate logic, universal and existential quantification. Notion of proof: proof by implication, converse, inverse, contra positive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example. Relations: Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings, Lattices. Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring. Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees,	quantification. Notion of proof: proof by implication, converse, inverse, contra positive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example. Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Generalized, Permutations and Combinations, Generating Permutations and Combinations, Binomial Coefficients and Identities. Advanced Counting Techniques: Applications of Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion–Exclusion, Applications of Inclusion–Exclusion. Relations: Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations,	Generating Functions, Inclusion–Exclusion, Applications of Inclusion–Exclusion.			

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Course Code	Course Name	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
			Minimum Spanning Trees.	Partial Orderings, Lattices. Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring. Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.				

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18CS3251S	CLOUD COMPUTING	PE-1	Overview of Cloud Computing: Introduction, Cloud computing elements, Essential characteristics, cloud services, cloud deployment models, NIST cloud computing reference architecture. Software as a Service (SaaS)- Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. Platform as a Service (PaaS)-IT Evolution Leading to the Cloud, Benefits of PaaS Solutions, Disadvantages of PaaS Solutions. Infrastructure as a Service (IaaS)-Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy, Utilizing Cloud-Based NAS Devices, Advantages, Server Type. Cloud Computing Security Architecture: Architectural Considerations,General	Overview of Cloud Computing: Introduction, Cloud computing elements, Essential characteristics, cloud services, cloud deployment models, NIST cloud computing reference architecture, ITU-T cloud computing reference architecture, network requirements for cloud computing. Software as a Service (SaaS)- Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. Platform as a Service (PaaS)-IT Evolution Leading to the Cloud, Benefits of PaaS Solutions, Disadvantages of PaaS Solutions. Infrastructure as a Service (IaaS)-Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy, Utilizing Cloud-Based NAS Devices, Advantages, Server Type. Introduction, Characteristics of virtualized environments, Taxonomy of virtualization	Added: CO1: ITU-T cloud computing reference architecture, network requirements for cloud computing CO3: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technologyexamples:Xen-paravirtualization, VMware: full virtualization, Microsoft Hyper- V. CO4:Microarchitectures, Identity Management and Access Control, Access Control, Autonomic Security	CO1, CO3, CO4	1. To accquire knowledge on the benefits of Virtualization in a Cloud Environment	30%

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			Issues, Trusted Cloud Computing, Secure Execution Environments and Communications.	techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technologyexamples:Xen-paravirtualization, VMware: full virtualization, Microsoft Hyper- V.Cloud Computing Security Architecture: Architectural Considerations,General Issues, Trusted Cloud Computing, Secure Execution Environments and Communications, Microarchitectures, Identity Management and Access Control, Access Control, Autonomic Security.				

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18CS3167	Natural Language Processing	PE-4	Introduction: overview of NLP. Statistical machine translation. Language models and their role in speech processing. The problem of ambiguity.. NLP tasks in syntax, semantics, and pragmatics. Words: Structure, Semantics, Parts of Speech, Sentences: Basic ideas in compositional semantics, Classical Parsing (Bottom up, top down, Dynamic Programming: CYK parser). Sentences: Parsing using Probabilistic Context Free Grammars and EM based approaches for learning PCFG parameters. N-gram Language Models and Information Theory: The role of language models. Simple N-gram models, Entropy, relative entropy, cross entropy. Statistical estimation and smoothing for language models. Part Of Speech Tagging and Sequence Labeling. Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training). n-gram models.	Introduction: overview of NLP. Statistical machine translation. Language models and their role in speech processing. The problem of ambiguity.. NLP tasks in syntax, semantics, and pragmatics. Words: Structure, Semantics, Parts of Speech, Sentences: Basic ideas in compositional semantics, Classical Parsing (Bottom up, top down, Dynamic Programming: CYK parser). Sentences: Parsing using Probabilistic Context Free Grammars and EM based approaches for learning PCFG parameters. N-gram Language Models and Information Theory: The role of language models. Simple N-gram models, Entropy, relative entropy, cross entropy. Statistical estimation and smoothing for language models. Part Of Speech Tagging and Sequence Labeling. Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training). n-gram models. Syntactic-parsing: Grammar formalisms and treebanks. Efficient parsing for	Added: CO3: Information Extraction (IE): Named entity recognition and relation extraction. IE using sequence labeling CO4: Statistical Alignment Models and Expectation Maximization (EM) EM and its use in statistical MT alignment models. The EM algorithm. Machine Translation (MT): Basic issues in MT. Rule based Techniques, Statistical Machine translation (SMT), word alignment, phrase-based translation, and synchronous grammars, case study: IBM models. Additional topics: Advanced Language Modelling (including LDA), other applications like summarization.	CO3, CO4	1. To extract information from a given document or hidden features automatically learned from data, the concept is included. 2. Acquire knowledge to handle situations where variables are partially observable.	27%

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| | | | | Syntactic-parsing: Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Top-down and bottom-up parsing, empty constituents, left recursion. Modern Statistical Parsers Search methods in parsing: Agenda-based chart, A*, and "best-first" parsing. Dependency parsing. Discriminative parsing. Semantic Analysis: Lexical semantics and word-sense disambiguation. Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Coreference, pronoun resolution algorithm, text coherence, discourse structure. Semantic Role Labeling and Semantic Parsing. Information sources, rule-based methods, evaluation (recall, precision). Statistical Machine Translation (MT), Alignment Models. | context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Top-down and bottom-up parsing, empty constituents, left recursion. Modern Statistical Parsers Search methods in parsing: Agenda-based chart, A*, and "best-first" parsing. Dependency parsing. Discriminative parsing. Semantic Analysis: Lexical semantics and word-sense disambiguation. Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Coreference, pronoun resolution algorithm, text coherence, discourse structure. Semantic Role Labeling and Semantic Parsing. Information Extraction (IE): Named entity recognition and relation extraction. IE using sequence labeling. Information sources, rule-based methods, evaluation (recall, precision). Statistical Machine Translation (MT), Alignment Models. Statistical Alignment Models and Expectation Maximization (EM) EM | | | | |

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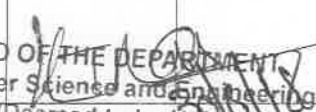Accredited by **NAAC** as 'A' Grade University ❖ Approved by AICTE ❖ ISO 9001-2015 Certified

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					and its use in statistical MT alignment models. The EM algorithm. Machine Translation (MT): Basic issues in MT. Rule based Techniques, Statistical Machine translation (SMT), word alignment, phrase-based translation, and synchronous grammars, case study: IBM models. Additional topics: Advanced Language Modelling (including LDA), other applications like summarization.					

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Course Code	Course Name	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
18CS3279	Network Security	PE-2	Message authentication codes: Requirements, functions, MACs, security of MACs, HMAC. Digital Signatures: ElGamal Digital Signature, Schnorr digital signature, DSS. Key management and distribution: Symmetric key distribution using symmetric encryption, symmetric key distribution using asymmetric encryption, distribution of public keys, X.509 Certificates, Public-Key Infrastructure User Authentication protocols: Remote User Authentication Principles, Remote User Authentication using Symmetric Encryption, Kerberos, Remote User Authentication Using Asymmetric Encryption, Transport-Level Security: Web Security issues, Secure Socket Layer and Transport Layer Security,	Message authentication codes: Requirements, functions, MACs, security of MACs, HMAC. Digital Signatures: ElGamal Digital Signature, Schnorr digital signature, DSS. Key management and distribution: Symmetric key distribution using symmetric encryption, symmetric key distribution using asymmetric encryption, distribution of public keys, X.509 Certificates, Public-Key Infrastructure User Authentication protocols: Remote User Authentication Principles, Remote User Authentication using Symmetric Encryption, Kerberos, Remote User Authentication Using Asymmetric Encryption, Transport-Level Security: Web Security issues, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Electronic Mail Security: Pretty Good Privacy,	Added: CO4:Electronic Mail Security: Pretty Good Privacy, S/MIME, Domain Keys Identified Mail IP Security: IP Security Overview. IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites	CO4	1. For buliding career in career in cybersecurity Electronic Mail Security concept will be useful. 2. To configure email settings to improve security	25%

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			HTTPS, Secure Shell (SSH)	S/MIME, Domain Keys Identified Mail IP Security: IP Security Overview. IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suite				
18SC1103	Single Variable calculus and Matrix Algebra	BS	Differential Equations: Definitions and terminology and mathematical models used in differential equations. First-order and higher-order differential equations, along with the methods of solutions and their applications. Modeling with first and higher-order also systems of linear first-order	Differential Equations: Definitions and terminology and mathematical models used in differential equations. First -order and higher-order differential equations, along with the methods of solutions and their applications. M odeling with first and higher-order also systems of linear first-order differential equations. Solutions of first	Added: CO4: Gauss Seidal iteration methods, orthogonal, symmetric, skew-symmetric, Hermitian, Skew-Hermitian and unitary matrices	CO4	1. To impart knowledge of numerical analysis in solving differential equations.	10%

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			differential equations. Solutions of first order ordinary differential equations by Numerical methods. Fourier series: Definitions and Fourier series for a periodic signal. Fourier series for simple functions. Fourier series of the summation of sinusoids directly from the definition by using Euler's formula. Solving particular solution to differential equation by Fourier series. Matrix algebra: Solving linear System of equations by Gauss-elimination, L U decomposition and Jacobi, Eigen values, Eigen vectors and their properties, Cayley - Hamilton theorem (without proof) and its applications, and quadratic forms.	order ordinary differential equations by Numerical methods. Fourier series: Definitions and Fourier series for a periodic signal. Fourier series for simple functions. Fourier series of the summation of s inusoids directly from the definition by using Euler's formula. Solving particular solution to differential equation by Fourier series. Matrix algebra: Solving linear System of equations by Gauss-elimination, L U decomposition and Jacobi, Gauss Seidal iteration methods, orthogonal, symmetric, skew-symmetric, Hermitian, Skew-Hermitian and unitary matrices, Eigen values, Eigen vectors and their properties, Cayley - Hamilton theorem (without proof) and its applications, and quadratic forms.				

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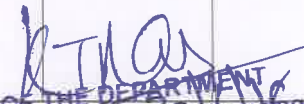Accredited by **NAAC** as 'A' Grade University ❖Approved by AICTE ❖ ISO 9001-2015 Certified

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Course Code	Course Name	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
18CS1003	Workshop practice for Computer Engineers	BS	CARPENTRY - Hands on practice on wood working operation using hand tools FITTING - Hands on practice on preparing fits. TIN SMITHY - Hands on practice on sheet metal working. HOUSE WIRING - Hands on practice on electrical house wiring connections WELDING - Hands on practice joining of metal plates using arc welding equipment	CARPENTRY - Hands on practice on wood working operation using hand tools FITTING - Hands on practice on preparing fits. TIN SMITHY - Hands on practice on sheet metal working. HOUSE WIRING - Hands on practice on electrical house wiring connections WELDING - Hands on practice joining of metal plates using arc welding equipment CASTING – Hands on practice on Gravity die casting MACHINE SHOP – Hands on practice on Lathe, Drilling, and surface grinding machine tools	Added: CO4: CASTING – Hands on practice on Gravity die casting MACHINE SHOP – Hands on practice on Lathe, Drilling, and surface grinding machine tools	CO4	1. To provide overview on Casting and Machine Shop	15%

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18CS3064	Big Data Optimization	PE-4	Introduction: Motivation, Why R, Representation of a Solution , Evaluation Function , Constraints , Optimization Methods , Demonstrative Problems Foundation of r -R Basics: Introduction Basic Objects and Functions, data structures, about usage, understanding data structures, functions, list, arrays, control structures, data manipulations, date and string manipulations Blind Search: Introduction, Full Blind Search, Grid Search , Monte Carlo Search , Local Search: Introduction , Hill Climbing, Simulated Annealing Tabu Search, Comparison of Local Search Methods, Population Based Search: Introduction, Genetic and Evolutionary Algorithms ,Differential Evolution , Genetic Programming Applications: Introduction, Travelling	Introduction: Motivation, Why R, Representation of a Solution , Evaluation Function , Constraints , Optimization Methods , Demonstrative Problems Foundation of r -R Basics: Introduction Basic Objects and Functions, data structures, about usage, understanding data structures, functions, list, arrays, control structures, data manipulations, date and string manipulations Blind Search: Introduction, Full Blind Search, Grid Search , Monte Carlo Search , Local Search: Introduction , Hill Climbing, Simulated Annealing Tabu Search, Comparison of Local Search Methods, Population Based Search: Introduction, Genetic and Evolutionary Algorithms ,Differential Evolution ,Particle Swarm Optimization, Estimation of Distribution Algorithm ,Comparison of Population Based Methods, Bag Prices with Constraint Genetic	Added: CO3: Particle Swarm Optimization, Estimation of Distribution Algorithm ,Comparison of Population Based Methods, Bag Prices with Constraint CO4:Wine Quality Classification Implementing R programming on various problems.	CO4	1. Inorder to solve various problems by more powerful optimization techniques, PSO and EDA concepts are added.	30%

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			Salesman Problem , Time Series Forecasting.	Programming Applications: Introduction, Travelling Salesman Problem , Time Series Forecasting , Wine Quality Classification Implementing R programming on various problems.				

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15CS3113	Platform Based Development		Overview of various platforms, Fundamentals of HTML, HTML5, Working with Images, Colors,and Canvas. Working with Forms, HTML5 for mobiles. CSS3: Colors, fonts, text styles positioning,working with jQuery. JavaScript Functions, Events, Image Maps, and Animations· JavaScript Objects,Validation, Errors, Exception Handling, and Security. Integrating PHP with Ajax. Mobile Programming: JS productivity tips, jQuery Mobile, Sencha Touch. Industrial Platforms: Geometric configurations, operations,programming and controls of robots, actuators, sensing for robots, Performance specifications, User Interface- User interaction and intuitive navigation, Delightful user experience, Testing	Overview of various platforms, Fundamentals of HTML, HTML5, Working with Images, Colors,and Canvas. Working with Forms, HTML5 for mobiles. CSS3: Colors, fonts, text styles positioning,working with jQuery. JavaScript Functions, Events, Image Maps, and Animations· JavaScript Objects,Validation, Errors, Exception Handling, and Security. Integrating PHP with Ajax. Mobile Programming: JS productivity tips, jQuery Mobile, Sencha Touch. Industrial Platforms: Geometric configurations, operations,programming and controls of robots, actuators, sensing for robots, Performance specifications, User Interface- User interaction and intuitive navigation, Delightful user experience, Testing UI, Background tasks- Background tasks, Triggering, scheduling, and	Added: CO4: Context resolvers and content providers, loading data using loaders. Web services: XML web services, SOAP, SOA.	CO4	1. To access data from other applications Context resolvers will be useful. 2. To share data with each other Content providers will be useful	8%

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			UI, Background tasks- Background tasks, Triggering, scheduling, and optimizing background tasks Data -- saving, retrieving, and loading- Shared Preference and settings, Storing data with SQLite	optimizing background tasks Data -- saving, retrieving, and loading- Shared Preference and settings, Storing data with SQLite, Context resolvers and content providers, loading data using loaders. Web services: XML web services, SOAP, SOA.				

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18CS3270	Soft Computing	PE-2	Introduction to computing: Differentiate Soft computing versus hard computing, properties of soft computing, Fundamentals of Fuzzy Logic Systems: Fuzzy sets, Fuzzy logic operations, generalized operations, Fuzziness and fuzzy resolution, fuzzy relations, composition and interface, considerations of fuzzy decision- making. Fundamentals of Artificial neural networks: Learning and acquisition of knowledge, features of artificial neural networks, fundamentals of connectionist modeling. Major classes of neuralnetworks: The multi-layer perceptrons, radial basis function networks, Kohonen's self-organizing network, The Hopfield network, industrial and commercial application of ANN. Dynamic Neural	Introduction to computing: Differentiate Soft computing versus hard computing, properties of soft computing, Fundamentals of Fuzzy Logic Systems: Fuzzy sets, Fuzzy logic operations, generalized operations, Fuzziness and fuzzy resolution, fuzzy relations, composition and interface, considerations of fuzzy decision- making. Fuzzy logic control: Basic of fuzzy control, Fuzzy control architecture, Properties of fuzzy control, robustness and stability. Fundamentals of Artificial neural networks: Learning and acquisition of knowledge, features of artificial neural networks, fundamentals of connectionist modeling. Major classes of neuralnetworks: The multi-layer perceptrons, radial basis function networks, Kohonen's self-organizing network, The Hopfield network, industrial and commercial application of	Added: CO2:Fuzzy logic control: Basic of fuzzy control, Fuzzy control architecture, Properties of fuzzy control, robustness and stability. CO4:Genetic algorithms - operations, integration of Genetic algorithms with neural networks, integration of Genetic algorithms with fuzzy logic, Swarm computing: Overview of swarm computing, Optimization with particle swarm optimization, integration of particle swarm optimization with neural networks and fuzzy logic.	CO2, CO4	1. Fuzzy control is a powerful tool for controlling complex systems and is easy to understand and implement. 2. Learning the basics of fuzzy control and fuzzy control architecture can help you to understand how fuzzy controllers work and how they can be used to control complex systems. 3. Learning about swarm computing	30%

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			Networks, Neuro Fuzzy Systems: Architecture of neuro fuzzy systems, construction of neuro fuzzy systems. Evolutionary computing: Overview of Evolutionary computing, Genetic algorithms and optimization, the schema theorem: the fundamental algorithm of Genetic algorithms	ANN. Dynamic Neural Networks, Neuro Fuzzy Systems: Architecture of neuro fuzzy systems, construction of neuro fuzzy systems. Evolutionary computing: Overview of Evolutionary computing, Genetic algorithms and optimization, the schema theorem: the fundamental algorithm of Genetic algorithms, Genetic algorithms - operations, integration of Genetic algorithms with neural networks, integration of Genetic algorithms with fuzzy logic, Swarm computing: Overview of swarm computing, Optimization with particle swarm optimization, integration of particle swarm optimization with neural networks and fuzzy logic.			understand how swarms work and how they can be used to solve complex problems. It can also helps to develop your own swarm computing applications.	

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Annexure-2(c)

Report- Analysis of Feedback on curriculum – received from the stake holders prior to the commencement of the Academic Year 2018-19

Feedback from different stake holders has been collected in respect of the curriculum offered for the academic year 2018-19

S. No.	Type of Stake holder	Number of feedback
1	Students	676
2	Parents	30
3	Alumni	20
4	Faculty	90
5	Academic peers	23
6	Industry persons	15
Total		**854**

Stakeholder Feedback / Recommendation	Action Taken in BOS
Academic Peer	
Mr.Digallinte Sreenivasulu, Priyadarshini College, dsnvas@gmail.com, It is suggested to add Hands on practice on casting and machine shop in Workshop practice for Computer Engineers course to provide overview on Casting and Machine shop that helps students to gain practical experience.	It is resolved and approved to add hands on practice experiments on Casting and Machine Shop in "Workshop practice for Computer Engineers" for 2018-19 admitted batch students.
Prof A.S.N. Chakravarthy, Academic peer suggested to revise syllabus of Big Data optimization to meet global needs.	It is resolved and approved by all BOS members to add Particle Swarm Optimization, Estimation of Distribution Algorithm, Comparison of Population Based Methods, Bag Prices with Constraint in CO3 to solve various problems by more powerful optimization techniques, PSO and EDA concepts in "Big Data Optimization" to offer for 2018-19 admitted batch students.
Dr. Vivek S Deshpande, Academic peer recommended to include "Quantum Physics for engineers" course under basic science category.	It is resolved to introduce "Quantum Physics for engineers" course as new course to 2018- 19 admitted batch students.
Prof.A.S.N.Chakravarthy, Academic Peer suggested to introduce new course on Big Data Analytics which helps student to grow significantly in data-driven decision- making and providing students with essential skills for	It is resolved to introduce "Big data Analytics" course as new course to 2018-19 admitted batch students.

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navigating and analyzing large-scale datasets.	
Alumni	
Mr.Mahendranath.N, Alumni Gayatri Educational Society Director, strongly recommends the inclusion of courses that improve students' communication skills into the curriculum.	It is resolved and approved new course "Professional Communication Skills" and "English Proficiency" to 2018-19 admitted batch students.
K. Devi Prasanna(14003464) Alumni, strongly suggested to include topics like permutations and combinations, linear recurrence relations to the syllabus of Discrete Mathematics course.	It is resolved and approved to revise syllabus for "Discrete Mathematics" for 2018-19 batch students.
Vishnu Teja (2006-2010 batch) Alumni, strongly recommend including virtualization concepts in detail in "Cloud Computing " course. Addressing Contemporary Needs, recognizing its relevance and importance in today's technological landscape.	It is resolved and approved to revise syllabus for "Cloud Computing" for 2018-19 batch students.
Faculty	
Mr.CH.RAMAIAHMr. CH. RAMAIAH, Faculty suggested introducing a new course, Microprocessors, that gives a basic knowledge to learn IOT specialization courses.	It is resolved to approve introducing a new course "Microprocessors" to 2018-19 admitted batch students.
Dr. P. V. VARA PRASAD, Faculty suggested to include topics Mathematical Background, Model, Analyze, Running Time Calculations, Red black trees, Rehashing, Hash Tables in the Standard Library, Extendible Hashing in Data structures to help students in Acquiring knowledge on basic mathematical tools and techniques of algorithm analysis and to gain knowledge on problem solving in the most efficient ways for finding and storing data.	It is resolved to approve the revision of syllabus in "Data Structures" course to 2018- 19 admitted batch students.
Dr. Rajya Lakshmi, Assistant Professor, Faculty suggested to include topics Gauss Seidel iteration methods, orthogonal, symmetric, skew-symmetric, Hermitian, Skew-Hermitian, and unitary matrices in "Single Variable calculus and Matrix Algebra" course under CO4 to impart knowledge of numerical analysis in solving differential equations.	It is resolved and approved to add suggested topics in "Single Variable calculus and Matrix Algebra" for 2018-19 admitted batch students.

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Mr. Mohannad Gouse suggested to revise syllabus of Natural Language Processing by adding feature extraction concepts to meet global industry requirements.	It is resolved and approved to add hidden feature extraction concepts in NLP course to offer for 2018-19 admitted batch students.
Dr.B.VIJAYA BABU, Faculty suggested adding more Email security related concepts in Network Security course to offer for 2018-19 admitted batch students for building career in cybersecurity, Electronic Mail Security.	It is resolved and approved to include Electronic Mail Security: Pretty Good Privacy, S/MIME, Domain Keys Identified Mail IP Security: IP Security Overview. IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites concepts in Network Security to offer for 2018-19 admitted batch students.
Dr.V Murali Mohan, Associate Professor, Faculty suggested including any Full Stack Development Courses into the Curriculum under Skill Development.	It is resolved to include to introduce new course "Technical Skilling (PFSD + Comp. Coding)" to 2018-19 B.Tech admitted batch students under SDC category.
Mr.CH.M.H.SAI BABA, Assistant Prof. saibaba.ch77@kluniversity.in, I recommend revising the course "Soft Computing" as they would significantly enrich the curriculum by encompassing cutting-edge topics in computational intelligence	It is resolved to approve the revision of "Soft Computing" Course for 2018-19 admitted batch Students.
Industry Person	
Vijay Krishna Pala Industry person suggested Data Science to equipping students with cutting-edge skills vital for navigating the data-driven landscape.	It is resolved and approved to introduce new course "Data Science" to offer for 2018-19 admitted batch students.
Mr. B. Srikanth industry person recommended including placement training so that students can be equipped with the skills necessary for placements.	It is resolved and approved to introduce new courses on "Placement Training" in the curriculum of 2018-19 admitted batch students.
Mr.Sagireddy Pulla Reddy,SP Software, Industry Person suggested to include "Internet of Things (IoT): Architectures and Protocols" which helps to prepare students for the evolving technological landscape.	It is resolved to include the new course "Internet of Things (IoT): Architectures and Protocols" to 2018-19 B.Tech admitted batch students.

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Mr. Poothabalan Somasundaram, Software Architect, Honeywell Technologies advised including courses which improve coding skills related to TechnicalSkilling.	It is resolved to include the new courses"Technical Skilling – 1 and Technical Skilling - 2" to 2018-19 B.Tech admitted batchstudents.
Meenakshi Sharma, Assistant Director, PR & Media, I Strongly recommend revising syllabus for "Platform based Development"	It is resolved to approve the revision of "Platform Based Development" Course for 2015 admitted batch onwards.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-3(a)

B.Tech 2018-19 Admitted Batch Category Wise Course Structure

Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisites	New/Revised/Retained	EES	Stake Holders Category	Justification for Considering the feedback
1	18UC1101	Basic English	HSS	0	0	4	0	2	4	NIL	Retained	SKILL DEVELOPMENT	No changes	—
2	18GN1107	Co-Curricular Activity - 1	HSS	0	0	0	2	0.5	2	NIL	Retained	—	No changes	—
3	18UC1202	English Proficiency	HSS	0	0	4	0	2	4	NIL	New	SKILL DEVELOPMENT	Alumni	A new course has been added to significantly enhance students' language skills
4	18GN1107	Co-Curricular Activity - 2	HSS	0	0	0	2	0.5	2	NIL	Retained	—	No changes	—
5	18UC2103	Professional communication skills	HSS	0	0	4	0	2	4	NIL	New	SKILL DEVELOPMENT	Alumni	A new course has been added to significantly enhance students' language skills
6	18UC2204	Aptitute Builder - 1	HSS	0	0	4	0	2	4	NIL	Retained	SKILL DEVELOPMENT	No changes	—
7	18UC3105	Aptitute Builder - 2	HSS	0	0	4	0	2	4	18SC2008	Retained	SKILL DEVELOPMENT	No changes	—
8		Foreign Language	HSS	2	0	0	0	2	2	NIL	—	—	—	—
						Total Credits		13						
9	18SC1103	Single Variable calculus and Matrix Algebra	BS	3	0	0	0	3	3	NIL	10%-Revised	SKILL DEVELOPMENT	Faculty	As per feedback to impart knowledge University memerial and ...

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Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisites	New/Revised/ Retained	EES	Stake Holders Category	Justification for Considering the feedback
														solving differential equations topics added.
10	18SC1104	Foundations of Computational Mathematics	BS	0	0	2	0	1	2	NIL	Retained	SKILL DEVELOPMENT	No changes	—
11	18SC1105	Logic & Reasoning	BS	0	0	2	0	1	2	NIL	Retained	SKILL DEVELOPMENT	No changes	—
12	18CS1003	Workshop practice for Computer Engineers	BS	0	0	4	0	2	4	NIL	15%-Revised	SKILL DEVELOPMENT	Academic Peer	As per Academic peer feedback, It is revised to provide overview on Casting and Machine shop that helps students to gain practical experience.
13	18MT1201	Multivariate Calculus	BS	3	0	2	0	4	5	NIL	Retained	EMPLOYABILITY	No changes	—
14	18CY1001	Engineering Chemistry	BS	3	0	2	0	4	5	NIL	Retained	EMPLOYABILITY	No changes	—
15	18SC2008	Discrete Mathematics	BS	2	1	0	0	3	3	NIL	30%-Revised Considered as New Course	SKILL DEVELOPMENT	Alumni	As per Alumni feedback, it is revised to fosters critical thinking and foundational problem solving skills

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16	18UC0009	Ecology and Environment	BS	2	0	0	0	2	2	NIL	Retained	SKILL DEVELOPMENT	No changes	—
17	18PH4101	Quantam Physics for Engineers	BS	3	0	0	0	3	3	NIL	New	SKILL DEVELOPMENT	Academic Peer	A new course has been added to prepare students to tackle complex engineering challenges in the rapidly evolving technological landscape.
					Total Credits			23						
18	18SC1101	Problem Solving & Computer Programming	ES	3	0	2	0	4	5	NIL	Retained	EMPLOYABILITY	No changes	—
19	18SC1106	Technical Skilling - 1 (Coding)	ES	0	0	0	6	1.5	6	NIL	New	SKILL DEVELOPMENT	Industry Person	A new course has been added to improves coding skills related to Technical Skilling
20	18EC1101	Digital System Design	ES	3	0	2	0	4	5	NIL	Retained	EMPLOYABILITY	No changes	—
21	18SC1202	Data Structures	ES	3	0	2	0	4	5	18SC1101	26%-Revised Considered as New Course	EMPLOYABILITY	Faculty	As per faculty feedback, it is revised to gain knowledge on problem solving

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														for finding and storing data
22	18SC1207	Technical Skilling - 2 (Coding)	ES	0	0	0	6	1.50	6	NIL	New	SKILL DEVELOPMENT	Industry Person	A new course has been added to improves coding skills related to Technical Skilling
23	18EC1002	Engineering Graphics & Design for Electronic & Computer Engineers	ES	0	0	4	0	2	4	NIL	Retained	EMPLOYABILITY	No changes	—
24	18SC2009	Object Oriented Programming	ES	3	0	2	6	5.5	11	18SC1101	Retained	EMPLOYABILITY	No changes	—
25	18CS2111	Microprocessors	ES	3	0	2	0	4	5	NIL	New	EMPLOYABILITY	Faculty	A new course has been added to offers a basic knowledge to learn IOT specialization courses
26	18TS307	Placement Training	ES	0	0	0	6	1.5	6	NIL	New	EMPLOYABILITY	Industry Person	A new course has been added to equip students with skills necessary for placements
27	18TS303	Placement Training	ES	0	0	0	10	2.5	10	18SC2009	New	EMPLOYABILITY	Industry Person	A new course has been added...

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Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisites	New/Revised/ Retained	EES	Stake Holders Category	Justification for Considering the feedback
														students with skills necessary for placements
				Total Credits				30.5						
28	18EC1202	Computer Organization & Architecture	PC	3	0	0	0	3	3	18EC1101	Retained	EMPLOYABILITY	No changes	—
29	18CS2102	Operating Systems	PC	3	0	2	2	4.5	7	18EC1202	Retained	EMPLOYABILITY	No changes	—
30	18CS2103	Software Engineering	PC	2	1	0	0	3	3	18SC1101	Retained	EMPLOYABILITY	No changes	—
31	18CS2204	Computer Network and Security	PC	3	1	0	0	4	4	18SC1101	Retained	EMPLOYABILITY	No changes	—
32	18CS2205	Database Management Systems	PC	3	0	2	2	4.5	7	18SC1202	Retained	EMPLOYABILITY	No changes	—
33	18CS2206	Artificial Intelligence	PC	2	0	2	0	3	4	18SC2008	Retained	EMPLOYABILITY	No changes	—
34	18CS3210	Enterprise Programming	PC	3	0	2	4	5	9	18SC2009	Retained	EMPLOYABILITY	No changes	—
35	18CS3211	Data Science	PC	2	0	2	4	4	8	NIL	New	EMPLOYABILITY	Industry Person	A new course has been added for equipping students with cutting-edge skills vital for navigating the data-driven landscape
36	18CS3109	Distributed Computing	PC	3	0	2	0	4	5	18CS2204	Retained	EMPLOYABILITY	No changes	

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Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisites	New/Revised/ Retained	EES	Stake Holders Category	Justification for Considering the feedback
37	18CS2207	Analysis & Design of Algorithms	PC	3	0	2	4	5	9	18SC1202	Retained	SKILL DEVELOPMENT	No changes	—
38	18CS3108	Automata Theory & Compiler Design	PC	3	1	0	0	4	4	18SC2008	Retained	EMPLOYABILITY	No changes	—
39	18TS309	Technical Skilling(PFSD + Comp.Coding)	PC	0	0	0	8	2	8	NIL	New	SKILL DEVELOPMENT	Faculty	A new course has been added to handle tasks related to user interface design, client-side scripting, server-side scripting, and database management. This versatility makes them valuable assets in the job market.
		Total Credits						46						
		Professional Elective-1	PE	2	0	2	4	4	8	NIL	—	—	—	—
		Professional Elective-2	PE	2	0	2	0	3	4	NIL	—	—	—	—
		Professional Elective-3	PE	2	0	2	4	4	8	NIL	—	—	—	—
		Professional Elective-4	PE	2	0	2	0	3	4	NIL	—	—	—	—
		Professional Elective-5	PE	2	0	2	0	3	4	NIL	—	—	—	—

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Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisites	New/Revised/ Retained	EES	Stake Holders Category	Justification for Considering the feedback
		Professional Elective-6	PE	3	0	0	0	3	3	NIL	—	—	—	—
							Total Credits	20						
40	18IE2246	Industrial Training	PR	0	0	0	0	2	0	NIL	Retained	SKILL DEVELOPMENT	No changes	—
41	18IE3247	Term Paper	PR	0	0	4	0	2	4	NIL	Retained	SKILL DEVELOPMENT	No changes	—
42	18IE4048	Project (Part I)	PR	0	0	12	0	6	12	NIL	Retained	EMPLOYABILITY	No changes	—
43	18IE4049	Project (Part II)	PR	0	0	12	0	6	12	NIL	Retained	EMPLOYABILITY	No changes	—
44	18IE4050	Practice School	PR	0	0	12	0	6	12	NIL	Retained	SKILL DEVELOPMENT	No changes	—
45	18IE4051	Internship	PR	0	0	12	0	6	12	NIL	Retained	EMPLOYABILITY	No changes	—
							Total Credits	16						
46		OE-1	OE	3	0	0	0	3	3	NIL	—	—	—	—
47		OE-2	OE	3	0	0	0	3	3	NIL	—	—	—	—
48		OE-3	OE	3	0	0	0	3	3	NIL	—	—	—	—
49		Management Elective	OE	3	0	0	0	3	3	NIL	—	—	—	—
							Total Credits	12						
50	18UC0007	Indian Heritage & Culture	AU	2	0	0	0	0	2	NIL	Retained	ENTREPRENEUR SHIP	No changes	—
51	18UC0008	Indian Constitution	AU	2	0	0	0	0	2	NIL	Retained	SKILL DEVELOPMENT	No changes	
52	18UC0010	Universal Human	AU	2	0	0	0	0	2	NIL	Retained	EMPLOYABILITY	No changes	

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		Values & Professional Ethics												
					Total Credits			160.5						
						PROFESSIONAL ELECTIVE COURSES								
						CLOUD & EDGE COMPUTING (CEC)								
53	18CS3251S	Cloud Computing	PE-1	2	0	2	4	4	8	18CS2204	30%-Revised Considered as New Course	EMPLOYABILITY	Alumni	As per Alumni feed It provides valuable insights into cloud computing and its practical applications.
54	18CS3254	Advanced Operating Systems	PE-2	2	0	2	0	3	4	18CS2102	Retained	EMPLOYABILITY	No changes	—
55	18CS3253S	Cloud System Infrastructure	PE-3	2	0	2	4	4	8	18CS2204	Retained	EMPLOYABILITY	No changes	—
56	18CS3242	Parallel Algorithms	PE-4	2	0	2	0	3	4	18CS2102	Retained	EMPLOYABILITY	No changes	—
57	18CS3150	Advance Computer Architecture	PE-5	2	0	2	0	3	4	18EC1202	Retained	EMPLOYABILITY	No changes	—
58	18CS3248	Edge Computing	PE-6	3	0	0	0	3	3	18CS2204	Retained	EMPLOYABILITY	No changes	—
						SOFTWARE MODELLING & DEVOPS (SM&DPS)								
59	18CS3037S	Web Engineering	PE-1	2	0	2	4	4	8	18CS2103	Retained	SKILL DEVELOPMENT	No changes	
60	18CS3038	Software Verification &	PE-2	2	0	2	0	3	4	18CS2103	Retained	EMPLOYABILITY	No changes	

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		Validation												
61	18CS3230S	Continuous Delivery & DevOps	PE-3	2	0	2	4	4	8	NIL	Retained	EMPLOYABILITY	No changes	—
62	18CS3233	UI/UX Design	PE-4	2	0	2	0	3	4	18CS2103	Retained	EMPLOYABILITY	No changes	—
63	18CS3131	Design Patterns	PE-5	2	0	2	0	3	4	18CS2103	Retained	EMPLOYABILITY	No changes	—
64	18CS3236	Software Project Management	PE-6	3	0	0	0	3	3	18CS2103	Retained	EMPLOYABILITY	No changes	—
ARTIFICIAL INTELLIGENCE & INTELLIGENT PROCESS AUTOMATION (AI & IPA)														
65	18CS3166S	Machine Learning	PE-1	2	0	2	4	4	8	18CS2206	Retained	SKILL DEVELOPMENT	No changes	—
66	18CS3270	Soft Computing	PE-2	2	0	2	0	3	4	18CS2206	30% -Revised Considered as New Course	EMPLOYABILITY	Faculty	To enrich the curriculum by encompassing cutting-edge topics in computational intelligence
67	18CS3074S	Deep Learning	PE-3	2	0	2	4	4	8	18CS2206	Retained	Skill Development	No changes	—
68	18CS3167	Natural Language Processing	PE-4	2	0	2	0	3	4	18CS2206	27%-Revised Considered as New Course	EMPLOYABILITY	Faculty	As per feedback from Faculty, it is revised to meet global industry requirements
69	18CS3168	Perception & Computer Vision	PE-5	2	0	2	0	3	4	18CS2206	Retained	EMPLOYABILITY	No changes	—

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70	18CS3272	Cognitive Computing	PE-6	3	0	0	0	3	3	18CS2206	Retained	EMPLOYABILITY	No changes	—
DATA SCIENCE & BIG DATA ANALYTICS (DS&BDA)														
71	18CS3262S	DATA VISUALIZATION	PE-1	2	0	2	4	4	8	18CS2205	Retained	SKILL DEVELOPMENT	No changes	—
72	18CS3159	Data Warehousing & Mining	PE-2	2	0	2	0	3	4	18CS2205	Retained	EMPLOYABILITY	No changes	—
73	18CS3065S	Big Data Analytics	PE-3	2	0	2	4	4	8	18CS2205	New	EMPLOYABILITY	Academic Peer	A new course has been added to provide essential skills for navigating and analyzing large-scale datasets
74	18CS3064	Big Data Optimization	PE-4	2	0	2	0	3	4	18CS2205	30%-Revised Considered as New Course	EMPLOYABILITY	Academic Peer	As per feedback from Academic Peer, it is revised to meet global industry requirements
75	18CS3260	Graph & Web Analytics	PE-5	2	0	2	0	3	4	18SC2008	Retained	EMPLOYABILITY	No changes	—
76	18CS3158	Advance Databases	PE-6	3	0	0	0	3	3	18CS2205	Retained	EMPLOYABILITY	No changes	—
CYBERSECURITY & BLOCKCHAIN TECHNOLOGY (CYS&BCT)														
77	18CS3175S	CRYPTANALYSIS & CYBER DEFENCE	PE-1	2	0	2	4	4	8	18CS2204	Retained	SKILL DEVELOPMENT	No changes	—
78	18CS3279	Network Security	PE-2	2	0	2	0	3	4	18CS2204	26%-Revised Considered as	EMPLOYABILITY	No changes	As per feedback from faculty, It is

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											New Course			revised to for building career in cybersecurity Electronic Mail Security concepts
79	18CS3176S	Digital Forensics	PE-3	2	0	2	4	4	8	18CS2204	Retained	EMPLOYABILITY	No changes	—
80	18CS 3278	Database & Systems Security	PE-4	2	0	2	0	3	4	18CS2204	Retained	EMPLOYABILITY	No changes	—
81	18CS3084	Blockchain & Crypto Currencies	PE-5	2	0	2	0	3	4	18CS2204	Retained	EMPLOYABILITY	No changes	—
82	18CS3281	Secure Software Engineering	PE-6	3	0	0	0	3	3	18CS2204	Retained	EMPLOYABILITY	No changes	—
GAME DEVELOPMENT & UX DESIGN (GUX)														
83	18CS3140S	Programming for Game Development	PE-1	2	0	2	4	3	4	18CS2102	Retained	ENTREPRENEUR SHIP	No changes	—
84	18CS3233	UI/UX DESIGN	PE-2	2	0	2	0	3	4	18CS2103	Retained	EMPLOYABILITY	No changes	—
85	18CS3286S	AR & VR Application Development	PE-3	2	0	2	4	4	8	18CS2102	Retained	EMPLOYABILITY	No changes	—
86	18CS3287	Digital Media Processing	PE-4	2	0	2	0	3	4	18SC2008	Retained	EMPLOYABILITY	No changes	—
87	18CS3288	Principles of Game Design	PE-5	3	0	0	0	3	3	Nil	Retained	EMPLOYABILITY	No changes	
88	18CS3289	Business of Games & Entrepreneur	PE-6	3	0	0	0	3	3	Nil	Retained	ENTREPRENEUR SHIP	No changes	

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisites	New/Revised/Retained	EES	Stake Holders Category	Justification for Considering the feedback
		ship												
							INTERNET OF THINGS (IOT)							
89	18EM3110	Fundamentals of Internet of Things	PE-1	2	0	2	0	3	4	Nil	Retained	EMPLOYABILITY	No changes	—
90	18SC3108	IoT Technical Skills	PE-1	0	0	0	4	1	4	Nil	Retained	SKILL DEVELOPMENT	No changes	—
91	18EM3107	IoT Sensing and Actuating Devices	PE-2	2	0	2	0	3	4	Nil	Retained	EMPLOYABILITY	No changes	—
92	18CS3285S	Cloud Computing for IoT Engineers	PE-3	2	0	2	4	4	8	Nil	Retained	EMPLOYABILITY	No changes	—
93	18EM4108	Internet of Things: Architectures and Protocols	PE-4	2	0	2	0	3	4	18CS2204	New	EMPLOYABILITY	Industry Person	A new course has been added to prepare students for the evolving technological landscape
94	18EM4109	Wireless Sensor Network	PE-5	2	0	2	0	3	4	18CS2204	Retained	EMPLOYABILITY	No changes	—
95	18EM4201	Security in Internet of Things	PE-6	2	0	2	0	3	4	Nil	Retained	EMPLOYABILITY	No changes	—
96	18CS3248	Edge Computing	PE-6	3	0	0	0	3	3	18CS2102	Retained	EMPLOYABILITY	No changes	—
							OPEN ELECTIVES							
	18CS40A6	Fundamentals of DBMS	OE	3	0	0	0	3	3	Nil	Retained		No changes	—

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	18CS40A7	Fundamentals of Software Engineering	OE	3	0	0	0	3	3	Nil	Retained	—	No changes	—
	18CS40A8	Fundmentals of Information Technology	OE	3	0	0	0	3	3	Nil	Retained	—	No changes	—

Total number of courses = 96

Percentage of Syllabus Revision=(Total No.of courses revised + new courses)*100/Total Courses=((12+9)*100)/96 = 21.875

Percentage of Courses focusing on Employability= 60*100/96=57.94 = 62.5

Percentage of Courses focusing on Entrepreneurship = 3*100/96=3.125

Percentage of Courses focusing on Skill Development = 26*100/96=27.08

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Annexure-3(b)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M.Tech – Computer Science and Engineering
2018 – 19 Admitted Batch Category Wise Course Structure

S.No	Category	Course Code	Course Title	Periods			Credits	New/Revised /Retained	EES
				L	T	P			
1	PCC	18CS5101	MATHEMATICAL FOUNDATIONS FOR COMPUTERSCIENCE	3	2	0	5	Retained	SKILL DEVELOPMENT
2	PCC	18CS5102	COMPUTER ORGANIZATION & ARCHITECTURE	3	2	0	5	Retained	EMPLOYABILITY
3	PCC	18CS5103	DATA STRUCTURES & ALGORITHMS	3	0	2	4	Retained	EMPLOYABILITY
4	PCC	18CS5104	DISTRIBUTED DATABASE MANAGEMENTSYSTEMS	3	0	2	4	Retained	EMPLOYABILITY
			ELECTIVE-I	3	0	0	3		
			ELECTIVE-II	3	0	0	3		
	PRI	18IE5149	SEMINAR	0	0	4	2	Retained	SKILL DEVELOPMENT
5	PCC	18CS5205	OPERATING SYSTEM DESIGN	3	2	0	5	Retained	EMPLOYABILITY
6	PCC	18CS5206	COMPUTER NETWORKS & SECURITY	3	2	0	5	Retained	EMPLOYABILITY
7	PCC	18CS5207	OBJECT ORIENTED ANALYSIS AND DESIGN	3	0	2	4	Retained	EMPLOYABILITY
8	PCC	18CS5208	ENTERPRISE PROGRAMMING	3	0	2	4	Retained	EMPLOYABILITY
			Elective-III	3	0	4	6		
			Elective-IV	3	0	4	6		
9	PRI	18IE5250	TERM PAPER	0	0	4	2	Retained	SKILL

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

								d	DEVELOPMENT
10	PRI	18IE6050	DISSERTATION	0	0	72	36	Retained	EMPLOYABILITY
Elective-I									
11	PEC	18CS51A1	SOFT COMPUTING	3	0	0	3	Retained	EMPLOYABILITY
12	PEC	18CS51A2	MACHINE LEARNING AND PATTERN CLASSIFICATION	3	0	0	3	Retained	EMPLOYABILITY
13	PEC	18CS51A3	DATA MINING	3	0	0	3	Retained	EMPLOYABILITY
14	PEC	18CS51A4	NATURAL LANGUAGE PROCESSING	3	0	0	3	Retained	EMPLOYABILITY
	PEC	18CS51A5	MACHINE LEARNING	3	0	0	3	Retained	SKILL DEVELOPMENT
Elective-II									
15	PEC	18CS51B1	REQUIREMENTS ENGINEERING	3	0	0	3	Retained	EMPLOYABILITY
16	PEC	18CS51B2	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	0	3	Retained	EMPLOYABILITY
17	PEC	18CS51B3	COMPILER DESIGN	3	0	0	3	Retained	EMPLOYABILITY
	PEC	18CS51B4	SOFTWARE TESTING & QUALITY ASSURANCE	3	0	0	3	Retained	EMPLOYABILITY
18	PEC	18CS51B5	SOFTWARE VERIFICATION & VALIDATION	3	0	0	3	Retained	SKILL DEVELOPMENT
Elective-III									
19	PEC	18CS52C1	CRYPTOGRAPHY & NETWORK SECURITY	3	0	0	0	Retained	EMPLOYABILITY
20	PEC	18CS52C2	MOBILE COMPUTING	3	0	0	0	Retained	EMPLOYABILITY

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21	PEC	18CS52C3	HIGH PERFORMANCE COMPUTING	3	0	0	0	Retained	EMPLOYABILITY
		18CS52C4	NETWORK MANAGEMENT SYSTEMS	3	0	0	0	Retained	EMPLOYABILITY
Elective-IV									
23	PEC	18CS52D1	SERVICE ORIENTED ARCHITECTURE	3	0	0	3	Retained	SKILL DEVELOPMENT
24	PEC	18CS52D2	VISUAL PROGRAMMING	3	0	0	3	Retained	EMPLOYABILITY
25	PEC	18CS52D3	DIGITAL IMAGE PROCESSING	3	0	0	3	Retained	SKILL DEVELOPMENT
26	PEC	18CS52D4	BIG DATA ANALYTICS	3	0	0	3	Retained	SKILL DEVELOPMENT

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-4(a)

M.Tech - Digital Forensics & Cyber Security
2018 Admitted Batch Category wise Course Structure

S.No	Category	Course Code	Course Title	Periods			Credits	New/Revised/ Retained	EES
				L	T	P			
1	PCC	18CS 5117	Introduction to Cyber Security & ICS	3	0	2	4	New	EMPLOYBILITY
2	PCC	18CS 5118	Digital Forensics	3	0	2	4	New	EMPLOYBILITY
3	PCC	18CS 5119	Advance Network Security & Investigations	3	0	2	4	New	EMPLOYBILITY
4	PCC	18CS 5120	Software Security	3	0	2	4	New	EMPLOYBILITY
			Elective-I	3	0	0	3		
			Elective-II	3	0	0	3		
5	PRI	18IE 5149	Seminar	0	0	4	2	New	SKILL DEVELOPMENT
6	PCC	18CS 5221	Cryptography for Cyber Defense	3	0	2	4	New	EMPLOYBILITY
7	PCC	18CS 5222	Malware Analysis & Reverse Engineering	3	0	2	4	New	EMPLOYBILITY
8	PCC	18CS 5223	Cyber Incident Response & Resilience	3	0	2	4	New	EMPLOYBILITY
9	PCC	18CS 5224	Cyber Law, Governance & Compliance	3	0	2	4	New	EMPLOYBILITY
			Elective-III	3	0	0	3		
			Elective-IV	3	0	0	3		
10	PRI	18IE 5250	Term Paper	0	0	4	2	New	SKILL DEVELOPMENT
11	PRI	18IE 6050	Dissertation	0	0	72	36	New	EMPLOYABILITY
Elective-I									
12	PEC	18CS 51I1	Mobile Device Threats & Investigation	3	0	0	3	New	EMPLOYBILITY
13	PEC	18CS 51I2	Fundamentals of E-Discovery	3	0	0	3	New	SKILL DEVELOPMENT
14	PEC	18CS 51I3	Fuzzy sets and Fuzzy Logic	3	0	0	3	New	SKILL DEVELOPMENT
Elective-II									
15	PEC	18CS 51J1	Introduction to Big Data Analytics	3	0	0	3	New	EMPLOYABILITY

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S.No	Category	Course Code	Course Title	Periods			Credits	New/Revised/ Retained	EES
				L	T	P			
16	PEC	18CS 51J2	Social Media Forensics	3	0	0	3	New	SKILL DEVELOPMENT
17	PEC	18CS 51J3	Critical Information Infrastructure Security	3	0	0	3	New	EMPLOYBILITY
Elective-III									
18	PEC	18CS 52K1	Infrastructure Attacks and Defense	3	0	0	3	New	EMPLOYBILITY
19	PEC	18CS 52K2	Software Vulnerability Analysis and Resilience	3	0	0	3	New	EMPLOYABILITY
20	PEC	18CS 52K3	Parallel & Cloud Computing	3	0	0	3	New	EMPLOYABILITY
Elective-IV									
21	PEC	18CS 52L1	Applied Cryptography and Steganography	3	0	0	3	New	SKILL DEVELOPMENT
22	PEC	18CS 52L2	Software Modeling	3	0	0	3	New	EMPLOYBILITY
23	PEC	18CS 52L3	Digital Image Processing	3	0	0	3	New	SKILL DEVELOPMENT

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-4(b)

M.Tech - Machine Learning & Computing
2018 Admitted Batch Category wise Course Structure

S.No	Category	Course Code	Course Title	Periods			Credits	New/Revised/ Retained	EES
				L	T	P			
1	PCC	18CS5109	Optimization Techniques	3	0	0	3	New	EMPLOYBILITY
2	PCC	18CS5110	Applied Statistics	3	0	0	3	New	SKILL DEVELOPMENT
3	PCC	18CS5111	Data Mining	3	0	2	4	New	EMPLOYABILITY
4	PCC	18CS5112	Matrix Computation	3	0	2	4	New	SKILL DEVELOPMENT
			Elective-I	3	0	0	3		
			Elective-II	3	0	0	3		
	PRI	18IE 5149	Seminar	0	0	4	2	New	SKILL DEVELOPMENT
5	PCC	18CS5113	Evolutionary And Natural Computing	3	0	2	4	New	EMPLOYABILITY
6	PCC	18CS5114	Discrete Mathematics	3	0	0	3	New	SKILL DEVELOPMENT
7	PCC	18CS5115	Pattern Recognition And Machine Learning	3	0	2	4	New	EMPLOYABILITY
8	PCC	18CS5116	Computer Modeling& Simulation	3	0	2	4	New	EMPLOYABILITY
			Elective-III	3	0	0	3		
			Elective-IV	3	0	0	3		
9	PRI	18IE 5250	Term Paper	0	0	4	2	New	SKILL DEVELOPMENT
10	PRI	18IE 6050	Dissertation	0	0	72	36	New	EMPLOYABILITY
Elective-I									
11	PEC	18CS51E1	Computer Vision And Image Processing	3	0	0	3	New	SKILL DEVELOPMENT
12	PEC	18CS51E2	Service Oriented Architecture	3	0	0	3	New	SKILL DEVELOPMENT
13	PEC	18CS51E3	Data Analysis	3	0	0	3	New	EMPLOYABILITY
14	PEC	18CS51E4	Cloud Computing	3	0	0	3	New	EMPLOYABILITY
Elective-II									
15	PEC	18CS51F1	Artificial Neural Networks	3	0	0	3	New	EMPLOYABILITY
16	PEC	18CS51F2	Application Development Frameworks	3	0	0	3	New	EMPLOYABILITY

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S.No	Category	Course Code	Course Title	Periods			Credits	New/Revised/ Retained	EES
				L	T	P			
17	PEC	18CS51F3	Big Data Analytics	3	0	0	3	New	SKILL DEVELOPMENT
18	PEC	18CS51F4	Cloud Security	3	0	0	3	New	EMPLOYABILITY
Elective-III									
19	PEC	18CS52G1	Control Theory	3	0	0	3	New	SKILL DEVELOPMENT
20	PEC	18CS52G2	Web Semantics	3	0	0	3	New	EMPLOYABILITY
21	PEC	18CS52G3	Map Reduce Design Patterns	3	0	0	3	New	EMPLOYABILITY
22	PEC	18CS52G4	Data Centre Virtualization	3	0	0	3	New	EMPLOYBILITY
Elective-IV									
23	PEC	18CS52H1	Reinforcement Learning	3	0	0	3	New	EMPLOYABILITY
24	PEC	18CS52H2	Multi Agent Systems	3	0	0	3	New	SKILL DEVELOPMENT
25	PEC	18CS52H3	Network Security	3	0	0	3	New	EMPLOYABILITY
26	PEC	18CS52H4	Cloud Application Architectures	3	0	0	3	New	SKILL DEVELOPMENT

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-6

2018-19 MOOCS COURSES

Sl No	Course Code	Course Title	Category	MODE	L	T	P	S	Cr	CH	Platform	MOOCS Course Link
		OPEN ELECTIVES										
1	18OE4002M	PHOTOGRAPHY BASICS	OE1	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/photography-basics
2	18OE4001M	GRAPHIC DESIGN	OE1	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/graphic-design
3	18OE4003M	EXPLORING OUR RESPONSES TO CLIMATE CHANGE	OE1	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/our-responses-climate-change
4	18OE4005M	ENERGY PRODUCTION, DISTRIBUTION & SAFETY	OE2	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/energy-industry
5	18OE4007M	GEOGRAPHIC INFORMATION SYSTEMS	OE2	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/gis
6	18OE4004M	SELF DRIVING CARS	OE2	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/self-driving-cars
7	18OE4006M	CONSTRUCTION MANAGEMENT	OE2	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/construction-management
8	18OE4008M	SOCIAL ENTREPRENEURSHIP	OE-3	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/social-entrepreneurship-cbs

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Sl No	Course Code	Course Title	Category	MODE	L	T	P	S	Cr	CH	Platform	MOOCS Course Link
				MANAGEMENT ELECTIVE								
9	18MB4058M	SIX SIGMA YELLOW BELT(SPECIALIZATION)	OE-1	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/six-sigma-fundamentals
10	18MB4060M	FINTECH: FINANCE INDUSTRY TRANSFORMATION AND REGULATION (SPECIALIZATION)	OE-1	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/fintech
11	18MB4059M	SEARCH ENGINE OPTIMIZATION (SPECIALIZATION)	OE-2	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/specializations/seo
				FOREIGN LANGUAGE								
12	18FL3060M	RUSSIAN FOR BEGINNERS	FL1	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/learn/learn-russian
13	18FL3063M	KOREAN LANGUAGE	FL2	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/learn/learn-korean
14	18FL3053M	LEARN CHINESE: HSK TEST PREPARATION	FL3	M	4	0	0	0	4	4	Coursera	https://www.coursera.org/learn/learn-chinese

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-7

2018-19 ADMITTED BATCH
VALUE ADDED COURSES

Sl No	Course Code	Course Title
1	18CC2210	CODECHEF CERTIFICATION
2	18CC2212	GCP ACE CERTIFICATION
3	18CC2213	CEH CERTIFICATION
4	18CC2214	CEH MASTER CERTIFICATION
5	18CC3044	AUTOMATION ANYWHERE ESSENTIALS + AUTOMATION ANYWHERE CERTIFIED ADVANCED RPA PROFESSIONAL
6	18CC3116	UI PATH CERTIFIED PROFESSIONAL
7	18CC3119	PEGA CERTIFIED SYSTEM ARCHITECT
8	18CC3210	EPAM CERTIFICATION
9	18CC3323	ORACLE CLOUD INFRASTRUCTURE CERTIFIED ARCHITECTASSOCIATE
10	18CC3336	DIGITAL SKILLS READINESS PROGRAM(W T N)
11	18CC3401	AZURE CLOUD ARCHITECT
12	18CC4114	WIPRO FUTURE SKILLS CERTIFICATION
13	18CC3114	SERVICENOW CERTIFIED APPLICATION DEVELOPER
14	18CC3115	SERVICENOW CERTIFIED SYSTEM ADMINISTRATOR
15	18CC3278	SALESFORCE CERTIFIED ADMINISTRATOR
16	18CC3320	AVIATRIX MULTI CLOUD NETWORK ASSOCIATE
17	18CC3402	ARTIFICIAL INTELLIGENCE ENGINEER
18	17CC3101	AUTOMATION TEST ENGINEER
19	18CC3039	FULL STACK WEB DEVELOPER - MEAN STACK
20	18CC3115	SERVICENOW CERTIFIED SYSTEM ADMINISTRATOR
21	18CC3044	AUTOMATION ANYWHERE ESSENTIALS + AUTOMATION ANYWHERE
22	17CC3044	SALESFORCE ADMINSTRATOR

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
Annexure - 8
Pre Ph.D.-Courses and syllabi

S.NO	PAPER – 2	Code	PAPER – 3	Code
1.	Information Retrieval System	15 CS 201	Big Data Analytics	15 CS 301
2.	Data Ware Housing And Mining	15 CS 202	Cloud Computing	15 CS 302
3.	Computer Networks	15 CS 203	Distributed Databases	15 CS 303
4.	Data Center Virtualization	15 CS 204	Pattern Recognition	15 CS 304
5.	Network Security	15 CS 205	Soft Computing	15 CS 305
6.	Software Architecture	15 CS 206	Software Engineering	15 CS 306
7.	Software Testing And QualityAssurance	15 CS 207	Software Reliability	15 CS 307
8.	Advances in Computing	15 CS 208	Web Security	15 CS 308
9.	Advanced Data Structures	15 CS 209	Wireless Sensor Networks	15 CS 309
10.	Digital Image Processing	15 CS 210	Software Project Management	15 CS 310
11.	Bio-Informatics	15 CS 211	Artificial Intelligence	15 CS 311
12.	Service Oriented Architecture	15 CS 212	Cloud Security	15 CS 312
13.	Mobile Cloud	15 CS 213	Data Security & Privacy	15 CS 313
14.	Distributed Computing	15 CS 214	Mobile Computing and Wirless Communication	15 CS 314
15.	Cryptography & Network Security	15 CS 215	Parallel Algorithms	15 CS 315

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
ADVANCES IN COMPUTING

Syllabus
UNIT I:

Grid Computing: Data & Computational Grids, Grid Architectures and its relations to various Distributed Technologies. Autonomic Computing, Examples of the Grid Computing Efforts (IBM)

UNIT II:

Cluster Computing 1: Cluster setup & its Administration, Performance Models & Simulations; Networking, Protocols & I/O, Lightweight Messaging systems, Active Messages

UNIT III:

Cluster Computing 2: Distributed shared memory, parallel I/O Clusters, Jib and Resource management system, scheduling parallel jobs on clusters

UNIT IV:

Cluster Computing 3: Load sharing and Fault tolerance manager, parallel programming scheduling techniques, Dynamic load balancing, Example Cluster System – Beowlf, COMPaS and NanOS

UNIT V:

Pervasive Computing : Pervasive Computing concepts & Scenarios, Hardware & Software, Human - machine interface Device connectivity, Java for Pervasive devices, Application examples, Quantum Computing : Introduction to Quantum Computing, QUbits, Quantum Mechanics, Quantum gates, Applications of quantum computing.

REFERENCE BOOKS:

1. J. Joseph & C. Fellenstein, Grid Computing, PEA.
2. Raj Kumar Buyya, High performance cluster computing, PEA.
3. J.Burkhardt et .al, Pervasive computing, PEA.
4. Vishal Sahni, Quantum computing, TMH.
5. Marivesar, Approaching quantum computing, PEA.
6. Neilsen & Chung L, Quantum computing and Quantum Information, CambridgeUniversity Press.
7. A networking approach to Grid Computing , Minoli, Wiley

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SERVICE ORIENTED ARCHITECTURE

Syllabus

UNIT-I

Introducing SOA: Fundamental SOA- Common Misperceptions about SOA- Common tangible benefits of SOA- Common pitfalls of adopting SOA. The Evolution of SOA:-from XML to Web services to SOA, The continuing evolution of SOA, The roots of SOA. Web Services and Primitive SOA: The Web services framework- Services, Service descriptions, messaging with SOAP.

UNIT-II

Web Services and Contemporary SOA: Message exchange patterns- Service activity- coordination-Atomic transactions- Business activities-Orchestration- Choreography- Web Services and Contemporary SOA: Addressing- Reliable messaging- Correlation- Policies- Metadata exchange- Security- Notification and eventing. SOA and Service-Orientation: Principles of Service-Orientation-Service-orientation. - Anatomy of a service-oriented architecture- Common principle of service-orientation-Service Layers –Service orientation.

UNIT-III

Building SOA: SOA Delivery Strategies- SOA delivery lifecycle phases. Service-OrientedAnalysis: Introduction to service-oriented analysis- Benefits of a business-centric SOA- Deriving business services- Service-Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches.

UNIT-IV

Service-Oriented Design Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SO Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

UNIT-V

SOA Service Design: -Overview-Service design of business service, application service, task centric service and guidelines. SOA Business Process Design: WS-BPEL language basics- WS Coordination.

Text Book:

1. Thomas Erl ," Service-Oriented Architecture: Concepts, Technology & Design", PearsonEducation Pte Ltd 2008.

Reference Books:

1. Thomas Erl,"SOA Principles Of Service Design"Pearson Exclusives 2007.
2. Tomas Erl and Grady Booch,"SOA Design Patterns"Printice Hall 2008.111

3. Michael Rosen, Boris Lublinsky, Kevin T. Smith, Marc J. Balcer, "Applied SOA: Service-Oriented Architecture and Design Strategies", Wiley, 2010.

4. Douglas K. Barry, "Web Services, Service-Oriented Architectures, and Cloud Computing",Elsevier, 2003.

5. James Bean, "SOA and Web Services Interface Design: Principles, Techniques, andStandards", Elsevier, 2010

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CLOUD COMPUTING

Unit-I

Overview of Computing Paradigm :Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Evolution of cloud computing: Business driver for adopting cloud computing. Introduction to Cloud Computing
:Cloud Computing (NIST Model): Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers; Properties, Characteristics& Disadvantages: Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing;Role of Open Standards

Unit-II

Cloud Computing Architecture:Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services; Service Models (XaaS): Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS); Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud.

Unit-III

Infrastructure as a Service(IaaS): Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM). Resource Virtualization: Server, Storage, Network, Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service); Examples: Amazon EC2, Renting, EC2 Compute Unit, Platform and Storage, pricing, customers, Eucalyptus. Platform as a Service(PaaS):Introduction to PaaS: What is PaaS, Service OrientedArchitecture (SOA), Cloud Platform and Management, Computation, Storage, Examples, Google App Engine, Microsoft Azure, SalesForce.com's Force.com platform.

Unit-IV

Software as a Service(PaaS):Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS. Service Management in Cloud Computing:Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data, Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing.

Unit-V

Cloud Security:Infrastructure Security: Network level security, Host level security, Application level security, Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Reference Books
1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.
2. Cloud Computing: Principles   and   Paradigms, Editors: Rajkumar Buyya,

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

JamesBroberg, Andrzej M. Goscinski, Wile, 2011.

3. Cloud Computing: Principles, Systems and Applications, Editors: NikosAntonopoulos, Lee Gillam, Springer, 2012.

4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L.Krutz, Russell Dean Vines, Wiley-India, 2010.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

MOBILE CLOUD

Syllabus

Unit-I

Mobile Connectivity Evolution: From Single to Multiple Air Interface Devices, NetworkEvolution: The UNeed for Advanced Architectures.

Unit-II

Mobile Clouds: An Introduction, Cooperation and Cognition in Mobile Clouds, MobileCloud Classification and Associated Cooperation Approaches.

UNIT-III

Sharing Device Resources in Mobile Clouds, Wireless Communication Technologies,Building Mobile Clouds.

UNIT-IV

Mobile Cloud Formation and Maintenance, Cooperative Principles by Nature, Social MobileClouds, Green Mobile Clouds: Making Mobile Devices More Energy Efficient.

UNIT-V

Mobile Clouds Applications, Future Developments of Mobile Clouds.

Text Book:

1. Frank H. P. Fitzek, Marcos D. Katz, Mobile Clouds: Exploiting Distributed Resourcesin Wireless, Mobile and Social Networks, Wiley Publications, ISBN: 978-0-470- 97389-9, Jan 2014.

References

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, and Michael Morgano, Android forProgrammers: An App-Driven Approach, Prentice Hall, November 3, 2011.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DATA CENTRE VIRTUALIZATION

Syllabus

Unit I

Data Center Challenges: How server, desktop, network Virtualization and cloud computing reduce data centre footprint, environmental impact and power requirements by driving server consolidation; **Evolution of Data Centres:** The evolution of computing infrastructures and architectures from stand alone servers to rack optimized blade servers and unified computing systems (UCS).

Unit II

Enterprise-level Virtualization: Provision, monitoring and management of a virtual datacenter and multiple enterprise-level virtual servers and virtual machines through software management interfaces; **Networking and Storage in Enterprise Virtualized Environments**: Connectivity to storage area and IP networks from within virtualized environments using industry standard protocols.

Unit III

Virtual Machines & Access Control: Virtual machine deployment, modification, management. monitoring and migration methodologies.

Unit IV
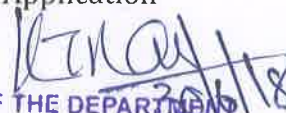
Resource Monitoring: Physical and virtual machine memory, CPU management and abstraction techniques using a hypervisor.

Unit V

Virtual Machine Data Protection: Backup and recovery of virtual machines using data recovery techniques; **Scalability**: Scalability features within Enterprise virtualized environments using advanced management applications that enable clustering, distributed network switches for clustering, network and storage expansion; **High Availability :** Virtualization high availability and redundancy techniques.

Reference Books:

1. Mickey Iqbal 2010, IT Virtualization Best Practices: A Lean, Green Virtualized DataCenter Approach, MC Press [ISBN: 978-1583473542]

2. Mike Laverick, VMware vSphere 4 Implementation [ISBN: 978-0071664523]

3. Jason W. McCarty, Scott Lowe, Matthew K. Johnson, VMware vSphere 4 AdministrationInstant Reference [ISBN: 978-0470520727]

4. Brian Perry, Chris Huss, Jeantet Fields, VCP VMware Certified Professional on vSphere 4Study Guide [ISBN: 978-0470569610]

5. Brian Perry, Chris Huss, Jeantet Fields, VCP VMware Certified Professional on vSphere 4 Study Guide [ISBN: 978-0470569610]

6. Jason Kappel, Anthony Velte, Toby Velte, Microsoft Virtualization with Hyper-V: Manage Your Datacenter with Hyper-V, Virtual PC, Virtual Server, and Application Virtualization [ISBN: 978-0071614030]

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CLOUD SECURITY

Syllabus:
unit-I

Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defense in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; **Cryptographic Systems:** Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.

Unit-II

Multi-tenancy Issues: Isolation of users/VMs from each other. How the cloud provider can provide this; **Virtualization System Security Issues:** e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery;

Unit-III

Virtualization System Vulnerabilities: Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).

Unit-IV

Virtualization System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking. **Technologies for Virtualization-Based Security Enhancement:** IBM security virtual server protection, virtualization-based sandboxing;

Unit-V

Storage Security: HIDPS, log management, Data Loss Prevention. Location of the Perimeter. **Legal and Compliance Issues:** Responsibility, ownership of data, right to penetration test. local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

Reference Books:

1. Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy:An Enterprise Perspective on Risks and Compliance [ISBN: 0596802765]
2. Ronald L. Krutz, Russell Dean Vines, Cloud Security [ISBN: 0470589876]
3. John Rittinghouse, James Ransome, Cloud Computing [ISBN: 1439806802]
4. J.R. ("Vic") Winkler, Securing the Cloud [ISBN: 1597495921]

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SOFTWARE ENGINEERING

Syllabus

Unit – I

Software and Software Engineering: Nature of software, software application domains, unique nature of web applications, software engineering, software process, software engineering practice, software myths. Process Models: Generic process model, prescriptive process models, specialized process models, unified process, personal and team process models, product and process. Agile development: Agility, agile process, extreme programming and other agile process models.

Unit – II

Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models: Context Models, Behavioral models, Data models, Object models, structured methods.

Unit – III

Design concepts: Design process, Design concepts, design model. Architecture Design: Software architecture, architectural styles, architectural design, assessing alternative architectural designs, architectural mappings using data flow. Component-level design:Designing class based components, conducting component level design.

Unit – IV

User interface design: The golden rules, user interface analysis and design, interface analysis, interface design steps. Quality concepts: software quality, software quality dilemma, achieving software quality. Software quality assurance: Elements of software quality assurance, sqa tasks, goals. Formal approaches.

Unit – V
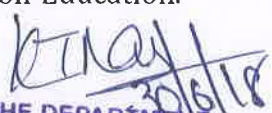
Software testing strategies: A strategic approach to software testing, strategic issues, teststrategies for conventional software, validation testing, system testing.

Text book:

1. Roger S.Pressman ,"Software Engineering – A Practitioner's Approach 7th Edition2010, Mc Graw Hill.

Reference Book:

1) Ian Sommerville,'Software Engineering', Sixth Edition,2001,Pearson Education.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SOFTWARE PROJECT MANAGEMENT

Syllabus

Unit-1 Introduction to software project management

Project Stakeholders, Project Management Knowledge Areas, Project Management Tools and Techniques, Program and Project Portfolio Management, the Role of the Project Manager, the Project Management Profession, Project Phases and the Project Life Cycle.

Unit-2 software project Time and Cost management

Time management: The Importance of Project Schedules, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule, Controlling the Schedule, Using Software to Assist in Project Time Management. Cost management: The Importance of Project Cost Management, Basic Principles of Cost Management, Estimating Costs, Types of Cost Estimates, Cost Estimation Tools and Techniques, Determining the Budget, Controlling Costs.

Unit-3 Human Resources Management

The Importance of Human Resource Management, Keys to Managing People, Developing the Human Resource Plan, Acquiring the Project Team, Developing the Project Team, Managing the Project Team, Using Software to Assist in Human Resource Management.

Unit-4 Risk Management
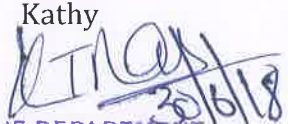
Planning Risk Management, Common Sources of Risk on Information Technology Projects, Identifying Risks, Performing Qualitative Risk Analysis, Performing Quantitative Risk Analysis, Planning Risk Responses, Monitoring and Controlling Risks, sing Software to Assist in Project Risk Management.

Unit-5 procurement Management

Strategic Planning and Project Selection, Developing a Project Charter, Developing a Project Management Plan, Directing and Managing Project Execution, Monitoring and Controlling Project Work ,Performing Integrated Change Control, Closing Projects or Phases.

Textbook:

1. "INFORMATION TECHNOLOGY PROJECT MANAGEMENT", Kathy Schwalbe,6 th edition, Cengage Learning, 2011.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SOFTWARE TESTING AND QUALITY ASSURANCE

Syllabus

Unit I

Introduction, Basics of Software Testing, Testing Principles, Goals, Testing Life Cycle, Phases of Testing, Defects, Defect Life Cycle, Defect Report, Test Plan(IEEE format), Importance of testing in software production cycle.

Unit II

Introduction, Need of black box testing, Black box testing Concept, Requirement Analysis, Test case design criteria, Testing Methods, requirement based testing, Positive & negative testing, Boundary value analysis, Equivalence Partitioning class, state based or graph based, cause effect graph based, error guessing, documentation testing & domain testing, design of test cases. Black-Box testing.

Unit III

Introduction, Need of white box testing, Testing types, Test adequacy criteria, static testing by humans, Structure - logic coverage criteria, Basis path testing, Graph metrics, Loop Testing, Data flow testing, Mutation Testing, Design of test cases. Testing of Object oriented systems, Challenges in White box testing.

Unit IV

Test organization, Structure of testing, Measurement tools, testing metrics: Type of metric – Project, Progress, Productivity, Metric plan, Goal Question metric model, Measurement in small & large system. Other Software Testing: GUI testing, Validation testing, Regression testing, Scenario testing, Specification based testing, Adhoc testing, Sanity testing, Smoke testing, Random Testing.

Unit V

Software quality, Quality attribute, Quality Assurance, Quality control & assurance, Methods of quality management, Cost of quality, Quality management, Quality factor, Quality management & project management.

Text books:

1. Software Testing, Second Edition By: Ron Patton, Pearson Education ISBN-13: 978-0-672-32798-8

2. Software Testing Principles and Tools By M.G. Limaye TMG Hill Publication, ISBN13:978-0-07-013990-9

References:

1. Metric and Model in Software Quality Engineering, By Stephen H Kan, Pearson EducationISBN 81-297-0175-8

2. Effective methods for software testing by William Perry, Willey Publication, ISBN 81-265-0893-0

3. Foundation of software testing by Dorothy Graham, Erik Van Veenendaal. CENGAGElearning, ISBN 978-81-315-0218-1

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SOFTWARE RELIABILITY

Syllabus

UNIT - 1 INTRODUCTION TO RELIABILITY ENGINEERING
Reliability — Repairable and Non Repairable systems — Maintainability and Availability — Designing for higher reliability — Redundancy — MTBF — MTTF MDT - MTTR— k out of in Systems.

UNIT - 2 SOFTWARE RELIABLITY
Software reliability - Software reliability Vs Hardware reliability – Failures and Faults - Classification of Failures – Counting – System Configuration – Components and Operational Models – Concurrent Systems – Sequential Systems – Standby Redundant systems.

UNIT - 3 SOFTWARE RELIABILITY APPROACHES
Fault Avoidance — Passive Fault detection — Active Fault Detection — Fault Tolerance - Fault Recovery - Fault Treatment.

UNIT - 4 SOFTWARE RELIABILITY MODELING
Introduction to Software Reliability Modeling – Parameter Determination and Estimation - Model Selection – Markovian Models – Finite and Infinite failure category Models – Comparison of Models – Calendar Time Modeling.

UNIT - 5 SPECIAL TOPICS IN SOFTWARE RELIABLITY
Management Techniques for reliability - Organization and Staffing — Programming Languages and Reliability — Computer Architecture and Reliability — Proving Program correctness & Reliability Design - Reliability Testing – Reliability Economics.

TEXT BOOKS

1. John D. Musa, " Software Reliability", McGraHill, 1985
2. Glenford J. Myers, "Software Reliability ", Wiley Interscience Publication, 1976

REFERENCE BOOKS

1. Patric D. T.O connor," Practical Reliability Engineering" , 4th Edition, John Wesley &sons , 2003.
2. Anderson and PA Lee : " Fault tolerance principles and Practice ", PHI ,1981
3. Pradhan D K (Ed.): " Fault tolerant computing – Theory and Techniques", Vol1 and Vol 2, Prentice hall, 1986.
4. E.Balagurusamy ," Reliability Engineering", Tata McGrawHill, 1994.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ADVANCED DATA STRUCTURES

Syllabus

UNIT-I

Introduction: Algorithms, algorithms as a technology, Analyzing algorithms , Designing algorithms, Asymptotic notations, standard notations, common functions, Recurrences – substitution method, master method. **Sorting and order statistics:** Merge sort, Quick sort, Heap sort, sorting in linear time, Median and order statistics.

UNIT-II

Data structures: Elementary Data Structures – Linked lists, Stacks, Queues, Hash Tables – Direct address tables, Hash tables, Hash functions, Open addressing, Search Trees – Binary search trees, Red-Black Trees. **Advanced Data Structures:** B – Trees, Binomial Heaps, Fibonacci Heaps, Data Structures for Disjoint Sets

UNIT-III

Graph Algorithms: Elementary graph algorithms – Representation of graphs, BFS, DFS, Topological Sort, Strongly connected components, Minimum Spanning Trees – The algorithms of Kruskal and Prim's. Single-Source Shortest Paths: The Bellman-Ford algorithm, Single source shortest paths in DAG's, Dijkstra's algorithm, All-Pair Shortest paths – Shortest paths and Matrix multiplication, Floyd-Warshall algorithm. Maximum Flow: Flow networks, The Ford-Fulkerson method, Maximum Bipartite matching.

UNIT-IV

Advanced Design and Analysis Techniques: Greedy Algorithms – An activity – selection Problem, Elements of greedy strategy, Huffman codes. Dynamic Programming: Matrix Chain multiplication, Elements of dynamic programming, Optimal Binary Search Trees.

UNIT-V

String Matching: The naïve string matching algorithm, Rabin-Karp algorithm, Knuth- Morris- Pratt algorithm. **NP-Completeness:** Polynomial time, Verification, NP-Completeness and reducibility, NP-Completeness proofs, NP-Complete problems.

Textbooks:

1. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson,R.L.Rivest, andC.Stein,PHI Pvt.Ltd./ Pearson Education

Reference Books:

1. Algorithm Design: Foundations,Analysis and Internet examples, M.T.Goodrich andR.Tomassia,John wiley and sons.

2. Fundamentals of Computer Algorithms,Ellis Horowitz,Satraj Sahni andS.Rajasekharam,Galgotia publications pvt. Ltd.

3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T.Lee,S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.

4. Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearsoneducation.

5. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SOFTWARE ARCHITECTURE

Syllabus

Unit-I – Understanding Software Architecture

Definitions of Software Architecture-Architecture define Structure, Architecture Specifies

Component Communication, Architecture Address's Non-functional Requirements; Architecture is an Abstraction, Architecture Views. Architectures and Technologies.

Unit-II-Architectural Styles

Architectural styles, Pipes and Filters, Data Abstraction and Object Oriented Organization, Event – Based Implicit Invocation, Layered Systems, Repositories, Interpreters ,Process Control ,Other familiar Architectures, Heterogeneous Architecture.

Unit-III-Software Quality Attributes

Quality Attributes, Performance, Scalability, Scalability for the ICDE Application, Modifiability, Modifiability for the ICDE Application Security, Security for the ICDE Application Availability, Integration, Other Quality Attributes.

Unit-IV-Architectural Design Guidance

Guidance for user interface architectures-Designs spaces and rules, A design space for user interface architectures, Design rules for user interface architecture, The qualified Design Space.

Unit-V-Software Agents

Agents in the ICDE Environment, Abstraction Revisited, An Example Agent technology, Architectural Implication-Concurrency, Scalability, Mobility, Agent Technologies.

Text Books:

1. Mary Shaw and David Garlan, Software Architecture- Perspectives on an EmergingDiscipline, Prentice-Hall of India, 2004.

2.Ian Gorton, Essential Software Architecture Springer International Edition -2006

Reference Book:

1. Richard N. Taylor, Nenad Medvidovic, Eric Dashofy, "Software Architecture: Foundations,Theory, and Practice", Wiley, 2009.

2. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 2/e, PearsonEducation, 2003.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

INFORMATION RETRIEVAL SYSTEMS

Syllabus

Unit I : Introduction to Information storage and retrieval systems: Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation Introduction to Data structures and algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

Unit II: Inverted Files: Introduction, Structures used in Inverted Files, Building an Inverted file using a sorted array, Modifications to the Basic Techniques. Signature Files : Introduction, Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning.

Unit III: New Indices for Text: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays. Lexical Analysis and Stoplists: Introduction, Lexical Analysis, Stoplists.

Unit IV: Stemming Algorithms: Introduction, Types of Stemming algorithms, Experimental Evaluations of Stemming, Stemming to Compress Inverted Files. Thesaurus Construction: Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Mergingexisting Thesauri.

Unit V: String Searching Algorithms: Introduction, Preliminaries, The Naive Algorithm, The Knutt-Morris-Pratt Algorithm, The Boyer-Moore Algorithm, The Shift-Or Algorithm, The Karp-Rabin Algorithm.

REFERENCE BOOKS

1. Modern Information Retrieval,Ricardo Baeza-Yates, Neto, PEA,2007.

2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski,Gerald, Mark Academic Press, 2000.

3. Information Retrieval: Algorithms and Heuristics , Grossman, Ophir Frieder, 2/e,Springer, 2004.

4. Information Retrieval Data Structures and Algorithms , Frakes, Ricardo Baeza-Yates,PEA

5. Information Storage and Retieval, Robert Korfhage, John Wiley & Sons.

6. Introduction to Information Retrieval, Manning, Raghavan, Cambridge UniversityPress.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BIG DATA ANALYTICS

Syllabus

Unit-1:
Big Data, Complexity of Big Data, Big Data Processing Architectures, Big Data Technologies, Big Data Business Value, Data Warehouse, Re-Engineering the Data Warehouse, Workload Management in the Data Warehouse, New Technology Approaches.

Unit-2: Integration of Big Data and Data Warehouse, Data Driven Architecture, Information Management and Lifecycle, Big Data Analytics, Visualization and Data Scientist, Implementing The "Big Data" Data. Choices in Setting up R for Business Analytics, R Interfaces, Manipulating Data, Exploring Data, Building Regression Models, Clustering and Data Segmentation, Forecasting and Time Series Models.

Unit-3: Writing Hadoop Map Reduce Programs, Integrating R and Hadoop, Using Hadoop Streaming with R, Learning Data Analytics with R and Hadoop, Understanding Big Data Analysis with Machine Learning. Big Data, Web Data, A Cross-Section of Big Data Sources and the Value They Hold, Taming Big Data, The Evolution of Analytic Scalability.

Unit-4: The Evolution of Analytic Processes, The Evolution of Analytic, Processes The Evolution of Analytic Tools and Methods. Legacy Data, Hypothesis Testing, Prediction, Software, Complexity, Business problems suited to big data analytics.

Unit-5: High Performance Appliances for Big Data Management, Using Graph analytics, The New Information Management Paradigm, Big Data's Implication for Businesses, Big Data Implications for Information Management, Splunk's Basic Operations on Big Data.

Textbooks:
1. Data Warehousing in the Age of Big Data by Krish Krishnan, Morgan Kaufmann.
2. A.Ohri, "R for Business Analytics", Springer, 2012.

References:
1. Big Data Analytics with R and Hadoop by Vignesh Prajapati
2. Principles of Big Data Preparing, Sharing, and Analyzing Complex Information, 1stEdition, by J Berman, published by Morgan Kaufmann
3. "Big Data Analytics - From Strategic Planning to Enterprise Integration with Tools,Techniques, NoSQL, and Graph" By David Loshin, Morgan Kaufmann
4. Big Data Imperatives: Enterprise 'big Data' Warehouse, 'BI' Implementations andAnalytics by Soumendra Mohanty, Apress
5. Big Data Analytics Using Splunk By Peter Zadrozny , Raghu Kodali, Apress 2013
6. Franks, Bill, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge DataStreams with Advanced Analytics", Wiley, 1st Edition, 2012.
7. Big Data Application Architecture Q&A: a Problem - Solution Approach NitinSawant, Himanshu Shah

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DATA WARE HOUSING & DATA MINING

Syllabus

UNIT – I

The compelling need for data warehousing: Escalating need for strategies information, Failures of Past Decision-Supporting System, Operational Versus Decision-Supporting System, Data Warehousing- The only Viable Solution, data Warehouse Defined. The Building Blocks: Defining Features, Data Warehouse and Data Marts, Overview of the Components, Metadata in the Data Warehouse. Planning and Planning Management: Planning your Data Warehousing, The Data Warehouse Project, The project team, Project Management Considerations. Defining the Business Requirement: Dimension Analysis, Information Package- A New Concept, Requirements Gathering Methods, Requirements Definition: Scope and content. Requirements as the Driving force for Data Warehousing: Data Design, The Architectural Plan, Data Storage Specification, and Information Delivery Strategy.

UNIT – II

The Architectural Component: Understanding Data Warehouse Architecture, Distinguishing Characteristics, Architectural framework, Technical Architecture. Infrastructure as the Foundation for Data Warehousing: Infrastructure Support Architecture, Hardware Operational System, Database Software, Collection of Tools. The Significant Role of Metadata: Why Metadata is Important, Metadata Types by Functional Areas, Business Metadata, How to Provide Metadata. Principles of Dimensional Modeling: From Requirement to Data Design, The STAR Schema, STAR Schema keys, Advantages of STAR Schema. Dimensional Modeling: Updates to the Dimensional Tables, Miscellaneous Dimensions, The Snowflake Schema, Aggregate Fact Tables, and Families of STARS. Data Extraction, Transformation, and Loading. OLAP in the Data Warehouse: Demand for Online Analytical Processing, Major Features and Functions, OLAP Models, OLAP Implementation Consideration

UNIT – III

Introduction : Data mining, kinds of data mined, kinds of patterns mined, technologies used: statistics, Machine learning, Database systems and Data Warehousing, Information Retrieval, Major issues in Data Mining: Mining methodology, User Interaction, Efficiency and Scalability, Diversity and database types, Data Mining & society.

UNIT – IV

Data Preprocessing: Overview, Data cleaning, Data Integration, Data Reduction, Data Transformation, Data cleaning: Missing Values, Noisy data, Data cleaning as a process. Data Integration: Entity identification problem, Redundancy and Correlation Analysis, Tuple duplication, Data value conflict detection and Resolution. Data Reduction: Overview, wavelet transforms, Principle components Analysis, Attribute subset selection, Regression and log-linear models, Histograms, clustering, sampling, Data cube Aggregation. Data Transformation and Data Discretization by Binning, Discretization by

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Histogram Analysis, Discretization by cluster, Decision Tree and correlation Analysis,concept Hierarchy generation for Nominal data.

UNIT – V

Mining Frequent Patterns, Association and Correlations: Basic Concepts, Frequent itemset Mining methods: Apriori Algorithm, Generate Association rules from Frequent itemsets, Improving the efficiency of Apriori, A pattern-growth approach for mining frequent itemsets, using frequent itemset using Vertical data format, Mining closed and max. patterns. Pattern Evaluation Methods, Advanced Pattern Mining: A Road map, Pattern mining in Multilevel, Multidimensional space, Constraint Based Frequent Mining, Classification: Basic Concepts, Decision Tree induction, Bayes Classification Method, Rule based Classification, Model evaluation & selection, techniques to improve classification accuracy. Classification Advanced Methods: Bayesian Belief networks, Classification by Back Propagation, Support Vector Method, Classification using frequent Patterns, lazy learners, other classification methods. Cluster Analysis: Basic Concepts & Methods, Cluster Analysis, partitioning methods, Hierarchical Methods, Density based Methods, Grid based Methods, Evaluation of Clustering. Advanced Cluster Analysis: Probabilistic Model based Clustering, Clustering High Dimensional Data, Clustering Graph & Network data, Clustering & Constraints.

Textbooks:

1. Data warehousing fundamentals, first edition, paulraj ponniah, Wiley.

2. Data Mining Concept & Techniques, Jiawei Han|Micheline Kamber|Jian Pei, 3rdEdition, M K Publishers.

Reference Books:

1. Data Warehousing in the real world, low price edition, Sam Anahory, Dennis Murray,Pearson Education.

2. Data warehousing Tool kit

3. Data Mining Techniques: For Marketing, Sales, and Customer RelationshipManagement by Gordon S. Linoff and Michael J. Berry (Apr 12, 2011).

4. Data Mining: A Tutorial Based Primer by Richard Roiger and Michael Geatz (Oct 6,2002).

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DISTRIBUTED DATABASES

Syllabus

UNIT I

Introduction: Distributed Data Processing, Distributed Database System, Promises of DDBSs, Complicating Factors, Problem Areas Distributed DBMS Architecture DBMS Standardization, Architectural Models for Distributed DBMSs, Distributed DBMS Architecture, Global Directory Issues

UNIT II

Distributed Database Design: Alternative Design Strategies, Distribution Design Issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data Security, Semantic Integrity Control.

UNIT III

Overview of Query Processing: Query Processing Problem, Objectives of Query Processing, Complexity of Relational Algebra Operations, Characterization of Query Processing, Layers of Query Processing Query Decomposition and Data Localization: Query Decomposition, Localization of Distributed Data Optimization of Distributed Queries Query Optimization, Centralized Query Optimization, Join Ordering in Fragment Queries, Distributed Query Optimization Algorithms

UNIT IV

Introduction to Transaction Management: Definition of a Transaction, Properties of Transactions, Types of Transactions, Architecture Revisited Distributed Concurrency Control Serializability Theory, Taxonomy of Concurrency Control Mechanisms, Locking-Based Concurrency Control Algorithms, Timestamp based Concurrency Control algorithms, Optimistic Concurrency Control Algorithms, Deadlock Management, Relaxed ConcurrencyControl

UNIT V

Distributed DBMS Reliability: Reliability Concepts and Measures, Failures and Fault Tolerance ion Distributed Systems, Failures in Distributed DBMS, Local Reliability Protocols, Distributed Reliability Protocols, Dealing with site failures, Network Partitioning, Architectural Considerations Parallel Database Systems Database Servers, Parallel Architectures, Parallel DBMS Techniques, Parallel Execution Problems

Textbook:

1. Principles of Distributed Database Systems, Second Edition, M.Tamer Ozsu, PatrickValduriez, Pearson Education, 1999.

Reference Book:

1. Distributed Database Management Systems: A Practical Approach] Saeed K. Rahimi,Frank S. Haug , Wiely,2010

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DATA SECURITY & PRIVACY

Syllabus:

Unit I

Introduction to Databases Security Problems in Databases Security Controls, Security Models
– 1: Introduction Access Matrix Model Take-Grant Mode! Acl cn Model PN Model Hartsor and Hsiao's Model Fernandez's Model Bussolati and Martella's Model for Distributed databases - Security Models – 2:Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu'r Model The Lattice Model for the Flow Control conclusion.

Unit II

Security Mechanisms: Introduction User Identification/Authentication Memory, Memory Protection Resource Protection Control Flow Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria - Security Software Design: Introduction A Methodological Approach to Security Software Design Secure Operating System Design Secure DBMS Design Security Packages Database Security Design.

Unit III

Statistical Database Protection & Intrusion Detection Systems: Introduction Statistics Concepts and Definitions Types of Attacks Inference Controls evaluation Criteria for Control Comparison. Introduction IDES System RETISS System ASES System Discovery.

Unit IV

Enterprise Security Architecture - Security as a Process-Security Data- Enterprise Security as a Data Management Problem- Tools for Data Management- David Isenberg and the "Stupid Network"-Extensible Markup Language- The XML Security Services Signaling Layer-XML and Security Standards- The Security Pattern Catalog Revisited-XML-Enabled Security Data-HGP: A Case Study in Data Management. Business Cases and Security: Building Business Cases for Security.

Unit V

Security – Encryption – Digital Signatures – Authorization – Authenticated RPC - Integrity - Consistency - Database Tuning - Optimization and Research Issues. Case Studies Security – Encryption – Digital Signatures – Authorization – Authenticated RPC - Integrity - Consistency - Database Tuning - Optimization and Research Issues. Case Studies.

References:

1. Database Security by Castano, Silvana; Fugini, Maria Grazia; Martella, Giancarlo,Pearson Edition, 1994
2. Database Security and Auditing: Protecting Data Integrity and Accessibility 1stEdition, Hassan Afyouni Thomos Edition, 2006
3. Philip M. Lewis, Arthur Bernstein and Michael Kifer, "Databases and TransactionProcessing: An Application-Oriented Approach", Addison-Wesley, 2002.

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4. R. Elmasri and S.B. Navathe, "Fundamentals of Database Systems", 3rd Edition,Addison Wesley, 2004.

5. Abraham Silberschatz, Henry. F. Korth and S.Sudharsan, "Database System Concepts", 4th Edition, Tata McGraw Hill, 2004.
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6. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3Edition, TMH, 2003.

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COMPUTER NETWORKS

SYLLABUS
UNIT I

Introduction: OSI, TCP/IP and other networks models, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN. Physical Layer : Transmission media copper, twisted pair wireless, switching and encoding asynchronous communications; Narrow band, broad band ISDN and ATM.

UNIT-II

Network Layer: Virtual circuit and Datagram subnets-Routing algorithm shortest path routing, Flooding,

Hierarchical routing, Broad cast, Multi cast, distance vector routing.

UNIT–III

Dynamic routing – Broadcast routing. Rotary for mobility. Congestion, Control Algorithms –General

Principles – of Congestion prevension policies. Internet working: The Network layer in theinternet and in the ATM Networks.

UNIT–IV

Transport Layer: Transport Services, Connection management, TCP and UDP protocols; ATM AAL

Layer Protocol.

UNIT – V

Application Layer – Network Security, Domain name system, SNMP, Electronic Mail; theWorld WEB, Multi Media.

TEXT BOOKS :

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networking – Behrouz A. Forouzan.Third Edition TMH.

REFERENCES:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, PearsonEducation
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DISTRIBUTED COMPUTING

Syllabus

Unit I: Introduction to distributed programming: Anatomy of a Distributed Application, Requirements for Developing Distributed Applications, What Does Java Provide? Introduction to sockets programming: Sockets and Streams, URLs, URL Connections, and Content Handlers, The Class Loader.

Unit II: Distributing Objects: Why Distribute Objects, What's So Tough About Distributing Objects?, Features of Distributed Object Systems, Distributed Object Schemes for Java,CORBA, Java RMI, RMI vs. CORBA Threads: Thread and Runnable, Making a Thread, Managing Threads at Runtime, Networked Threads

Unit III: Security: Security Issues and Concerns, The java.security Package, Identities and Access Control, Keys: Public, Private, and Secret, Digital Signatures, Data Encryption, Choosinga Cryptographic Algorithm. Message-Passing Systems: Messages Defined, WhyDo We Need Messages?, Message Processing, Fixed Protocols, Adaptable Protocols, Message Passing with Java Events, Using Remote Objects Databases: An Overview of JDBC, Remote Database Applications, Multi-Database Applications.

Unit IV: RMI: The Basic Structure of RMI, The Architecture Diagram Revisited, Implementing the Basic Objects, The Rest of the Server, The Client Application The RMI Registry: Why Use a Naming Service? The RMI Registry, The RMI Registry Is an RMI Server, Examining the Registry, Limitations of the RMI Registry, Security Issues Naming Services: Basic Design, Terminology, and Requirements, Requirements for Our Naming Service, Federation and Threading, The Context Interface, The Value Objects, ContextImpl, Switching Between Naming Services, The Java Naming and Directory Interface (JNDI) The RMI Runtime: Reviewing the Mechanics of a Remote Method Call, Distributed Garbage Collection, RMI's Logging Facilities, Other JVM Parameters

Unit V: Service Oriented Architecture: Introduction, Defining a Service, Defining SOA, Identifying Service Candidates, Identifying Different Kinds of Services, Modeling Services, Making a Service Composable, Supporting Your SOA Efforts, Selecting a Pilot Project, Establishing Governance. Introduction to Web Services: Introduction, Using Publicly Available Web Services to Test Against, Installing Metro, Installing Oracle WebLogic, Creating and Deploying the Simplest Web Service, Creating and Deploying a Service to WebLogic, Setting

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Up a Maven 2 Service and Client Project, Understanding WSDL, Using References in NetBeans to Generate Web Service Clients, Monitoring SOAP Traffic with Metro, Monitoring SOAP, Traffic with TCPMon.

REFERENCE BOOKS:

1. Java Distributed Computing, Jim Farley, O'Reilly.

2. Java RMI Designing and Building, The Basics of RMI Applications, William Grosso, O'Reilly.

3. Java SOA Cookbook SOA Implementation Recipes, Tips, Techniques, Eben Hewitt, O'Reilly, 2009.

4. Service Oriented Architecture With Java, Malhar Barai, Vincenzo Caselli, Binildas A.Christudas, Packt Publishing, 2008.

5. Distributed Programming with Java, Qusay H. Mahmoud, Manning Publisher 2000.

6. Java in Distributed Systems, Concurrency, Distribution and Persistence, Marko Boger, 2001.

7. Developing Distributed and E-commerce Applications, Darrel Ince, 2/e, Wesly, 2004.

8. Java Message Service (O'Reilly Java Series), Richard Monson-Haefel, David Chappell.

9. Sun SL 301 Distributed Programming with Java.

10. Java Tutorial, http://java.sun.com/docs/books/tutorial/index.html.

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NETWORK SECURITY

Syllabus

Unit I:

Introduction to Network Security: Attacks, services, Security. A model of Inter network Security, Steganography, One time PADS. Basic and ESOTERIC Cryptographic Protocols: Key Exchange, Authentication, Formal Analysis of Authentication and key Exchange Protocols, Multiple & Public Key Cryptography, Secret Splitting & Sharing Secure elections,Secure multiparty, Communication, Digital Cash.

Unit II:

Crypto Graphic Algorithms (Block Cipher): RC2, GOST, CAST, BLOW FISH, SAFEER,RC5, NEWDES, CRAB, Theory of Block Cipher design. Key Management:

Key lengths, Generating Keys, Transferring, Verification, Updating, Storing, Backup,Compromised, Lifetime of, Destroying Keys, Public key Management.

Unit III:

Digital Signature Algorithms: Digital Signature, DSA, DSA variants, Gost, Discrete Lagorithm, One – Schnorr – Shamir digital Signatures, Esign, Cellular Automata. Mails:Electronic Mail & IO Security good Privacy, SIMIME, IP Security Architecture, Authentication Header, Encapsulating Security, Pay load Key Management Issues.

Unit IV:

Security: Web Security Web Security requirements, Secure Sockets Layer and TransportLayer Security, Secure Electronic Transaction.

Unit V:

Viruses and Threats: Intruders, Viruses, Worms and Firewalls Intruders, Viruses and RelatedThreats, Firewall Design Principles, Trusted Systems.

REFERENCE BOOKS:
1. Applied Cryptography, 7/e, Bruce SCHNEIER John Wiley & Sons Inc.
2. Cryptography and Network Security, William Stallings, PHI.
3. Introduction to cryptography with coding Theory, 7/e, Wade Trappe, C. Washington, PEA.
4. Cryptography and Information Security, V.K. Pachghare, PHI.
5. Cryptography and Network Security, Forouzan, TMH, 2007.
6. Cryptography and Network Security, 2/e, Kahate , TMH.
7. Modern Cryptography, Wenbo Mao, PEA

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WIRELESS COMMUNICATIONS AND MOBILE COMPUTING

Syllabus

UNIT -I:

The Cellular Concept-System Design Fundamentals: Introduction, Frequency Reuse, Channel

Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring

UNIT –II:

Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation

Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from prefect

conductors, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife- edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley- Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models- Partition losses (Same Floor), Partition losses between Floors, Log- distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeli

UNIT –III:

Introduction to Mobile Computing Architecture: Mobile Computing – Dialog Control – Networks –Middleware and Gateways – Application and Services – Developing Mobile Computing Applications –Security in Mobile Computing – Architecture for Mobile Computing – Three Tier Architecture – Design considerations for Mobile Computing – Mobile Computing through Internet – Making existing Applications Mobile Enabled.

Cellular Technologies: GSM, GPS, GPRS, CDMA and 3G: Bluetooth – Radio Frequency Identification – Wireless Broadband – Mobile IP – Internet Protocol Version 6 (IPv6) – Java Card –GSM Architecture – GSM Entities – Call Routing in GSM – PLMN Interfaces – GSM addresses and Identifiers – Network aspects in GSM – Authentication and Security – Mobile computing over SMS –GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations – Data

Services in GPRS – Applications for GPRS – Limitations of GPRS – Spread Spectrum technology –Is-95 – CDMA Versus GSM – Wireless Data – Third Generation Networks – Applications on 3G

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UNIT –IV:

Wireless Application Protocol (WAP) and Wireless LAN: WAP – MMS – Wireless LAN Advantages – IEEE 802.11 Standards – Wireless LAN Architecture – Mobility in wireless LAN**Intelligent Networks and Interworking :** Introduction – Fundamentals of Call processing –Intelligence in the Networks – SS#7 Signaling – IN Conceptual Model (INCM) –soft switch – Programmable Networks – Technologies and Interfaces for IN. **Client Programming, Palm OS, Symbian OS, Win CE Architecture:** Introduction – Moving beyond the Desktop – A Peek under the Hood: Hardware Overview – Mobile phones – PDA

– Design Constraints in Applications for Handheld Devices – Palm OS architecture – Application Development – Multimedia – Symbian OS Architecture – Applications for Symbian, Different flavors of Windows CE -Windows CE Architecture **J2ME:** JAVA in the Handset – The Three-prong approach to JAVA Everywhere – JAVA 2 Micro Edition (J2ME) technology – Programming for CLDC – GUI in MIDP – UI Design Issues – Multimedia – Record Management System – Communication in MIDP – Security considera considerations in MIDP –Optional Packages

UNIT –V:

Voice Over Internet Protocol and Convergence: Voice over IP- H.323 Framework for Voice over IP – Session Initiation Protocol – Comparison between H.323 and SIP – Real Time protocols –Convergence Technologies – Call Routing – Voice over IP Applications –IP multimedia subsystem (IMS) – Mobile VoIP **Security Issues in Mobile Computing:** Introduction – Information Security – Security Techniques and Algorithms – Security Protocols – Public Key Infrastructure – Trust – Security Models – Security

TEXT BOOKS:

1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002,PHI.

2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.

3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.

4. Mobile Computing – Technology, Applications and Service Creation – Asoke K Talukder,Roopa R Yavagal, 2009, TATA McGraw Hill

5. Mobile Communications – Jochen Schiller – 2nd Edition – Pearson Education

REFERENCE BOOKS:

1. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE.

2. Wireless Digital Communications – Kamilo Feher, 1999, PHI.

3. Wireless Communication and Networking – William Stallings, 2003, PHI.

4. Wireless Communication – Upen Dalal, Oxford Univ. Press.

5. Wireless Communications and Networking – Vijay K. Gary, Elsevier.

6. The CDMA 2000 System for Mobile Communications – Vieri Vaughi, Alexander DamnJaonvic – Pearson

7. Adalestein : Fundamentals of Mobile & Parvasive Computing, 2008, TMH

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CRYPTOGRAPHY AND NETWORK SECURITY

Syllabus

UNIT –I:

Understanding Computer Network Security: Securing the Computer Network Forms of Protection, Security Standards. **Security Threats to Computer Networks:** Sources of Security Threats, Security Threat Motives, Security Threat Management, Security Threat Correlation, Security Threat Awareness. **Computer Network Vulnerabilities:** Sources of Vulnerabilities, Vulnerability Assessment. **Cyber Crimes and Hackers:** Cyber Crimes, Hackers, Dealing with the Rising Tide of Cyber Crimes. **Hostile Scripts:** Introduction to theCommon Gateway Interface (CGI), CGI Scripts in a Three-Way Handshake, Server–CGI Interface, CGI Script Security Issues, Web Script Security Issues, Dealing with the ScriptSecurity Problems, Scripting Languages. **Security Assessment, Analysis, and Assurance:** System Security Policy, Building a Security Policy, Security Requirements Specification, Threat Identication, Threat Analysis, Vulnerability Identification and Assessment, Security Certification, Security Monitoring and Auditing, Products and Services.

UNIT –II:

Disaster Management: Disaster Prevention, Disaster Response, Disaster Recovery, Make your Business Disaster Ready, Resources for Disaster Planning and Recovery. **Access Control and Authorization:** Access Rights, Access Control Systems, Authorization, Typesof Authorization Systems, Authorization Principles, Authorization Granularity, Web Access and Authorization. **Authentication:** Multiple Factors and Effectiveness of Authentication, Authentication Elements, Types of Authentication, Authentication Methods, Developing an Authentication Policy.

UNIT –III:

Firewalls: Types of Firewalls, Configuration and Implementation of a Firewall, The Demilitarized Zone (DMZ), Improving Security Through the Firewall, Firewall Forensics, Firewall Services and Limitations. **System Intrusion Detection and Prevention:** Intrusion Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Other Types of Intrusion Detection Systems, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools.

UNIT –IV:

Computer and Network Forensics: Computer Forensics, Network Forensics, Forensics Tools. **Virus and Content Filtering:** Scanning, Filtering, and Blocking, Virus Filtering, Content Filtering, Spam. **Computer Network Security Protocols:** Application Level Security, Security in the Transport Layer, Security in the Network Layer, Security in the Link

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Layer and over LANS. **Security in Wireless Networks and Devices:** Cellular Wireless Communication Network Infrastructure, Wireless LAN (WLAN) or Wireless Fidelity (Wi- Fi), Standards for Wireless Networks, Security in Wireless Networks. **Security in Sensor Networks:** The Growth of Sensor Networks, Design Factors in Sensor Networks, Security in
Sensor Networks, Security Mechanisms and Best Practices for Sensor, Trends in Sensor Network Security Research.

UNIT –V:

Security Beyond Computer Networks: Information Assurance: Collective Security Initiatives and Best Practices. **Network Perimeter Security:** General Framework, Packet Filters, circuit Gateways, Application Gateways, Trusted Systems and Bastion Hosts, Firewall Configurations, Network Address Translations, Setting Up Firewalls. **The Art of Anti Malicious Software:** Viruses, Worms, Virus Defence, Trojan Horses, Hoaxes, Peer-to- Peer Security, Web Security, Distributed Denial of Service Attacks. **The Art of Intrusion Detection:** Basic Ideas of Intrusion Detection, Network-Based Detections and Host-Based Detections, Signature Detections, Statistical Analysis, Behavioural Data Forensics, Honeypots.

Textbooks:

1. Computer Network Security- Theory and Practice by Jie Wang, 2009 edition, HigherEducation Press, Beijing and Springer-Verlag.

2. A Guide to Computer Network Security by Joseph Migga Kizza, 2009 Edition,Springer-Verlag London Limited.

References:

1. Network Security Essentials- Applications and Standards by William Stallings, 4thedition.

2. Modern Cryptography: Theory and Practice by Wenbo Mao Hewlett-Packard Company, 1st edition, Prentice Hall PTR.

3. Network Security: Private Communication in a Public World by Charlie Kaufman, Radia Perlman, Mike Speciner, 2nd edition.

4. Cryptography and Network Security: Principles and Practice by William Stallings, 6th edition.

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WIRELESS SENSOR NETWORKS

SYLLABU
SUNIT I

Basics of Wireless Sensors and Applications, The Mica Mote, Sensing and Communication Range, Design Issues, Energy consumption, Clustering of Sensors, Applications

UNIT II

Data Retrieval in Sensor Networks, Classification of WSNs, MAC Layer, Routing Layer, High-Level Application Layer Support, Adapting to the Inherent Dynamic Nature of WSNs Sensor Network Platforms and Tools, Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms.

UNIT IV

Operating System: TinyOS, Imperative Language: nesC, Dataflow Style Language: TinyGALS, Node-Level Simulators, ns-2 and its Sensor Network Extension, TOSSIM.-

UNIT V

Sensor Network Databases : Challenges ,Query Interfaces, High level Database Organization, In-Network Aggregation, Data-centric Storage, Temporal Data.

TEXT BOOKS:

1. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, LeonidasGuibas, Elsevier Science Imprint, Morgan Kauffman Publishers, 2005, rp2009.

REFERENCES:

1. Adhoc Wireless Networks: Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy,Pearson Education, 2004

2. Wireless Sensor Networks: Principles and Practice, Fei Hu, Xiaojun Cao, An AuerbachBook, CRC Press, Taylor & Francis Group, 2010

3. Wireless Ad hoc Mobile Wireless Networks: Principles, Protocols and Applications, SubirKumar Sarkar et al., Auerbach Publications, Taylor & Francis Group, 2008.

4. Wireless Sensor Networks: Signal Processing and Communications Perspectives,Ananthram Swami et al., Wiley India, 2007, rp2009.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SOFT COMPUTING

Syllabus

UNIT-I:

Introduction to Neuro-Fuzzy and soft computing: computing constituents and conventions, characteristics. **Fuzzy set theory:** basic definitions and terminology, set- theoretic operations, Mf formulation and parameteization. **Fuzzy rules and reasoning:** extension principles and fuzzy relations, fuzzy if-then rules, fuzzy reasoning. Fuzzy inference systems: mamdani fuzzy models, sugeno fuzzy models, Tsukamoto fuzzy models, other considerations.

UNIT-II

Regression and optimization: least-squares methods for system identification. Introduction, basics of matrix manipulation and calculus, least-square estimator, geometric interpretation of LSE, recursive least squares estimator, recursive LSE for time varying systems, statistical properties and maximum likelihood estimator, LSE for nonlinear models. **Derivative-based optimization:** introduction, descent methods, the method of steepest descent, newtons methods, step-size determination, conjugate gradient methods, analysis of quadratic case, non linear least square problems, incorporation of stochastic mechanisms. **Derivative-free optimization:** introduction, genetic algorithms, simulated annealing, random search, downhill simple search.

UNIT-III

Neural Networks: Adaptive networks, supervised learning neural networks, unsupervised learning and other neural networks. neuro-fuzzy modeling: ANFIS, **Coative Neuro-Fuzzy Modeling:** Towards Generalized ANFIS. **Advanced Neuro-Fuzzy modeling:** classification and regression trees, data clustering algorithms, rule based structure identification.

UNIT-IV

Neuro Fuzzy control: ANFIS: introduction, architecture, hybrid learning algorithm, learning methods that cross fertilize ANFIS and RBFN, ANFIS as a universal approximation. Simulation examples: example 1.Modeling a two-input sinc function, Example 2. Modeling a three input non-linear function, example 3. On-line identification in control systems, example
4. Predicting chaotic time series. coactive neuro-fuzzy modeling: Towards Generalized **ANFIS:** introduction, framework, neuron functions for adaptive networks, neuro-fuzzy spectrum, analysis of adaptive learning capability.

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NEURO-FUZZY CONTROL-I

Introduction, framework, control systems and neuro-fuzzy control, expert control, inverse learning, specialized learning, back-propagation through time and real-time recurrent learning.

NEURO-FUZZY CONTROL-II

Introduction, Reinforcement learning control, Gradient-free optimization, Gain Schediling, Feedback Linearization and Sliding Control.

UNIT-V

GENETIC ALGORITHMS: A Genetic Introduction to Genetic Algorithms: What are Genetic Algorithms, Robustness of Traditional Optimization and search methods, goals of Optimization, How genetic algorithms different from traditional methods, A Simple Genetic Algorithm, Genetic Algorithms at work.

Genetic Algorithms Revisited: Mathematical Foundations Computer implementation of a genetic algorithm.

Advanced Operations and Techniques in Genetic Search: Introduction to Genetics based Machine Learning, Applications of Genetics based Machine Learning.

Text Books:

1. Neuro-Fuzzy And Soft Computing BY "J-S.R.Jang, Ct. Sun, E.Mizutani" Prentic-Hall OfIndia Private Limited Publications.

2. Genetic Algorithms BY "David E. Goldberg" Pearson Education.
REFERENCES:

1. Neural Networks and Learning Machines By "Simon Haykin"3rd Edition, Phi Publication.

2. Fuzzy Sets and Fuzzy Logic By "George J. Klir|Bo|Yuan" In Phi Publications.

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DIGITAL IMAGE PROCESSING

Syllabus

UNIT I:

Introduction: Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Visual Perception, Image sensing & Acquisition, Image Sampling & Quantization, Some Basic Relationships between Pixels.

UNIT II:

Image Enhancement in the Spatial Domain: Some basic Gray level Transformations, Histogram Processing, Enhancement using Arithmetic/Logic Operations, Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement methods.

UNIT III:

Image Enhancement in the Frequency Domain: Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphism Filtering, Implementation.

UNIT IV:

Image Restoration: Image Degradation/Restoration Process, Linear, Position-Invariant Degradations, Inverse Filtering, Minimum, Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Wavelets and MultiResolution Processing : MultiResolution Expansions, Wavelet Transforms in One dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions.
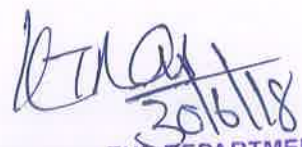
UNIT V:

Image Compression: Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

Text Book:

1.Rafael C.Gonzalez, Richard E. Woods; "Digital Image Processing ' Addison Wesley Pubs(Second Edition),2007.

Reference Books :

1. Milan Sonka, Vaclav Hlavac, Roger Boyle Image Processing. Analysis, and MachineVision(Second Edition,2003).
2. A.K.Jain, 'Fundamentals of Digital Image Processing' PHI,`1999.

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WEB SECURITY

Syllabus
UNIT I

Introduction: The Web Security Landscape, Architecture of the World Wide Web, Cryptography basics, Cryptography and the web, Understanding SSL and TLS, Digital Identification: Passwords, Biometrics and Digital Signatures.

UNIT II

Digital Certificates, CAs and PKI, Web's war on privacy, privacy protecting techniques, privacy protecting technologies

UNIT III

Web Server Security: Physical security for servers, Host security for servers, securing web applications.

UNIT IV

Web Server Security: Deploying SSL server certificates, securing your web service, computer crime Security for content providers: Controlling access to web content, Client-side digital certificates, code signing and Microsoft's Authenticode .

UNIT V

Security for content providers: Pornography, Filtering software, Censorship, privacy policies,legislation, P3P, Digital Payments, Intellectual property and actionable content.

Textbook

1. Web Security, Privacy and Commerce, Simson Garfinkel, Gene Spafford, 2nd Edition, O'REILLY, 2002. Pvt. Ltd.

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BIO-INFORMATICS

Syllabus

UNIT I:

INTRODUCTION: The Central Dogma, The Killer Application, Parallel Universes – Watson's Definition – Top Down Versus Bottom up – Information Flow , Convergence Databases , Data Management , Data Life Cycle , Database Technology , Interfaces Implementation.

UNIT II:

NETWORKS: Networks , Geographical Scope , Communication Models , Transmissions Technology , Protocols ,Bandwidth , Topology , Hardware , Contents , Security , Ownership Implementation , Management. **SEARCH ENGINES:** The search process , Search Engine Technology , Searching and Information Theory , Computational methods , Search Engines and Knowledge Management.

UNIT III:

DATA VISUALIZATION: Data Visualization , sequence visualization , structure visualization , user Interface , Animation Versus simulation , General Purpose Technologies. **STATISTICS:** Statistical concepts , Microarrays , Imperfect Data , Randomness Variability, Approximation , Interface Noise , Assumptions , Sampling and Distributions , Hypothesis Testing , Quantifying Randomness , Data Analysis , Tool selection statistics of Alignment

UNIT IV:

DATA MINING: Clustering and Classification , Data Mining , Methods , Selection and Sampling , Preprocessing and Cleaning , Transformation and Reduction , Data Mining Methods , Evaluation , Visualization , Designing new queries , Pattern Recognition and Discovery , Machine Learning , Text Mining , Tools.

PATTERN MATCHING: Pairwise sequence alignment , Local versus global alignment Multiple sequence alignment ,Computational methods , Dot Matrix analysis , Substitution matrices , Dynamic Programming , Word methods , Bayesian methods , Multiple sequence alignment , Dynamic Programming , Progressive strategies , Iterative strategies , Tools Nucleotide Pattern Matching , Polypeptide pattern matching , Utilities , Sequence Databases.

UNIT - V:

MODELING AND SIMULATION: Drug Discovery , components , process , Perspectives, Numeric considerations , Algorithms , Hardware Issues , Protein structure , AbInitio Methods,Heuristic methods , Systems Biology , Tools , Collaboration and Communications, standards , Issues , Security , Intellectual property.

REFERENCE BOOKS

1. Bio Informatics Computing, Bryan Bergeron, PHI, 2003.
2. Introduction to Bio Informatics, Attwood, Smith, Longman, 1999. CSE / Pre PhD R1032
3. Bio-Informatics, D Srinivasa Rao, Biotech.

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4. Bio Informatics Computing, Bergeron, PHI
5. Bio Informatics, Managing scientific Data, Lacroix, Terence Critchlow, Elsevier
6. Bio Informatics Methods and Applications, Rastogi, Mendiratta, Rastogi, PHI

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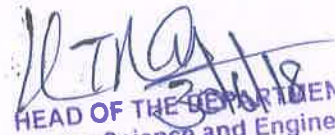Accredited by NAAC as 'A' Grade University ❖ Approved by AICTE ❖ ISO 9001-2015 Certified
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PATTERN RECOGNITION

Syllabus
UNIT I :

Introduction: Basic concepts, Applications, Fundamental problems in pattern Recognition system design, Design concepts and methodologies, Examples of Automatic Pattern recognition systems, Simple pattern recognition model.

UNIT II:

Decisions and Distance Functions: Linear and generalized decision functions, Pattern space and weight space, Geometrical properties, implementations of decision functions, Minimum- distance pattern classifications.

Probability - Probability of events: Random variables, Joint distributions and densities, Movements of random variables, Estimation of parameter from samples.

STATISTICAL UNIT - III:

DECISION MAKING - Introduction, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal cost of error,e stimation of error rates, the leaving-one-out-techniques, characteristic curves, estimating the composition of populations. Baye's classifier for normal patterns.

Non Parametric Decision Making: Introduction, histogram, kernel and window estimation, nearest neighbour classification techniques. Adaptive decision boundaries, adaptive discriminant functions, Minimum squared error discriminant functions, choosing a decision making techniques.

UNIT IV:

Clustering and Partitioning: Hierarchical Clustering: Introduction, agglomerative clusteringalgorithm, the single-linkage, completelinkage and average-linkage algorithm.Ward's method Partition clustering-Forg's algorithm, K-means's algorithm, Isodata algorithm.

Pattern Preprocessing and Feature selection: Introduction, distance measures, clustering transformation and feature ordering, clustering in feature selection through entropy minimization, features selection through orthogonal expansion, binary feature selection.

UNIT V:

Syntactic Pattern Recognition and Application of Pattern Recognition:
Concepts from formal language theory, formulation of syntactic pattern recognition problem, syntactic pattern description, recognition grammars, automata as pattern recognizers, Application of pattern recognition techniques in bio-metric, facial recognition, IRIS scon, Finger prints, etc.,**REFERENCES BOOKS:**
1. Pattern recognition and Image Analysis, Gose. Johnsonbaugh Jost, PHI.
2. Pattern Recognition Principle, Tou. Rafael. Gonzalez, Pea.
3. Pattern Classification, Richard duda, Hart., David Strok, Wiley.

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PARALLEL ALGORITHMS

Syllabus
UNIT I:

Introduction: Computational demand in various application areas, advent of parallel processing, terminology pipelining, Data parallelism and control parallelism-Amdahl's law. Basic parallel random access Machine Algorithms-definitions of P, NP and NP-Hard, NP- complete classes of sequential algorithms-NC –class for parallel algorithms.

UNIT II:

Organizational features of Processor Arrays,Multi processors and multicomputers.Mapping and scheduling aspects of algorithms. Mapping into meshes and hyper cubes-Load balancing- List scheduling algorithm Coffman-graham scheduling algorithm for parallel processors.

UNIT III:

Elementory Parallel algorithms on SIMD and MIMD machines, Analysis of these algorithms. Matrix Multiplication algorithms on SIMD and MIMD models.

Fast Fourier Transform algorithms. Implementation on Hyper cube architectures. Solving linear file - system of equations, parallelizing aspects of sequential methods back substitution and Tri diagonal.

UNIT IV:

Parallel sorting methods---Odd-even transposition Sorting on processor arrays.Biotonic – merge sort on shuffle –exchange ID –Array processor, 2D-Mesh processor and HypercubeProcessor Array. Parallel Quick-sort on Multi processors. Hyper Quick sort on hypercube multi computers. Parallel search operations. Ellis algorithm and Manber and ladner's Algorithms for dictionary operations.
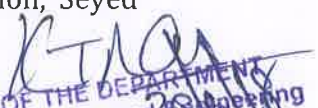
UNIT V:

Parallel algorithms for Graph searching— All Pairs shortest paths and minimum costspanning tree.

Parallelization aspects of combinatorial search algorithms with Focus on Branch and BoundMethods and,Alpha-beta Search methods.

REFERENCE BOOKS:

1. Parallel computing theory and practice, MICHAEL J.QUINN

2. Programming Parallel Algorithms, Guy E. Blelloch, Communications of the ACM

3. Algorithms for Parallel processing, Michael T Heath, Abhiram Ranade, Schreiber(Ed),Springer.

4. Handbook of Parallel Computing Models, algorithms and applications, SamgithevarRajasekharan, John Reif(Ed), Taylor and Franics group.

5. Parallel Processing and Parallel Algorithms: Theory and Computation, Seyed H. Roosta,Springer

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ARTIFICIAL INTELLIGENCE

Syllabus

Unit-1

Introduction to Artificial Intelligence: AI Problems, The underlying Assumption, AI Techniques, Level of the Model Problems, Problem spaces &Search: Defining the Problemas a state space search, Production System, Problem Characteristics, Production System Characteristics.

Unit-2

Heuristic Search Techniques: Generate and Test, Hill Climbing, Best first Search,Problem Reduction, Constraint Satisfaction , Means-Ends Analysis.

Unit-3

Knowledge Representation Issues: Representation and Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation, The Frame Problem Predicate Logic: Representing simple facts in logic, Computable Functions and Predicates,Resolution, Natural Deduction.

Unit-4

Representing Knowledge using rules : Procedural Versus Declarative Knowledge, LogicProgramming , Forward Versus Backward Reasoning, Matching, Control Knowledge

Unit-5

Common Sense: Qualitative Physics, Common Sense Ontologies, Memory Organization Expert Systems: Representing and Using Domain Knowledge, ExpertSystem Shells, Knowledge Acquisition

Text Book:

Elaine Rich & Kevin Knight," Artificial Intelligence ", 2nd Edition ,(Tata McGraw HillEdition)

Reference Books:

Patrick Henry Winston, 'Artificial Intelligence', Pearson Education,2003

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-5(c)

M.Tech- Digital Forensics and Cyber Security
Syllabus

18CS5117: Introduction to Cyber Security & ICS
L-T-P-S: 3-0-2   **Credits: 4**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Student should be able to understand security concepts and its impact on data security and application. Students should understand cyber laws and ethics.	PO1,PO2	2
CO2	Student should be able to various threats faced by cyber system. Students should be able to understand rolls and responsibility of law enforcement against cybercrime.	PO3,PO2	3
CO3	Student should be able to understand malware exhibit the processes involved in malware analysis.	PO1,PO2	4
CO4	Students should be able to understand risk analysis and management in the context of cyber security.	PO1,PO2,PO3	4
CO5	Examine and device a solution for cyber threats to secure cyber system.	PO6,PO3,PO4	5

Syllabus:

Introduction to Cyber Crime: Types of Cyber Crimes, Threat vectors, Cyberspace and Criminal profiling, Cyber security, Computer as a target, Introduction to Incident Response, Introduction to Digital Forensics, Recent threats to cyber domain, Internet, Destruction of Data, Privacy, Cyber Laws and Ethics. Cyber Security Threats: Unauthorized Access, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses. Malware Fundamentals: Types of malware, Malware analysis techniques, How malware can affect the system security, Malware analysis lab setup, Financial malwares, Code review, Behavior analysis, online malware analysis. BCP, DR planning & Audit: Introduction to Risk Analysis, Risk Assessment, Risk Mitigation, need for BCP, Overview of BCP Life

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Cycle, Identifying and Selecting Business Continuity Strategies, DR Strategies, Plans for Business Resumption, BCM Program Management and System Audit.

Text Books:
1. Cyber Security & Cyber War–P.W.Singer and Allan Friedman.
2. Principles of Cybercrime by Jonathan Clough.

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18CS5118: Digital Forensics

L-T-P-S: 3-0-2   **Credits: 4**   **Pre-requisite: Nil**

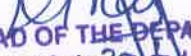Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the steps of forensics process.	PO1	2
CO2	Apply forensics analysis on different hard drives and analyse the file systems.	PO2	3
CO3	Analyse the various components and data in mobile phone for evidence.	PO2	3
CO4	Analyse windows registry and the various anti forensics techniques.	PO2	3
CO5	Create a virtual lab and experiment forensics expts based on the 5 stages of forensics process.	PO3	3

Syllabus:

Locard's Principal as applicable to Digital Forensics, Digital Forensics & its terminology, Classification of Digital Forensics, Digital Forensics basic Practices, Computing Devices, Storage Media, Potential Digital Evidence, Artifacts, Search & seizure, Forensic acquisition of digital devices, Digital evidence handling, Chain of Custody, Legal Report Writing Computing Device Forensics Hardware& software, Data Storage system, Hard Disk Geometry& Fundamentals, Disk Forensics, Types of OS, Data Recovery Tools, Open Source tools for investigation, Peripherals forensics, Tools and Techniques, *nix Forensics, Command line tools, Rootkits, RAM Forensics Mobile Phone Forensics Recent developments in mobile technology, Cell Phone Theory, Smart devices, Smart Operating Systems, Android, iOS, RIM OS, Windows, Mobile Phone Forensics, Logical v/s Physical extraction, Mobile phone forensics tools, SIM Forensics, Call Data Records, Smartphones Artifact analysis & Anti Forensics Operating Systems related Artifact analysis, Internet Artifacts, OS Artifacts, File System Artifacts, Registry Artifacts, Application Artifacts, Log analysis, Windows Logs, UNIX Logs, Application Logs, Network Log Analysis, File System Analysis, Anti- Forensics of Windows & Linux, Tool Development, Tool Strategy, Smart phone Anti-forensics, Log Manipulation, Application Manipulation, Time Date based Anti-forensics concepts.

Text Books:
1. Digital Forensics and Cyber Crime: by Pavel Gladyshev, Andrew Mar- rington, Ibrahim Baggili.

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2. The Basics of Digital Forensics: The Primer for Getting Started in Digital ... By John Sammons.

Reference Books:

1. Practical Digital Forensics by Richard Boddington, Packt Publishing, 2016.
2. Digital Forensics by Andrew Arnes, Wiley, 2018.
3. Hacking Exposed Computer Forensics, By Aaron Philipp, David Cowen, Chris Davis, The McGraw-Hill Companies, 2010.

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18CS5119: Advanced Network Security & Investigations

L-T-P-S: 3-0-2　　　　**Credits: 4**　　　　**Pre-requisite: NIL**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Memorizing the Network system architecture.	PO1	4
CO2	Describe the network architecture and locate various network components while estabilishing a network connection.	PO2	4
CO3	Demonstrate protocols and operate various forensic approaches	PO1	4
CO4	Analyze different phases of pen testing, identify vulnerabilities in the network and do investigations on the network.	PO2	4
CO5	Experiment with various network based attacks.	PO3	5

SYLLABUS:

Introduction to Network Systems: Networking concepts, how network works, LAN, MAN, WAN, Network Topology, Protocols & Technologies governing Internet, OSI Model, TCP/IP, IP Calculation, List of well- known ports & services, Internet Relay Chat, Point to Point, Packet Switching, Network services and applications: DNS, FTP, BGP, HTTP, SMTP, P2PNetwork. Network Connectivity: Network transport architectures, TCP, UDP, ICMP, ARP, NETBIOS, Network Devices, Modem, DSL/ADSL, Router, Switch, Hub, Repeater, Ethernet, Wi-Fi, Windows Networking, Work groups and Domains, NETBIOS, RPC, PS tools, Unix Networking, SSH, Routing and forwarding, intra-domain and inter- domain routing algorithms, Link layers and local area networks. Network Protocols&EmailForensics:NetworkBasics&Concepts,Types of Network, How network works, Protocols &Technologies,TCP/IP,IP Calculation, DNS, BGP,FTP, HTTP, List of well-known ports & services, Internet Relay Chat, Point to Point, Packet Switching, Packet Capture, Sniffing, Instant Messaging and IRC, Network Forensics, Email Forensics,Email header analysis,tracing&tracking of emails,Cloud Forensics. Network Attacks: Network Threat Vectors, MITM, OWAPS, ARP Spoofing, IP& MAC Spoofing, DNS Attacks, SYN Flooding attacks, UDP ping-pong and fragile attacks, TCP port scanning and reflection attacks, DOS , DDOS. Network Penetration Testing: Threat assessment,

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Penetration testing tools, Penetration testing,VulnerabilityAnalysis,Threatmatrices,Firewall and IDS/IPS,Wireless networks, Wireless Fidelity (Wi-Fi), Wirelessnetwork security protocols, Nmap, Network fingerprinting,BackTrack,Metasploit. Network Investigation: Network Artifact analysis, Sq lite database file analysis for various browsers, Introduction to Social engineering, Port Scanning, Peer to Peer Networking, Torrent Forensics, LAN Security assessment, HTTPS, Secure socket layer, Network Surveillance,Intelligence Gathering.

TEXT BOOKS:
1. Introduction to Network Security: Theory and Practice By Jie Wang, Zachary A.Kissel.
2. The Practice of Network Security Monitoring: Understanding Incident...By Richard Bejtlich.
3. Penetration Testing:A Hands-On Introduction to Hacking By Georgia Weidman.
4. Compitia Network+ Study Guide Fourth Edition.
5. Emmett Dulaney Compitia Network+ Study Guide Sixth Edition.

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18CS5120: Software Security

L-T-P-S: 3-0-2   **Credits: 4**   **Pre-requisite: Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the importance of web architecture and able to list out various levels of security	PO2	2
CO2	Learn and demonstrate various attacks that are occurred in web applications (OWASPTOP10vulnerabilities)	PO1,PO4	2
CO3	Differentiate various web application testing techniques and incorporate secure coding practices	PO3,PO5	3
CO4	To demonstrate skills needed to deal with common programming errors that lead to most security problems and to learn how to develop secure applications and Summarize on web investigation process P	PO1	4

Syllabus:

Secure Software Life Cycle, Memory Corruption flaws, Static Analysis, Security testing & Fuzzing, Sandbox, Input problems (Validation and Sanitization), Information flaw. Web Security: Evolution of Web applications, Web application security, Core Defense Mechanisms, Web Application Management, Web Architecture, Web Hacking, Internet Filtration, Pornographic evidence, Link Redirection Attacks, Web Messenger, Unblocking applications, OWASP, Code Injecting. Web Hacking Review of attack methods and tools, Penetration testing methodology, Port scanning, denial of service, attack on authentication system, and input validation attacks, Web application attacks, SQL injection, Cross-Site Scripting, Directory traversal Protocol based Attacks TCP Syn Flooding, Frame busting, Web Anonymity, Cookie Reusing, SSL/TLS Attacks, Forceful browsing, Session Stealing, DNS Changer, APT Secure coding: Programming Fundamentals, LangSec / State ML, Security Principles, Introduction to JAVA, .NET and PHP, Secure coding for SQL Injection, XSS,XSRF and Response splitting, Buffer overruns and format string problems. Web Investigation Web Hacking Investigations, Web site Crime Scene, web Logs, Investigation of hacking incident, database logs, web server intrusion investigations, code bugs. IEEE standard (Avoiding top 10 security design flaws).

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Text Books:

1. Security Controls Evaluation, Testing, and Assessment Handbook- Leighton Johnson.
2. Securing Systems: Applied Security Architecture and Threat Models - By Brook S. E. Schoen field.

Reference Books:

1. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws by Dafydd Stuttard (Author), Marcus Pinto (Author).
2. Web Application Security, A Beginner's Guide by BryanSullivan (Author), VincentLiu (Author).
3. SQL Injection Attacks and Defense by Justin Clarke-Salt(Author).
4. Security Controls Evaluation, Testing, and Assessment Handbook -Leighton Johnson.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS5221: Cryptography for Cyber Defence

L-T-P-S: 3-0-2   **Credits: 4**   **Pre-requisite: Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	able to demonstrate the concepts of cryptography.	PO1	3
CO2	able to experiment the functionality of cryptographic algorithms.	PO2,PO3	4
CO3	able to implement the algorithms and explain the strength of the alogirthms	PO4	4
CO4	able to analyze the security engineering principles in cryptography for cyber defence.	PO6	4

Syllabus:

Introduction to Cryptography: Encryption & Decryption, Cipher text, Review of number theory and algebra, Security definitions and secure padding schemes, computational complexity, probability and information theory, primarily testing. Cryptography and Cryptanalysis: Best practices and standardized cryptographic algorithms, Key generation and management, symmetric key encryption, DES, Triple DES, AES, RC4, OpenSSL, HTTPS, modes of operation. Public key encryption: RSA cryptosystem, Diffie-Hellman, elliptic curve cryptography, Rabin, ElGamal, Goldwasser-Micali, Blum-Goldwasser cryptosystems, Security engineering principles, Smart cards and RFID Message authentication, Digital signatures and time stamping, Digital Certification, Security handshake pitfalls, Strong password protocols. Side-channel attacks and countermeasures: Applications of cryptographic algorithms, Bank cards and terminals, Electronic passports, RFID systems in public transportation and automobiles, Smart cards and mobile phone security, Financial cryptography, payment systems, crypto currencies, bitcoin.

Text Books:

1. Applied Cryptography for Cyber Security and Defense: Information Encryption and Cyphering: by Hamid R. Nemati and Li Yang.

Reference Books:

1. Cryptography and Network Security, William Stallings, 5th Edition, Pearson Education, 2011.
2. Atul Kahate, Cryptography and Network Security, Tata Mc Graw Hill, 2007.
3. Comptia Security + Study Guide,7th edition,EmmettDulaney,Wiley publications.
4. Cryptography and Network Security, B.Forouzon.
5. Computer and Network Security Essentials,edited by Kevin Daimi Information Theory Coding and Cryptography,ArijithSaha,Pearson Publications.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS5222: Malware Analysis & Reverse Engineering

L-T-P-S: 3-0-2   **Credits: 4**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	Understand Malware types and malware fundamentals.	PO2	2
CO2	Understand Malware Reverse Engineering techniques.	PO4	3
CO3	Understand static and dynamic Malware Analysis by using different tools and techniques.	PO4	3
CO4	Apply Malware Analysis on malicious Microsoft Office (Word, Excel, PowerPoint) and Adobe PDF documents	PO4	4

Syllabus:

Introduction to Malware: Malware Analysis Fundamentals & Approaches, Types of malware and their features, Malware distribution techniques, Web threats, Intrusion signatures, Honeypot technology, Project work. Malware taxonomy and characteristics, Understanding Malware Threats, Malware indicators, Malware examination. Introduction to RE: Sandboxing Executable and Gathering Information from Runtime Analysis, The Portable Executable (PE32) File Format, Introduction to the IDA Pro Disassembler, Identifying Executable Metadata, Executable Packers and Compression, and Obfuscation Techniques, Memory Dumping, Kernel Rootkit, Kernel hook (function pointer) protection, File carving, Metadata Analysis. Malware Analysis: Static Analysis, Code Review, Dynamic Analysis, Behavioral analysis of malicious executable, Sandbox Technologies, Reverse-engineering malware, Defeat anti-reverse engineering technique, automated analysis, intercepting network connections, Network flow analysis, Malicious Code Analysis, Network analysis, Anti assembling techniques, Identifying assembly logic structures with a disassembler. Malware Handling: Malicious Documents and Memory Forensics -Reverse engineering of malicious executable using memory forensic techniques, Analyze malicious Microsoft Office (Word, Excel, PowerPoint) and Adobe PDF documents, Analyzing memory to assess malware characteristics and reconstruct infection artifacts. Using memory forensics to analyze rootkit infections, Legal & Ethical Issues Reinforce understanding and the application of discipline specific legal and ethical issues, Reverse Engineering Malware (REM)Methodology.

Text Books:

1. Cameron H. Malin (Author), Eoghan Casey (Author), James M. Aquilina (Author), Linux Malware Incident Response: A Practitioner's Guide to Forensic Collection

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and Examination of Volatile Data:An Excerpt from Malware Forensic Field Guide for Linux Systems.

2. Malware Analyst's Cookbook: Tools and Techniques for Fighting Malicious Code, First Edition: Michael Ligh, Steven Adair, Blake Hartstein, and Matthew Richard. ISBN-10:0470613033, ISBN-13:978-0470613030.WileyPublications.

3. Malware: Fighting Malicious Code: Ed Skoudis and Lenny Zeltser. ISBN-10: 0131014056, ISBN-13:978-0131014053.PrenticeHallPublications Practical Malware Analysis.

Reference Books:

1. Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software Book by Andrew Honig and Michael Sikorski.

2. Learning Malware Analysis by K.A.Monnappa.

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18CS5223: Cyber Incident Response & Resilience

L-T-P-S: 3-0-2   **Credits: 4**   **Pre-requisite: Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	Understand Incident Response concepts.	PO2	1
CO2	Understand the functionality of Incident Response and Incident categories and handling.	PO2	2
CO3	Exhibit the processes involved in Incident Handling Process	PO2	3
CO4	Analyse and understand Incident Response Team Members Roles and Responsibilities.	PO4	4

Syllabus:

Introduction to Incident Response: Cyber Incident Statistics, Computer Security Incident, Information as Business Asset, Data Classification, Information Warfare, Key Concepts of Information Security, Vulnerability, Threat, and Attack, Types of Computer Security Incidents, Examples of Computer Security Incidents, Verizon Data Breach Investigations Report – 2008, Incidents That Required the Execution of Disaster Recovery Plans, Signs of an Incident, Incident Categories, Incident Categories: Low Level, Incident Categories: Middle Level, Incident Categories: HighLevel. Incident Response and Handling Process: Step1:Identification,Step 2: Incident Recording, Step 3: Initial Response, Step 4: Communicating the Incident, Step 5: Containment, Step 6: Formulating a Response Strategy, Step 7: Incident Classification, Step 8: Incident Investigation, Step 9: Data Collection, Step 10: Forensic Analysis, Step 11: Evidence Protection, Step 12: Notify External Agencies, Step 13: Eradication, Step 14: Systems Recovery, Step 15: Incident Documentation, Step 16: Incident Damage and Cost Assessment, Step 17: Review and Update the Response Policies Incident Response Team Development: Security Awareness and Training Checklist, Incident Management, Purpose of Incident Management, Incident Management Process, incident Management Team, Incident Response Team, Incident Response Team Members, Incident Response Team Members Roles and Responsibilities, Developing Skills in, Incident Response Personnel, Incident Response Team Structure, Incident Response Team Dependencies, Incident Response Team Services.

Text Books:

1. file:///D:/inci/ECIH_Guide.pdf.
2. https://www.sans.org/score/checklists/apt-incident-handling.
3. https://thycotic.com/company/blog/2018/08/28/incident-response-template-plan-checklist-breach-ready/.
4. https://whatis.techtarget.com/definition/security-incident.

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18CS5224: Cyber Law, Governance and Compliance

L-T-P-S: 3-0-2   **Credits: 4**   **Pre-requisite: Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	Understand the Concepts of Cyber Ethics and cyberlaw importance	PO1	3
CO2	Identify the various IT Acts ITA2000,ITAA 2008..	PO2	3
CO3	Analysis of various protection of intellectual property Rights.	PO1	3
CO4	investigate the different real time Cyber Frauds.	PO2	4

Syllabus:

Computer ethics, Privacy & Legislation: Computer ethics, moral and legal issues, descriptive and normative claims, Professional Ethics, code of ethics and professional conduct. Privacy, Computers and privacy issue, legislative background and better privacy protection. Intellectual property issues in cyberspace: Introduction to intellectual property, WIPO, Copyright, Trade Secrets, Trademarks, Patents, Design, protection of intellectual property, Protection options – Encryption, copyright on web-content, copyright on software. Ethical Decision Making: Types of ethical choices, Making defensible decisions. Cyber Forensics legal aspects: Cyber forensics, cybercrime examples, forensics casework, investigative incident response actions, computer forensics tools, Threats in cyberspaces. Compliances & Standards: IT Service Management Concept, IT Audit standards, ISO/IEC 27000 Series, COBIT, HIPPA, SOX, System audit, Information security audit, ISMS, SoA (Statement of Applicability), BCP (Business Continuity Plan), DR (Disaster Recovery), RA (Risk Analysis/Assessment).

Text Books:

1. Earnest A. Kallman, J.P Grillo, "Ethical Decision making and IT:An Introduction with Cases".
2. Deborah G Johnson,"Computer Ethics" 3. WIPO INTELLECTUAL PROPERTY HANDBOOK.

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18CS5I1: Mobile Device Threats & Investigation

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand Mobile Application Functions	PO1,PO2	1
CO2	Learn and demonstrate Mobile Hacking & Investigation	PO3	2
CO3	demonstrate Securing smart OS	PO4	3
CO4	Summarize the Mobile Device Management	PO5	4
CO5	Investigate the various threats in mobile devices on real time fashion	PO2, PO4	5

Syllabus:

The evolution of mobile device and applications, common Mobile Application Functions, Mobile Application Security, Key problem factors, OWASP Mobile security practices. Mobile Hacking & Investigation, Android Process Dump, YAFFS, iOS Hacking, Tools for mobile device Anti forensics, Mobile device Security, Securing smart OS, Smart Phone Packet capturing, Firesheep, Mobile Device Management.

Text Books:
1. The Mobile Application Hacker's Handbook - Dominic Chell, Tyrone Erasmus
2. Mobile Forensic Reference Materials: A Methodology and Reification by U.S. Department of Commerce

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS5112: Fundamentals of E-discovery

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO	BTL
CO1	become familiar with the e-discovery rules and other sources of e-discovery law	PO2	3
CO2	become familiar with e-discovery ethical issues and e-discovery best practices	PO3	3
CO3	learn how to apply their knowledge to resolve typical and somewhat more complex e-discovery problems	PO2	3
CO4	acquire basic knowledge and skill in using e-discovery software	PO2	3

SYLLABUS:

Introduction to eDiscovery: – Client Interview, Electronic Data Preservation and Litigation Hold – eDiscovery Plan, phasing of Discovery and Meet and confer with opposing counsel – eDiscovery document review and production – Spoliation, eDiscovery ethical issues and case conclusion

TEXT BOOKS:

Sheindlin, Capra, and The Sedona Conference, Electronic Discovery and Digital Evidence 3d ed.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS5113: FUZZY SETS AND FUZZY LOGIC

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite: Nil**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	COURSE OUTCOME (Cos)	PO's	BTL
CO1	Understand basic knowledge of the fuzzy sets, operations and their properties	PO1 PO2	2
CO2	Understand the fundamental concepts of Fuzzy functions and Fuzzy logic	PO1	2
CO3	Apply the concepts of Fuzzy sets in decision-making.	PO1 PO4 PO6	3
CO4	Apply the concepts of Fuzzy logic in different applications.	PO1 PO4 PO6	3
CO5	Interpret the inclusion of fuzzy sets in various real time applications	PO1 PO4 PO6	4

SYLLABUS:

Classical sets : Operations and properties of classical sets, Mapping of classical sets to the functions. Fuzzy sets - Membership functions, Fuzzy set operations, Properties of fuzzy sets. Classical and Fuzzy relations : Cartesian product, crisp relations-cardinality, operations and properties of crisp relations. Fuzzy relations-cardinality, operations, properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations, value assignments and other format of the composition operation.

Fuzzification and Defuzzification : Features of the membership functions, various forms, fuzzification, defuzzification to crisp sets, - cuts for fuzzy relations, Defuzzification to scalars. Fuzzy logic and approximate reasoning, Other forms of the implication operation.

Fuzzy Systems : Natural language, Linguistic hedges, Fuzzy (Rule based) System, Aggregation of fuzzy rules, Graphical techniques of inference, Membership value assignments: Intuition, Inference, rank ordering, Fuzzy Associative memories.

Fuzzy decision making : Fuzzy synthetic evaluation, Fuzzy ordering, Preference and consensus, Multi objective decision making, Fuzzy Bayesian, Decision method, Decision making under Fuzzy states and fuzzy actions. Fuzzy Classification : Classification by equivalence relations-crisp relations, Fuzzy relations, Cluster analysis, Cluster validity, C-Means clustering, Hard C-Means clustering, Fuzzy C-Means algorithm, Classification metric, Hardening the Fuzzy C-Partition.

TEXT BOOKS:

1. Timothy J.Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley,2010.
2. George J.KlirBo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi,1995.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS51J1: Introduction to Big Data Analytics

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite: Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Students should be able to Understand the Overview of the term Big Data and their Evaluation	PO1	2
CO2	Students should be able to come across different types of databases, differentiate NOSQL, SQL	PO2	3
CO3	Students should be able to Understand Analytics in data.	PO4	4
CO4	Students should be able to Illustrate different tools in unstructured data.	PO7	2

Syllabus:

Introduction to Big Data and Database Evolution in Big Data: Introduction to Big Data, Relational Databases and SQL, Introduction to Hadoop, Pig, Hive, Casadenra, Mahout, Introduction to R, NoSQL databases and MongoDB, Comparison between SQL and NoSQL DBs, HDFS, Polyglot Persistence Data Analytics: What is data analytics?, Basics for Data Analytics, Data Analytics Lifecycle and methodology, Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, Communicating results, Deployment, Data exploration & preprocessing, Measures and evaluation, Using R for Initial Analysis of the Data, Methods and Tools for Data Analytics: Methods and Tools for Data Analytics (Structured Data), Methods and Tools for Data Analytics (Unstructured Data), Text mining, Web mining

Text Books:
1. Data-Intensive Text Processing with MapReduce, Jimmy Lin and Chris Dyer, Morgan & Claypool Publishers, 2010.
2. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Addison-Wesley April 2005.
3. Hadoop Beginner's Guide, Garry Turkington, PACKT Publication, ISBN: 9789351101109.
4. Mining of Massive Datasets, Anand Rajaraman and Jeff Ullman, Cambridge Press.
5. Hadoop: The Definitive Guide, Oreilly, 3rd Edition, Yahoo Release.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS51J2: Social Media Forensics

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	COURSE OUTCOME (Cos)	PO's	BTL
CO1	Understand open-source intelligence and how to utilize it.	PO1 PO2	2
CO2	Analyze online cyber investigations and intelligence gathering on the Dark Web.	PO2 PO4	4
CO3	Apply social networking searching and monitoring	PO1 PO2	3
CO4	Investigate criminal groups on social media and understand the legal fundamentals of cyber investigations.	PO2 PO4	4

Syllabus:

Introduction of Cybercrime: Types, The Internet spawn's crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident.Initial Response and forensic duplication, Initial Response & Volatile Data Collection from Windows system -Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. Duplicate/Qualified Forensic Duplicate of a Hard Drive. Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Current Forensic tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools. Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

Text Books:

1. Social Network Forensics by Jung Son, LAP Lambert Academic Publishing (26 July 2012)

2. Forensic Science in Criminal Investigation and Trials,by B R Sharma, 6th Edition, 2020

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS51J3: Critical Information Infrastructure Security
L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	COURSE OUTCOME (Cos)	PO's	BTL
CO1	Identify the key characteristics and problems in the area of cyber-security of critical infrastructure	PO2 PO4	4
CO2	Apply research methods which includes survey, experiments, and articulation of research problems in this area, and methods for finding solutions to selected problems	PO1 PO2 PO6	3
CO3	Present in written and/or verbal form key findings in the specific subject area of the course from contemporary research papers.	PO3	3
CO4	Analyze and identify research verticals in the specific domain area of cyber-security of critical infrastructure.	PO2 PO7	4

Syllabus:

Introduction Cyber-attacks, Vulnerabilities, Defense Strategies and Techniques, Authentication Methods- Password, Token and Biometric, Access Control Policies and Models (DAC,MAC, RBAC, ABAC, BIBA, Bell La Padula), Authentication and Access Control Services- RADIUS, TACACS. Wireless Security Mobile Device Security- Security Threats, Device Security, GSM, UMTS and 4G Security, IEEE 802.11xWireless LAN Security, VPN Security, Wireless Intrusion Detection System. Cloud Security Cloud Security Risks and Countermeasures, Data Protection in Cloud, Cloud Application Security, Cloud Identity and Access Management, Cloud Security as a Service, SAML, OAuth. Web Security Web Security Considerations, User Authentication and Session Management, Cookies, SSL, HTTPS, SSH, Privacy on Web, Web Browser Attacks, Account Harvesting, Web Bugs, Clickjacking, CrossSite Request Forgery, Session Hijacking and Management, Phishing and Pharming Techniques, DNS Attacks, Web Service Security, Secure Electronic Transaction, Email Attacks, Web Server Security as per OWASP, Firewalls, Penetration Testing.

Text Books

1. Computer Security Principles and Practice, William Stallings, Sixth Edition, Pearson Education
2. Security in Computing, Charles P. Pfleeger, Fifth Edition, Pearson Education
3. Network Security and Cryptography, Bernard Menezes, Cengage Learning
4. Network Security Bible, Eric Cole, Second Edition, Wiley

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Reference Books

1. Web Application Hackers Handbook by Wiley.
2. Computer Security, Dieter Gollman, Third Edition, Wiley
3. CCNA Security Study Guide, Tim Boyle, Wiley
4. Introduction to Computer Security, Matt Bishop, Pearson.
5. Cloud Security and Privacy, Tim Mather, Subra Kumaraswamy, Shahed Latif ,ORiely

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS52K1: Infrastructure Attacks and Defense

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the Concepts of Infrastructure attacks and defense.	PO1	3
CO2	Demonstrate the operating system internals & Mobile Security.	PO2	3
CO3	Understand network security and wireless attacks.	PO2	4
CO4	Analyse the cloud concepts & cloud security	PO4	4
CO5	Analyse web architectures and their security	PO4	4

Syllabus:

Operating System Internals: System Hacking, File Systems, Process Hacking, Sysinternals for manipulation detection, System Hacking Investigation, Virtual memory analysis, Hibernation concepts & Hibernation files, Inter Process Communication, System Security, Infrastructure Assessments. Mobile Operating System: Mobile Hacking & Investigation, Android Process Dump, YAFFS, iOS Hacking, Tools for mobile device Anti forensics, Mobile device Security, Securing smart OS, Smart Phone Packet capturing, Firesheep, Mobile Device Management. Introduction to Network Security and Wireless Attacks: Network Protocols, Network Attacks, Network Hacking, Network Hacking Investigation, Network security, Packet capturing, Deep Packet Injection, XSS Vulnerability, IPv4 & IPv6 Vulnerabilities, Session Hijacking, HTTP Authentication, Infrastructure Monitoring, Wireless Fundamentals, IEEE 802.11, Hardware, WEP Security, WEP Decryption Script, Analysis Wireless device Attacks, Virtual Private Network, Wireless Public Key Infrastructure, Wireless device Hacking Investigation, Wireless Security, Auditing Tools, 3GPP, GSM Architecture. Introduction to Cloud: Different Cloud Services, IaaS, PaaS, SaaS, Sandboxing, Virtualization, Hypervisor, Cloud Attacks, Cloud Hacking and Investigation, Cloud Forensic, Virtualization host security.Misc: Web security and forensic overview, Web languages, Introduction to different web attacks, Overview of N-tier web applications, Web Servers(Apache, IIS), Database Servers, Securing databases, ODBC, Secure JDBC, Applet Security.

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Text Books:

1. Don Murdoch, Blue Team Handbook: Incident Response Edition: A Condensed Field Guide for the Cyber Security Incident Responder: Version 2.0.
2. Ben Clark, Rtfm: Red Team Field Manual .
3. Metasploit - The Penetration Tester's Guide Paperback, by David Kennedy, Jim O'gorman, Devon Kearns, Mati Aharoni .
4. David Nathans, Designing and Building a Security Operations Center.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS52K2: Software Vulnerability Analysis and Resilience

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	COURSE OUTCOME (Cos)	PO's	BTL
CO1	Understand how to exploit a program and different types of software exploitation techniques	PO1 PO2	2
CO2	Understand the exploit development process	PO2 PO5	2
CO3	Investigate various vulnerabilities in closed-source applications	PO4	3
CO4	Design their own exploits for vulnerable applications	PO4 PO7	3
CO5	Apply and analyse the designed exploits in real time applications	PO4 PO7	4

Syllabus:

Introduction to several important aspects about malicious codes and software security, including Internet virus/worm/spam, typical software vulnerabilities (e.g., buffer overflow), software fuzz testing, secure programming, vulnerability prevention techniques, etc. software security and malware research to learn the frontier of software security research. Real time project work on a software security.

Text Book:

1. 19 Deadly Sins of Software Security (Security One-off) by Michael Howard, David LeBlanc, John Viega.
2. The Basics of Hacking and Penetration Testing (2 nd edition) by Patrick Engebretson.
3. Hacker Techniques, Tools, and Incident Handling (2 nd edition) by Sean-Philip Oriyano.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS52K3: Parallel & Cloud Computing
L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	COURSE OUTCOME (Cos)	PO's	BTL
CO1	Articulate the main concepts, key technologies, strengths, limitations of parallel and cloud computing and the possible applications for state-of-the-art cloud computing.	PO1 PO2	2
CO2	Identify the architecture and infrastructure of parallel and cloud computing, including cloud delivery and deployment models.	PO2 PO5	4
CO3	Analyze the core issues of parallel and cloud computing such as security, privacy, and interoperability.	PO4	4
CO4	Identify problems and analyze various cloud computing solutions.	PO4 PO7	4
CO5	Demonstrate and evaluate various cloud computing solutions.	PO2, PO4	5

Syllabus:

Taxonomy of Parallel Architectures, Computation, Storage and Networking in Clouds, Models of Parallel Computations, Parallel Programming using MPI, OpenCL, CUDA, OpenMP and OpenACC, Elastic Cloud Computing, Fundamental Algorithms – Sorting, Matrix Computation, Graph, Simulation and Big Data Analytics, Parallel Complexity including P-Completeness.

Text Books:

1. Quinn, M. J. (2004) Parallel programming in C with MPI and OpenMP, McGraw-Hill.
2. Introduction to algorithms. T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein. 3rd edition, MIT press.
3. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar (2003) Introduction to Parallel Computing, 2nd Edition. Addison Wesley.

Reference Books:

1. Akl, S. G. (1997) Parallel Computation Models and Methods, Prentice-Hall.
2. Barlas, G.(2015), Multicore and GPU Programming: An integrated approach, Morgan Kaufmann.
3. Henri Casanova, Arnaud Legrand, and Yves Robert (2008) Parallel Algorithms. Chapman & Hall/CRC.
4. Pacheco P (2011) An Introduction to Parallel Programming. Morgan Kaufmann.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS52L1: Applied Cryptography and Steganography

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	COURSE OUTCOME (Cos)	PO's	BTL
CO1	Understand the main concepts of Modern Cryptography and steganography.	PO1 PO4	2
CO2	Apply various cryptographic and steganography algorithms in a real time approaches and analyse the working methodologies and key properties.	PO2 PO4	3
CO3	Evaluate functionality, security and performance properties of cryptography and steganography methods used as components of complex security solutions	PO4 PO6	5
CO4	Analyse the impact of errors or different designs of cryptography and steganography algorithms and protocols	PO4 PO6	4

Syllabus:

History of cryptography, some background in probability and algorithms, classical cryptography (shift cipher, monoalphabetic substitution cipher, polyalphabetic substitution cipher), encryption with perfect secrecy, one-time pad; implementation aspects: shared secret randomness vs perfect secrecy. Some background in algorithms and complexity theory, modern cryptography principles, one-way functions, trapdoor functions, hard-core bits, construction of a public-key cryptosystem based on general cryptographic primitives, implementation aspects: computational efficiency vs hardness. Algorithmic number theory, number theory and cryptographic assumptions, Reductions, proofs by reductions, number theory candidates for cryptographic primitives (e.g., factoring and related problems), public-key cryptosystems from number theory problems; brief discussion of quantum computing; implementation aspects: large integer arithmetic for implemented public-key cryptosystems. Randomness and pseudo-randomness, pseudo-random generators, functions and permutations. Symmetric encryption: introduction, security notions, symmetric encryption schemes based on pseudo-randomness primitives, security proofs, fundamental concepts; implementation aspects: generating and testing randomness.

Text Books:

J. Katz and Y. Lindell, Introduction to Modern Cryptography: Principles and Protocol s, Chapman & Hall/CRC Press, 2nd edition.

A. Menezes, P. Van Oorschot, S. Vanstone, Handbook of Applied Cryptography, CRC Press, August 2001.

N. Ferguson, B. Schneier and T. Kohno, Cryptography Engineering: Design, Principles and Practical Applications, Wiley Publishing, Inc., 2010.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

18CS52L2: Software Modelling

L-T-P-S: 3-0-0   **Credits: 3**   **Pre-requisite:Nil**

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Student should be able to understand the cconcepts of Basics of Software Engineering	PO1	2
CO2	Student should be able to understand the functionality of Unified Modelling Language.	PO2	3
CO3	Student should be able to analyze the feasibility by performing Root Cause Analysis, Reverse estimation and by tracking.	PO3	3
CO4	Student should be able to Acquire knowledge on programming languages	PO2	4

Syllabus:

UNIT - I Basics of Software Engineering Definitions, Characteristics of Software, Software Engineering vs other engineering disciplines, Software Myths, Secure Software Life Cycle Models, Selection of Software Process models, Prototyping, Specification, Analysis modeling, Software design, Abstraction, Modularity, Software architecture. UNIT - II UML & Testing Unified Modeling Language, Effective modular design, Cohesion and Coupling, Architectural design and procedural design, Data flow oriented design, Software testing, Path testing, Control structures testing, Black Box testing, Unit, Integration, Validation and system testing, Software Maintenance. UNIT - III Feasibility Analysis Reverse Engineering and Re-engineering, wrappers, Case Study of CASE tools, Role of metrics in software development, Project metrics, Process metrics, Project initiation, Feasibility study, Planning, Estimation, Resource allocation, Root Cause Analysis, Scheduling, Tracking, Timeline chart UNIT - IV Java Basic skills and concepts of computer programming in an object-oriented approach using Java, Classes, methods and argument passing, control structures, iteration, Basic graphical user interface programming, Problem solving, class discovery and stepwise refinement, Programming and documentation style. UNIT - V Python Python Setup, Comments And Pound Characters, Numbers And Math, Variables And Names, Printing Strings, Text, Unpacking File, Handling Functions, Reading some code, If, Else and If, Making Decisions Loops and Lists, Branches and Functions, Designing and Debugging, Dictionaries Modules, Classes

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and Objects (OOP) Is-A, Has-A, Objects and Classes Inheritance and Composition, SQLite integration.

Text Books:

1. https://lecturenotes.in/notes/17228-note-for-software-engineering-se-by-mohit-kaushik.
2. Java Object-Oriented Problem Solving,R.Morelli Third Edition.
3. Introduction to Programming Using Java,David.J Version 5.0, December 2006.
4. Python Guide Documentation,Kenneith Reitz Page number(3-21) .
5. Learn Python3 the hard way,Zed A Shaw ,exercise 3, exercise 6.
6. Learning python,Mark Lutz, Chapter 4,Chapter 3 .
7. Automate the Boring Stuff with Python,Alsweigart, chapter 10,chapter 5.

30/6/18

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18CS52L3: Digital Image Processing

L-T-P-S Structure: 3-0-0   Credits: 3   Pre-requisite: NIL

Mapping of Course Outcomes (CO) with Program Outcomes (PO):

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	To understand the fundamental concepts of Digital Image Processing	PO1,PO4	2
CO2	To understand the pre-processing process of remote sensing data	PO4,PO1	2
CO3	To understand basic image processing operations	PO1,PO4	2
CO4	To understand image classification techniques	PO1,PO4	2

Syllabus:

Digital Computers and Image Processing: Introduction: Information Systems – Encoding and decoding, modulation Satellite data – acquisition, storage and retrieval – generation of data products digital data formats. Computer basics: Hardware and Software, Networks, Image Display Subsystem, Color Display System, Hard copy System, Data Format for Digital Satellite Imagery, Image file Format and Data Compression. Pre Processing of Remote Sensing Data: Introduction, Cosmetic Operations- Missing Scan Lines, De –stripping Methods, Geometric Corrections and Registration. Coordinate Transformations, Atmospheric Correction Methods, Illuminations and View Angle Effects, Sensor Calibration and Terrain Effects and radiometric correction methods. Image Enhancement Techniques: Introduction, Human Visual Systems, Contrast Enhancement Linear Contrast Stretch, Histogram Equalization, Guassian Stretch, Pseudo Color Enhancement Density Slicing, Pseudo Color Transform. Image Transforms: Introduction, Arithmetic Operations- Image Addition, Subtraction, Multiplication and Division. Empirically Based Image Transforms- Perpendicular Vegetation Index, Tasselled Cap Transformations, NDVI. Principal Component Analysis. Image Filtering Techniques: Introduction, Low Pass Filters- Moving Average Filters, Median Filters, Adaptive Filters, High Pass Filters- Image Subtraction Method, Derivative Based Method, Frequency Domain Filters, Filtering for Edge Enhancement Image Classification: Introduction, Geometrical Basis of Classification, Unsupervised classification, Supervised Classification Training Samples, Statistical Parameters and Classifiers. Image Classification Accuracy Assessment: Image classification accuracy assessment, Performance analysis, Various Band Data for Land use, Land Cover Classification System with Case Studies. Image Classification and GIS, Integration and Linkage. Software: ERDAS, Geomatics, ENVI and e-Cognition CO- 5 Image Processing Lab: Geo-coding of Images/Toposheets, Geo-referencing of Images, Subset & Mosaic of

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images/Toposheets, Data fusion (Data merging), Image Enhancement, Point operators, Spatial domain operators, Edge detection, Supervised classification of data, Unsupervised classification of data GIS – Creating of layered thematic information and GIS Analysis, TIN – 3D viewing Basic understanding of the TNT MIPS, ERDAS, GEOMEDIA, ENVI Software packages.

Textbooks:

1. John, R. Jensen. 1986. Introductory Digital Image Processing – Prentice Hall, New Jersey, USA.

2. Robert, A. Schowengergt. 1983. Techniques for image processing and classification in Remote Sensing, Academic Press.

3. Lillesand, T.M. and Kiefer R.W. 1987. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York.

Reference Books:

1. Hord, R.M. 1982. Digital Image Processing, Academic Press.

2. Paul. M. Mather and Magaly Koch. 2011. Computer Processing of Remotely-Sensed Images, Wiley Inc.

3. Bhatta, B. 2011. Remote sensing and GIS second edition, Oxford University Press.

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Annexure-5(d)

M.Tech-Machine Learning and Computing
Syllabus

18CS5109: OPTIMIZATION TECHNIQUES

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE:** NIL

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Learn efficient computational procedures to solve optimization problems,	PO1	2
CO2	To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology	PO1	2
CO3	Cast engineering minima/maxima problems into optimization framework to solve real world problems.	PO5,PO3	3
CO4	Apply and Evaluate knowledge of optimization to formulate and solve engineering problems	PO1	4

SYLLABUS:

Optimization: Need for unconstrained methods in solving constrained problems, Necessary conditions of unconstrained optimization, unconstrained optimization: Structure methods, Quadratic models, Methods of line search, Steepest descent method, Quasi-Newton methods: DFP (DFP (Davidon, Fletcher & Powell), BFGS, (Broyden–Fletcher–Goldfarb–Shanno algorithm) Conjugate-direction methods: Methods for sums of squares and nonlinear equations. Linear Programming: Simplex Methods, Duality LPP, Transportation problem Nonlinear programming: Lagrange Multiplier, KKT conditions, Convex programming.

TEXT BOOKS:

1. E. K. Chong and S. H. Zak, An Introduction to Optimization, 2nd Ed., Wiley India, 2001.

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1. D. G. Luenberger and Y. Ye, Linear and Nonlinear Programming, 3rd Ed., Springer India, 2008.
2. N. S. Kambo, Mathematical Programming Techniques, East-West Press, 1997.

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18CS5110: APPLIED STATISTICS

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Identify the suitable probability distribution to the given experimental data and calculation of various characteristics of the respective probability distributions	PO1,PO2	3
CO2	Draw the statistical inference of the given data through various tests of statistical hypothesis, viz., tests for means and proportions (single and two) and design of experiments	PO2,PO1	3

SYLLABUS:

Review of Probability Distribution and Statistical Inference, Design of Experiments, Single Factor, Randomized Block, Latin Square. Regression, Linear, Multiple, Curvilinear, Nonparametric Texts, Sign, Signed Rank, Randomness and Other Parametric Tests. Statistical Quality Control, Control for Charts for Measurements and for Attributes. Tolerance Limits, Acceptance Sampling. Reliability and Life Testing.

TEXT BOOKS:

1. Ronald E. Walpoe, Raymond H. Myers, Sharon L. Myers, Keying E.Ye, "Probability and Statistics for Engineers and Scientists", Pearson publishers, Ninth Edition.
2. Miller and Freund's, "Probability and Statistics for Engineers", Prentice Hall of India, Eigth Edition.

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18CS5111: DATA MINING

L-T-P-S: 3-0-2　　　　　**CREDITS: 4**　　　　　**PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand stages in building a Data Warehouse	PO1,PO5	2
CO2	Analyze Pre-processing techniques for data cleansing and multi-dimensional modelling techniques	PO5,PO2	4
CO3	Analyze performance of algorithms for Association Rule	PO2,PO5	4
CO4	Analyze Classification and Clustering algorithms	PO2,PO5	4
CO5	Evaluate the results obtained from all the algorithms	PO5	5

SYLLABUS:

KDD Process, Introduction to Data Warehouse, Data Pre-processing- Data Cleaning methods, Descriptive Data Summarization, Data Reduction, Data Discretization and Concept hierarchy generation, Overview of ETL and OLAP OLTP integration – comparison of OLAP with OLTP systems, ROLAP, MOLAP and DOLAP, Data Cube Computation methods, Advanced SQL support for OLAP, multi-dimensional modelling, Attribute-oriented Induction, Data Warehouse architecture and implementation - Parallel execution, Materialized views. Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity Data Mining Techniques: Basic concepts of Association Rule Mining, Frequent Item set mining, mining various kinds of association rules, Classification by decision tree induction, Bayesian Classification, Classification based on Back-propagation, Support Vector Machine classifier, Softmax Classifier, lazy learners. Model Evaluation and Selection, Techniques to improve classification accuracy, Multiclass classification, semi-supervised classification, Transfer Learning. Outliers and Outlier analysis, Outlier Detection methods, Statistical approaches to outlier detection, classification based approaches for outlier detection. Clustering methods, Data Objects and Attribute Types, Partitioning-Based Clustering Methods; Hierarchical Clustering Methods; Density Based and Grid-Based Clustering Methods, Advanced clustering techniques such as probabilistic model based clustering.

TEXT BOOKS:

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1. Han J & Kamber M, "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2011.
2. Pang-Ning Tan, Michael Steinback, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2008.

REFERENCE BOOKS:

1. M.Humphires, M.Hawkins, M.Dy,"Data Warehousing: Architecture and Implementation", Pearson Education, 2009.
2. Anahory, Murray, "Data Warehousing in the Real World", Pearson Education, 2008.
3. Kargupta, Joshi,etc., "Data Mining: Next Generation Challenges and Future Directions", Prentice Hall of India Pvt Ltd, 2007.

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18CS5112: MATRIX COMPUTATION

L-T-P-S: 3-0-2   **CREDITS: 4**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Use sophisticated scientific computing and visualization environments to solve application problems involving matrix computation algorithms and Explain the effects of errors in computation and how such errors affect solutions.	PO1,PO2	1
CO2	Analyze numerical algorithms, and understand the relationships between the computational effort and the accuracy of these algorithms.	PO3,PO2	3
CO3	Interpret the results produced by computer implementations of numerical algorithms.	PO3,PO4	3
CO4	Apply Rayleigh quotient iterations and Explicit and implicit QR algorithms.	PO5,PO6	3
CO5	Demonstrate the necessary analytical background for further studies leading to research in Machine Learning	PO5,PO6	4

SYLLABUS:

Floating point computations, IEEE floating point arithmetic, analysis of roundoff errors; Sensitivity analysis and condition numbers; Linear systems, LU decompositions, Gaussian elimination with partial pivoting; Banded systems, positive definite systems, Cholesky decomposition - sensitivity analysis; Gram-Schmidt orthonormal process, Householder transformation, Givens rotations; QR factorization, stability of QR factorization. Solution of linear least squares problems, normal equations, singular value decomposition(SVD), polar decomposition, Moore-Penrose inverse; Rank deficient least-squares problems; Sensitivity analysis of least-squares problems; Review of canonical forms of matrices; Sensitivity of eigenvalues and eigenvectors. Reduction to Hessenberg and tridiagonal forms; Power, inverse power and Rayleigh quotient iterations; Explicit and implicit QR algorithms for symmetric and non-symmetric matrices; Reduction to bidiagonal form; Golub- Kahan algorithm for computing SVD.

TEXT BOOKS:

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1. D. S. Watkins, Fundamentals of Matrix Computations, 2nd Ed., John Wiley, 2002.
2. L. N. Trefethen and D. Bau, Numerical Linear Algebra, SIAM, 1997.

REFERENCE BOOKS:

1. G. H. Golub and C. F. Van Loan, Matrix Computations, 3rd Ed., John Hopkins University Press, 1996.
2. J. W. Demmel, Applied Numerical Linear Algebra, SIAM, 1997.

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18CS5113: EVOLUTIONARY AND NATURAL COMPUTING

L-T-P-S: 3-0-2   **CREDITS: 4**   **PRE-REQUISITE: NIL**

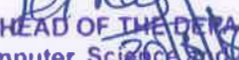### MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Demonstrate the natural evolution, basic principles of GA	PO1	2
CO2	Apply techniques of genetic algorithms, genetic programming to understand the problems	PO2,PO4	3
CO3	Identifying different types of genetic algorithms, Improving GA, Types of Genomes and demonstration of basic principles of ACO	PO3,PO4	3
CO4	Demonstration of different techniques of Ant Colony Optimization, Swarm Intelligence and application to problems, Comparing the different approaches to solve problems. To Explain Artificial Immune Systems, Computational Embryology, and ArtificialLife.	PO2	3
CO5	Execute lab experiments and develop a small project along with his/her team members.	PO2,PO4	4

SYLLABUS:

Introduction to Natural Evolution, Genetic Algorithms, Classification of Genetic Algorithm, Genetic Programming, Genetic Algorithm Optimization Problems, Evolutionary Programming, Ant Colony Optimization, Swarm Intelligence, Artificial Immune Systems, Computational Embryology, Artificial Life.

TEXT BOOKS:

1. An Introduction to Genetic Algorithms Melanie Mitchell. Mit Press. 1998.
2. Self-Organisation in Biological Systems, Camazine, Deneubourg, Franks, Sneyd, Theraulaz, Bonabeau, Princeton University Press, 2002.
3. Wolfgang Banzhaf, Peter Nordin, Robert E. Keller, And Frank D. Francone, Genetic Programming: An Introduction, Academic Press/Morgan Kaufmann, 1998.

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2. Self-Organisation in Biological Systems, Camazine, Deneubourg, Franks, Sneyd, Theraulaz, Bonabeau, Princeton University Press, 2002.
3. Wolfgang Banzhaf, Peter Nordin, Robert E. Keller, And Frank D. Francone, Genetic Programming: An Introduction, Academic Press/Morgan Kaufmann, 1998.
4. Ant Colony Optimization Marco Dorigo Thomas Stu¨tzle A Bradford Book The MIT Press Cambridge, Massachusetts London, England.
5. Introduction to Genetic Algorithms S.N.Sivanandam, S.N.Deepa ISBN 978-3-540-73189-4 Springer Berlin Heidelberg New York.
6. Evolutionary Optimization Algorithms, Biologically-Inspired and Population-Based Approaches to Computer Intelligence, Dan Simon 2013 John Wiley & Sons.

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18CS5114: DISCRETE MATHEMATICS

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply the principle of counting to solve the problems related to discrete event occurrences; Apply propositional logic to solve the problems	PO1,PO3	3
CO2	Apply the laws of set theory and formulate recurrence relation	PO2	3
CO3	Understand the sequence of symbols to represent in terms of finite sequence of characters; Understand graph & tree concepts; apply tree concepts to solve related problems	PO2,PO4	3
CO4	Apply graphs concepts using algorithms and Optimal transportation problems	PO2,PO4	3

SYLLABUS:

Basic Counting Principle: Pigeonhole Principle, Inclusion - Exclusion Principle, Recurrence Relations, Generating Functions. Fundamentals of Logic, Set Theory, Language and Finite State Machines. • Undirected and Direct Graphs, Modelling with Graphs, Trials and Cycles, Connectivity and Trees. • Graph Algorithms: Bfs, Dfs, Shortest Path, Optimal Spanning Trees, Matching, Job Assignment Problem, Optimal Transportation Through Flows in Networks.

TEXT BOOKS:

1. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata Mcgraw-Hill, 2000.
2. R.P.Grivaldi And B.V.Ramana , Discrete And Combinatorial Mathematics, Pearson 2008.

REFERENCE BOOKS:

1. R. L. Graham, D. E. Knuth, And O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
2. K. H. Rosen, Discrete Mathematics and Its Applications, 6th Ed., Tata Mcgraw-Hill, 2007.

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18CS5115: PATTERN RECOGNITION AND MACHINE LEARNING

L-T-P-S: 3-0-2   **CREDITS: 4PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	The student will be able to apply kernel methods, support vector machines for classification and regression problems	PO1,PO2,PO4	3
CO2	The students will be able to apply Kernel Ridge Regression; Kernel Density Estimation; Kernel PCA	PO1,PO2,PO4	3
CO3	The students will be to apply Kernel Online Learning, Spectral Clustering, Model Based Clustering, Expectation Maximization	PO1,PO2,PO4	3
CO4	The student will be able to analyze Independent Component Analysis; Hidden Markov Models; Factor Analysis; Introduction to Graphical Models & Sampling Methods.	PO4,PO1,PO2	4
CO5	The students will be able to apply above techniques for classification, clustering and multiclass classification etc...	PO1,PO2,PO3	3

SYLLABUS:

Kernel Methods: Introduction to Metric Space, Vector Space, Normed Space, Inner Product Space; RKHS; Learning Theory; SVM for Classification & Regression; Implementation Techniques of SVM; Kernel Ridge Regression; Kernel Density Estimation; Kernel PCA; Kernel Online Learning. Spectral Clustering; Model Based Clustering, Expectation Maximization; Independent Component Analysis; Hidden Markov Models; Factor Analysis; Introduction to Graphical Models & Sampling Methods.

TEXT BOOKS:

1. C.M. Bishop. Pattern Recognition and Machine Learning springer, 2006.
2. Hastie, R. Tibshirani and J. Friedman. The Elements of Statistical Learning: Data Mining, Inference, And Prediction. Springer, 2002.
3. Cristianini, N. And Shawe-Taylor, J., An Introduction to Support Vector Machines and Otherkernel-Based Methods, Cambridge Univ. Press (2000).

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4. B. Scholkopf and A. J. Smola. Learning with Kernels. The Mit Press, 2002.
5. J. S. Taylor and N. Cristianini. Kernel Methods for Pattern Analysis. Cambridge University Press, 2004.

REFERENCE BOOKS:

1. C.M. Bishop. Pattern Recognition and Machine Learning springer, 2006.
2. Hastie, R. Tibshirani and J. Friedman. The Elements of Statistical Learning: Data Mining, Inference, And Prediction. Springer, 2002.
3. Cristianini, N. And Shawe-Taylor, J., An Introduction to Support Vector Machines and Otherkernel-Based Methods, Cambridge Univ. Press (2000).
4. B. Scholkopf and A. J. Smola. Learning with Kernels. The Mit Press, 2002.
5. J. S. Taylor and N. Cristianini. Kernel Methods for Pattern Analysis. Cambridge University Press, 2004.

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18CS5116: COMPUTER MODELING & SIMULATION

L-T-P-S: 3-0-2   **CREDITS: 4**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the basics of simulation and modeling with examples and platforms supporting simulation	PO1	3
CO2	Analyze discrete event simulation principles, mathematical, Statistical and Queuing Models.	PO1	3
CO3	Analyze Input Modeling, Verification and Validation of the simulation Models	PO1	3
CO4	Apply the Simulation on Manufacturing and Material Handling Systems, Computer System and Computer Networks.	PO1	3
CO5	Develop the basic concepts of Simulation and Modeling using Arena simulation tool	PO1	2

SYLLABUS:

Meaning and Importance of Simulation and Modelling, Classification of Models, Variables and Problem Formulation, Performance Measures, Data Collection and Analysis, Simscript Language Concept: General Syntax, Discrete Event Modelling, Process and Resources, Timing and Pending List, Accumulate and Tally, Process Instance and Object Oriented Aspects, Sets and Data Structures, Probability Distribution, Random Number and Random Variant Generation. Input Modelling and Output Analysis. Generation of Graphical Output, User Interface and Animation in Simscript, Development of Simulation Models of Real System Through Integration of Programming and Statistical Concepts, Issues Related to Credibility of Models.

TEXT BOOKS:

1. Simulation Modeling and Analysis by Law, Mcgraw - hill Publications.

REFERENCE BOOKS:

1. Hastie, R. Tibshirani and J. Friedman. The Elements of Statistical Learning: Data Mining, Inference, And Prediction. Springer, 2002.

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18CS51E1: COMPUTER VISION AND IMAGE PROCESSING

L-T-P-S: 3-0-0   **PRE-REQUISITES: NIL**   **CREDITS: 3**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	POs	Blooms Taxonomy Level (BTL)
CO1	Understand image representation and modelling	PO1,PO3	1
CO2	Apply image transformation methods	PO3,PO2	3
CO3	Interpret image processing algorithms	PO2,PO4	3
CO4	Apply and analyse transformation, pose consistency and segmentation algorithms	PO2,PO5	4

SYLLABUS:

Cameras: Sensing, Sources, Shadows, and Shading: Qualitative Radiometry, Sources and their effects, Local shading models, Application: photometric stereo, Inter-reflections: global shading models Color: The physics of color, Human color Perception, Representing color, A Model for image color, Surface color from image color Linear Filters: Linear filters and convolution, Shift Invariant linear systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Technique: Scale and Image Pyramids. Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture: Representing Texture, Analysis Using Oriented Pyramids, Application: pooled texture representation, Synthesizing Textures for Rendering, Image denoising, Shape from Texture The Geometry of Multiple Views: Two Views, Three Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras. Segmentation by Clustering: Human Vision: Grouping and Gestalt, Applications: shot boundary detection and background subtraction, Image segmentation by clustering pixels, Segmentation by Graph-Theoretic Clustering, Segmentation by fitting a model: The Hough Transform, Fitting Lines, Fitting Curves, Robustness, Missing Data Problems. Segmentation and Fitting using probabilistic methods: Fitting, and Segmentation, The EM Algorithm in practice, Model selection: best Fit, Model-Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses Using Invariants, Verification, Application: Registrations in Medical Imaging Systems, Curved Surfaces and Alignment, Geometric Templates from Spatial Relations: Simple Relations

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between object and image, Primitives, Templates, and Geometric Inference, Applications : Range Data: Object Recognition.

TEXT BOOKS:

1. Forsyth David A and Ponce J, "Computer Vision – A Modern Approach", Pearson Publication, (2003).

REFERENCE BOOKS:

1. R. Szeliski ,"Computer Vision: Algorithms and Applications", Springer Verlag, (2011).
2. Milan Soanka, Vaclav Hlavac and Roger Boyle, "Digital Image Processing and Computer Vision", Cengage Learning.
3. R.C. Gonzalez and R.E. Woods," Digital Image Processing", Pearson Education, 3rd Edition.

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18CS51E2: SERVICE ORIENTED ARCHITECTURE

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the fundamentals of web services and distributed computing	PO1 PO3	2
CO2	Understand the basic standards and principles of service oriented architectures	PO1 PO3	2
CO3	Analyse the integration of SOA technological points with Web Services.	PO1 PO2	3
CO4	Implement of SOA in development cycle of Web Services.	PO3 PO5	4

SYLLABUS:

Introduction: Concepts of Distributed Computing, XML, Fundamental of SOA, evolution of SOA, Web Services Fundamental and Standard: Web Services: Definition, Architectures and Standards. Directory services, SOAP, REST WSDL, UDDI, Principles of Service-Oriented Architecture- Service-orientation and object- orientation, SOA Standards Stack, SOA with Web Services, Key Principles of SOA, SOA and WS-* Extension: Message Exchange Pattern, Coordination, Atomic Transactions, Business Activities, Orchestration, Choreography, WS-Addressing, WS-Reliable Messaging, WS-Policy (including WS-Policy Attachments and WS-Policy Assertions), WS-Metadata Exchange, WS-Security (including XML-Encryption, XML- Signature, and SAML), Principles of Service-Oriented Computing: RPC versus Document Orientation, Service Life Cycle, Service Creation, Service Design and Build, Service Deployment, Publish Web service using UDDI, Service Discovery, Service Selection, Service Composition, Service Execution and Monitoring, Service Termination, Service Composition and Modelling Business Processes with Business Process Execution Language (BPEL).

TEXT BOOKS:

1. Thomas Erl, "Service Oriented Archit ecture: Concepts, Technology, and Design", Pearson education.

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2. Service-Oriented Computing: Semantics, Processes, Agents, Munindar P. Singh and Michael N. Huhns, John Wiley & Sons, Ltd., 2005.

REFERENCE BOOKS:

1. SOA Using Java™ Web Services by Mark D. Hansen

2. SOA Design Pattern by Thomas Erl PHI

3. Web service contract Design & Versioning for SOA by Thomas Erl PHI

4. SOA with .NET by Raj balasubhramaniam Prentice Hall

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18CS51E3: DATA ANALYSIS

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand a meaningful pattern in data and graphically interpret data	PO1 PO2	2
CO2	Implement the analytic algorithms	PO5	4
CO3	Handle large scale analytics projects from various domains	PO3 PO5	3
CO4	Develop intelligent decision support systems	PO1 PO2	4

SYLLABUS:

Data Definitions and Analysis Techniques - Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing, Introduction to statistical learning and R-Programming, Descriptive Statistics - Measures of central tendency, Measures of location of dispersions, Practice and analysis with R, Basic Analysis Techniques - Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Correlation analysis, Maximum likelihood test, Practice and analysis with R, Data analysis techniques - Regression analysis, Classification techniques, Clustering, Association rules analysis, Practice and analysis with R, Case studies and projects - Understanding business scenarios, Feature engineering and visualization, Scalable and parallel computing with Hadoop and Map-Reduce, Sensitivity Analysis.

TEXT BOOKS:

1. Probability & Statistics for Engineers & Scientists (9th Edn.), Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Prentice Hall Inc.
2. The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Trevor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014.
3. An Introduction to Statistical Learning: with Applications in R, G James, D. Witten, T Hastie, and R. Tibshirani, Springer, 2013.
4. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer.

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5. Mining Massive Data Sets, A. Rajaraman and J. Ullman, Cambridge University Press, 2012.
6. Advances in Complex Data Modeling and Computational Methods in Statistics, Anna Maria Paganoni and Piercesare Secchi; Springer, 2013.
7. Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012.
8. Hadoop: The Definitive Guide (2ndEdn.) by Tom White, O'Reilly, 2014.
9. MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems, Donald Miner, Adam Shook, O'Reilly, 2014.
10. Beginning R: The Statistical Programming Language, Mark Gardener, Wiley, 2013.

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18CS51E4: CLOUD COMPUTING

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Articulate the main concepts, key technologies, strengths, limitations of cloud computing and the possible applications for state-of-the-art cloud computing.	PO1	3
CO2	identify the architecture and infrastructure of cloud computing, including cloud delivery and deployment models	PO1	1
CO3	Analyse the core issues of cloud computing such as security, privacy, and interoperability.	PO1	3
CO4	Identify problems, analyse, and evaluate various cloud computing solutions.	PO1	1

SYLLABUS:

Cloud Computing fundamentals: Essential characteristics, Architectural Influences, Technological Influences, and Operational Influences. Cloud Computing Architecture: Cloud Delivery models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service(PaaS), Cloud Infrastructure as a Service(IaaS), Cloud deployment models, Public Clouds, Community Clouds, Hybrid Clouds, Alternative Deployment models, Expected benefits. Cloud Computing Software Security fundamentals: Cloud Information Security Objectives, Confidentiality, Integrity, Availability, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Secure Development practices, Approaches to Cloud Software Requirement Engineering, Cloud Security Policy Implementation. Cloud Computing Risk Issues: The CIA Traid, Privacy and Compliance Risks, Threats to Infrastructure, Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks. Cloud Computing Security challenges: Security Policy Implementation, Policy Types, and

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Computer Security Incident Response Team (CSIRT). Cloud Computing Security Architecture: Architectural Considerations, General Issues, Trusted Cloud Computing, Secure Execution environments and Communications, Micro architectures, Identity Management and Access Control, Autonomic Security.

TEXT BOOKS:

1.Ronald L. Krutz, Russell Dean Vines, "Cloud Security a Comprehensive Guide to secure Cloud Computing" Wiley.

REFERENCE BOOKS:

1. John W. itinghousejamesF.Ransome, "Cloud Computing Implementation, Management and Security" , CRC Press.

2. Borko Furht. Armando Escalante, "Handbook of Cloud Computing", Springer

3. Charles Badcock, "Cloud Revolution", TMH

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18CS51F1: ARTIFICIAL NEURAL NETWORKS

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand and build basic network representations, topologies and models	PO1,PO2	2
CO2	Apply various techniques for training and optimizing neural networks	PO1,PO2	3
CO3	Analyze different techniques related to network stochastics	PO3,PO4	4
CO4	Analyze different techniques related to learning algorithms for neural networks and develop knowledge on emerging software, tools and technologies related to these algorithms	PO4,PO5	4

Syllabus:

Basics of Artificial Neural Networks: Historical perspective; Characteristics of Neural Networks; Artificial Neural Networks (ANN) terminology; Neuron Models; Topology; Basic learning laws, Activation dynamics models; Synaptic dynamics models; Learning methods; Stability and convergence; Recall;

Feed forward Neural Networks: Analysis of Pattern association; pattern classification and pattern mapping by feedforward neural networks (FFNNs); Hebbian Rule; Perceptron learning; Delta rule; Backpropagation Algorithm; Gradient descent and its variants, RBFN.

Feedback Neural Networks: Analysis of linear auto associative networks; Associative Memory, Exponential BAM Hopfield model for pattern storage; Stochastic networks and Simulated annealing; Restricted Boltzmann machine.

Kohenen Self Organizing Maps – Learning Vector Quantization – Counter Propagation Networks, dynamically driven recurrent networks- RNN, Learning algorithms (BPTT, RTRL, Kalman Filter) Applications of neural networks.

TEXT BOOKS:
1. B. Yegnanarayana "Artificial Neural Networks", PHI, 2006.
2. Simon Haykin, "Neural Networks: A Comprehensive Foundation", Pearson Prentice Hall, 2008.
3. Christopher M Bishop, "Neural networks for Pattern Recognition", Oxford, Indian Edition, 2010.

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18CS51F2: APPLICATION DEVELOPMENT FRAMEWORKS

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Identify basic aspects of web-frameworks.	PO1	3
CO2	Apply the basic concepts, principles and practices of Web-site development using server-side technologies	PO2 PO3	4
CO3	Create and manage Blogs, Websites using WordPress	PO1 PO2 PO5	4
CO4	Create Web Application using Moodle and manage features of Moodle sites	PO1 PO2 PO5	4

SYLLABUS:

Practice on various Web Technologies - Practice on HTML, CSS, Java Script, Ajax. Practice on Servier side scripting i.e. PHP &MySql ,What is WordPress, Introduction to Web frameworks - Introduction to WordPress, How WordPress Works, Introduction to Moodle, Pedagogy, Moodle site - basic structure - Installation of WordPress, Introduction to Blogging, Creating Blogs, Using Images, Wrapping Text Around Images, Comments, Post Formats, Linking to Posts, Pages, and Categories, Using Smilies, Links Manager, WordPress Feeds, Customizing Feeds, Use Gravatars in WordPress, Writing Code in Your Posts, Using Password Protection, Developing a Colour Scheme, Designing Headers, CSS Horizontal Menus, Dynamic Menu Highlighting, Navigation Links, Next and Previous Links, Styling for Print, Designing Your Post Meta Data Section, Separating Categories in your Post Meta Data Section, Customizing the Read More, Formatting Date and Time, Finding CSS Styles, Creating Individual Pages, Uploading Files, Using WordPress Themes, Templates, Template Tags, Template Hierarchy, Validating a Website, Know Your Sources, WordPress Site Maintenance, Installing Moodle, Installing plugins, Version Upgrading, Verify Database Schema, Managing a Moodle site, Managing authentication, Manual accounts, No login, Email-based self-registration, IMAP authentication, Browse list of users, Bulk user actions, Add a new user, Upload users, User profile, Managing enrolment plugins, Manual enrolment, Guest access, Category enrolments, External database enrolment, Managing Roles and permissions, Assign roles, Site administrator, Manager role, Course creator role, Teacher role, Non-editing

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teacher role, Student role, Guest role, Roles settings, Permissions, Password salting. Site appearance, Front page, Front page settings, My Moodle, User profiles, Navigation, Course list, Themes, Theme settings, Standard themes, Installing a new theme, Header and footer, Language settings, Language customization, Server settings, System paths, Session handling, HTTP, Maintenance mode, Cleanup, Environment, Site registration, Config changes report, Using web services, Publishing a course, Blogs, Blog settings, Using Blogs, Comments, Tags, RSS feeds settings, Using RSS feeds, Using Calendar, Site backup, Course backup, Course Restore.

TEXT BOOKS:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Pro Mean Stack Development, 1st Edition, ELad Elrom, Apress O'Reilly, 2016
3. Java Script & jQuery the missing manual, 2nd Edition, David sawyer mcfarland, O'Reilly, 2011.
4. Web Hosting for Dummies, 1st Edition, Peter Pollock, John Wiley & Sons, 2013.
5. RESTful web services, 1st Edition, Leonard Richardson, Ruby, O'Reilly, 2007.
6. FULL STACK REACT – The complete guide to ReactJS and Friends ,1st Edition, Anthony Accomazzo, Leanpub,2020.

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18CS51F3: BIG DATA ANALYTICS

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO 1	Understand the concepts of big data, Initial exploration of analysis of data and Data visualization	PO-1, PO-5	2
CO 2	Understand Initial exploration of data and advanced data analytics by using R	PO-2, PO-3	2
CO 3	Apply advanced algorithms & Statistical modeling for big data using HDFS, HIVE, and PIG.	PO-2, PO-4	3
CO 4	Apply advanced SQL functions for in-database analytics by MADlib, Greenplum along with common deliverables of analytics life cycle project	PO-1, PO-2	3

SYLLABUS:

Introduction to Big Data Analytics: Big Data Overview, State of the Practice of Analytics, Big DataAnalytics in Industry Verticals. It also covers Overview of Data Analytics Lifecycle, Discovery, DataPreparation, Model Planning, Model Building, Communicating Results and Findings, and Operationalizing.

Initial Analysis of the Data: Initial Exploration and Analysis of the Data, Basic Data Visualization. Basic data analytics, reporting, and applying basic data visualization techniques to your data. Apply basic analytics methods such as distributions, statistical tests, and summary operations, and differentiate between results that are statistically sound vs. statistically significant. Identify a model for your data and define the null and alternative hypotheses. Experimentation and demonstration of the initial analysis of data using R. Advanced Analytics and Statistical Modeling for Big Data — Theory and Methods: Need to analyze and select an appropriate technique based on business objectives; initial hypotheses; and the data's structure and volume. Apply some of the more methods in Analytics solutions, algorithms, and the technical foundations for the methods. The environment (use case) in which each technique can provide the most value. Use appropriate diagnostic methods to validate the models created Use R and in-database analytical functions to fit, score, and evaluate models.

Advanced Analytics and Statistical Modeling for Big Data — Technology & Tools: Tool to PerformAnalytics on Unstructured data using MapReduce Programming paradigm. Use Hadoop, HDFS, HIVE, PIGand other products in the Hadoop ecosystem for unstructured

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data analytics

Effectively use advanced SQL functions and Greenplum extensions for in-database analytics. Use MADlib to solve analytics problems in a database. Endgame - Operationalizing an Analytics Project: Tasks needed to operationalize an analytics project. Four common deliverables of an analytics lifecycle project meet the needs of key stakeholders. Use a framework for creating final presentations for sponsors and analysts. Evaluate data visualization and identify ways to improve it.

TEXTBOOKS:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services 2014
2. MapReduce Design Patterns, Author: Donald Miner, Publisher: O'Reilly(2012), ISBN-13:- 9789350239810
3. Practical Data Science with R Manning, 1st Edition, 2014, Nina Zumel, John Mount
4. Big Data Analytics with R and Hadoop, Packt Publishing, 2013 by Vignesh Prajapathi.

REFERENCE BOOKS:

1. Practical Data Science with R Manning, 1st Edition, 2014, Nina Zumel, John Mount
2. Big Data Analytics with R and Hadoop, Packt Publishing, 2013 by Vignesh Prajapathi.
3. Hadoop TheDefenitive Guide, O'REILLY, Second Edition, Yahoo Press

18CS51F4: CLOUD SECURITY

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the principles of cryptography and Apply various cryptographic algorithms	PO1	3
CO2	Analyze various security issues and system vulnerabilities in virtualization	PO2	4
CO3	Analyze the technologies for virtualization based security enhancements	PO3,PO2	4

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CO4	Analyze legal and Compliance issues and examine modern security standards	PO4	4

Syllabus:

Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, importance of security in the cloud, Importance in PaaS, IaaS and SaaS; Cryptographic Systems: Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL. Multi-tenancy Issues: Isolation of users/VMs from each other. Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; Virtualization System Vulnerabilities: Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc). Virtualization System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking. Technologies for Virtualization-Based Security Enhancement: IBM security virtual server protection, virtualization-based sandboxing; Storage Security: HIDPS, log management, Data Loss Prevention. Location of the Perimeter, Legal and Compliance Issues: Responsibility, ownership of data, right to penetration test. Local laws, examination of modern Security Standards (eg PCIDSS), Standards to deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

TEXT BOOKS:

Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O 'ReillyMedia Inc, 2009

REFERENCE BOOKS:

1. Ronald L. Krutz, Russell Dean Vines, Cloud Security,2010.
2. John Rittinghouse, James Ransome, Cloud Computing,2009.
3. J.R. ("Vic") Winkler, Securing the Cloud,2011.

18CS52G1: CONTROL THEORY

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO	Course Outcome (CO)	PO/PSO	Blooms

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NO			Taxonomy Level (BTL)
CO1	Understand the fundamentals of the Control system.	PO1 PO2	2
CO2	Understand about Type & Order of the system with Time Response Specification.	PO1 PO2	2
CO3	Examine different techniques for Time & Frequency Response Analysis	PO3 PO5	3
CO4	Design controller as per given specifications using different techniques.	PO1 PO2 PO5	4

SYLLABUS:

Necessity of Control System with examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra. Standard test signals. Order & Type of the system, Time response analysis of first and second order systems for different standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci. Relationship between time and frequency response, Polar plots, Bode plots. Nyquist Plot & Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response. Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Design of Controller for any physical system.

TEXT BOOKS:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.

2. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

3. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

4. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

18CS52G2: WEB SEMANTICS

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L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the Cloud Computing Techniques and Virtualization on cloud platforms	PO1 PO2	2
CO2	Understand the semantic web Vision and technologies	PO1 PO2	2
CO3	Understand about ontology	PO1 PO2	2
CO4	Analyse about Data Web and apply linked open data Cloud	PO5	3

SYLLABUS:

Foundation of Semantic Web Technologies – Introduction, Current web vs Semantic Web, Semantic Web Technologies, A layered approach, Descriptive Logic – Introduction, Definition of the basic formalism, Reasoning algorithms, Language extensions, Structured Web Documents in XML – Introduction, XML, Structuring, Namespaces, Addressing and querying XML document, Processing, Describing Web Resources: RDF – Introduction, RDF: Basic Ideas, RDF: XML-Based Syntax, RDF serialization, RDF Schema: Basic Ideas, RDF Schema: The Language, RDF and RDF Schema in RDF Schema. Web Ontology Language: OWL – Introduction, OWL and RDF/RDFS, Three Sublanguages of OWL, Description of the OWL Language, Layering of OWL, Examples, OWL in OWL.

TEXT BOOKS:

1. A Semantic Web Primer by Grigoris Antoniou Frank van Harmelen, The MIT Press Cambridge
2. Foundation of Semantic Web Technologies, Pascal Hitzler, Markus and Sebastian
3. Linked Data : Evolving the Web into a Global Data space by Tom Heath, Christian Bizer , Morgan & Claypool publication
4. Basic Description Logic by Franz Baader, Warner Nutt

18CS52G3: MAP REDUCE DESIGN PATTERNS

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

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CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO 1	Illustrate how Test Driven Development and Refactoring work in software design and maintenance.	PO-3	2
CO 2	Understanding Structural and Creational Patterns for effective design of a system	PO-2	2
CO 3	Utilization of behavioural design pattern and Anti-patterns for system design	PO-2, PO-3	3
CO 4	Understanding the design patterns in an object oriented language along with clean coding principles to a real world application.	PO-2, PO-3	2

SYLLABUS:

MVC architecture, Introduction to design patterns, Selecting a Design pattern, Using Design pattern, Test-Driven Development, Refactoring.

Introduction to Structural patterns And its criteria adapted Bridge pattern in details, Façade pattern composite, Decorator and revision of all structural patterns, Introduction to Creational patterns, Abstract Factory, Builder, Factory Method.

Prototype, Singleton Discussion of Creational Patterns, Introduction to Behavioral design patterns, Behavioral DP in detail, Interpreter Iterator, Anti-patterns.

Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking, Hyphenation, Case Study on Creating Document Editor, case study on creating document editor continues.

TEXT BOOKS:
1. Design Patterns, Erich Gamma, Pearson Education
2. Refactoring, Improving design of Existing Code by Martin Fowler, Kent Beck
3. Clean Code: A Handbook of Agile Software Craftsmanship (Robert C. Martin Series) 1st Edition, Kindle Edition
4. The Clean Coder – A code of conduct for Professional Programmers by Robert C Martin

REFERENCE BOOKS:
1. Pattern's in Java, Vol –I, Mark Grand, Wiley Dream Tech.
2. Patterns in Java, Vol-II, Mark Grand, Wiley Dream Tech.
3. Java Enterprise Design Patterns Vol-III, Mark Grand, Wiley Dream Tech.
4. Head First Design Patterns, Eric Freeman, O'reily publications

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18CS52G4: DATA CENTRE VIRTUALIZATION

L-T-P-S: 3-0-0　　　　**CREDITS: 3**　　　　**PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO	Blooms Taxonomy Level (BTL)
CO1	Configure and manage virtual network and storage such as vCenter server	PO1 PO5	2
CO2	Deploy, manage and migrate virtual machines.	PO1 PO3	4
CO3	Describe the architecture of a Data Center environment with RAID and Intelligent Storage Systems.	PO1 PO2 PO3	2
CO4	Configure replication of data and configure security through best practices	PO5	4

SYLLABUS:

System Architectures – Virtual Machine Basics – Process Virtual Machines – System Virtual Machines – Taxonomy of Virtual Machines – Emulation: Basic Interpretation – Threaded Interpretation – Pre-Coded and Direct Interpretation – Binary Translation – Full and ParaVirtualization – Types of Hypervisor – Types of Virtualization. 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 – Datapath 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. Comparison of Virtualization Technologies: Guest OS, Host OS, Hypervisor, Emulation, Kernel Level – Shared Kernel – Enterprise Solutions: Vmware Server, ESXi, Citrix Xen Server, Microsoft Virtual PC, Microsoft Hyper-V, Virtual Box – Server Virtualization: Configuring Server with Server Virtualization, Adjusting and Tuning Virtual Servers, VM Backup and Migration – Desktop Virtualization: Terminal Services, Hosted Desktop, Web Based Solutions, Localized Virtualized Desktop – Network and Storage Virtualization: VPN, VLAN, SAN and VSAN, NAS.

TEXT BOOKS:

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1. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.
2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

REFERENCE BOOKS:

1. William von Hagen, "Professional Xen Virtualization", Wrox Publications, January, 2008.
2. Kumar Reddy, Victor Moreno, "Network virtualization", Cisco Press, July, 2006.
3. Amy Newman, Kenneth Hess, "Practical Virtualization Solutions: Virtualization from the Trenches", Prentice Hall, October 2009.

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18CS52H1: REINFORCEMENT LEARNING

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning.	PO1 PO3	3
CO2	Apply reinforcement algorithms for real time applications.	PO3,PO5	4
CO3	Describe (list and define) multiple criteria for analysing RL algorithms and evaluate algorithms	PO1,PO2	3
CO4	Describe the exploration vs exploitation challenge and compare and contrast at least two approaches for addressing this challenge	PO1,PO2	3

SYLLABUS:

Introduction and Basics of RL, Defining RL Framework and Markov Decision Process, Policies, Value Functions and Bellman Equations, Exploration vs. Exploitation, Code Standards and Libraries used in RL (Python/Keras/Tensorflow), Tabular methods and Q-networks, Planning through the use of Dynamic Programming and Monte Carlo, Temporal-Difference learning methods (TD(0), SARSA, Q-Learning), Deep Q-networks (DQN, DDQN, Dueling DQN, Prioritised Experience Replay), Policy optimization, Introduction to policy-based methods, Vanilla Policy Gradient, REINFORCE algorithm and stochastic policy search, Actor-critic methods (A2C, A3C), Advanced policy gradient (PPO, TRPO, DDPG), Model based RL, Model-based RL approach, Recent Advances and Applications, Meta-learning, Multi-Agent Reinforcement Learning, Partially Observable Markov Decision Process, Ethics in RL, Applying RL for real-world problems.

TEXT BOOKS:

1. Reinforcement Learning: An Introduction, Sutton and Barto, 2nd Edition.

REFERENCE BOOKS:

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1. Reinforcement Learning: State-of-the-Art, Marco Wiering and Martijn van Otterlo, Eds.
2. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig.
3. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
4. David Silver's course on Reinforcement Learning

18CS52H2: MULTI AGENT SYSTEMS

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the notion of an agent, how agents are distinct from other software paradigms (eg objects) and understand the characteristics of applications that lend themselves to an agent-oriented solution	PO1 PO2	2
CO2	Understand the key issues associated with constructing agents capable of intelligent autonomous action, and the main approaches taken to developing such agents	PO1 PO2	2
CO3	Understand the key issues in designing societies of agents that can effectively cooperate in order to solve problems, including an understanding of the key types of multi-agent interactions possible in such systems	PO1 PO2	2
CO4	Understand the main application areas of agent-based solutions, and be able to develop a meaningful agent-based system using a contemporary agent development platform	PO1 PO2	2

SYLLABUS:

Introduction: what is an agent? agents and objects; agents and expert systems; agents and distributed systems; typical application areas for agent systems. Intelligent Agents: the design of intelligent agents - reasoning agents (egAgent0), agents as reactive systems (eg subsumption architecture); hybrid agents (eg PRS); layered agents (egInterrap) a contemporary (Java-based) framework for programming agents (eg the Jack language, the JAM! system). Multi-Agent Systems: Classifying multi-agent

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interactions - cooperative versus non-cooperative; zero-sum and other interactions; what is cooperation? how cooperation occurs - the Prisoner's dilemma and Axelrod's experiments; Interactions between self-interested agents: auctions & voting systems: negotiation; Interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination; Interaction languages and protocols: speech acts, KQML/KIF, the FIPA framework.

TEXT BOOKS:

1. An Introduction to MultiAgent Systems - Second Edition. Michael Wooldridge (Wiley, 2009)
2. Programming Multi-agent Systems in AgentSpeak Using Jason. Rafael H. Bordini, Jomi Fred Hubner and Michael Wooldridge (Wiley, 2007)

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18CS52H3: NETWORK SECURITY

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Develop Concept of Security needed in Communication of data through computers and networks along with Various Possible Attacks	PO2	3
CO2	Understand Various Encryption mechanisms for secure transmission of data and management of key required for required for encryption	PO1 PO2 PO3	2
CO3	Understand authentication requirements and study various authentication mechanisms	PO1 PO2	2
CO4	Understand network security concepts and study different Web security mechanisms.	PO1 PO2	2

SYLLABUS:

Introduction - Need for Security, Security Attacks, Services and Mechanisms, Network Security, ModelSymmetric Ciphers - Substitution &Transposition Techniques, Block Cipher, DES, Triple DES, Stream Ciphers, RC4, Public Key Cryptography - Need and Principles of Public Key Cryptosystems, RSA Algorithm, Key Distribution and Management, Diffie-Hellman Key Exchange, Digital Signatures, Authentication - Authentication Requirements, Message Authentication Codes, Hashes, MD5 & SHA. User Authentication: Password, Certificate based & Biometric Authentication, Kerberos, Network Security – Firewalls, IP Security, VPN, Intrusion Detection, Web Security, SSL, TLS

TEXT BOOKS:
1) Cryptography & Network Security", PHI, William stalling.
2) Cryptography & Network Security", Mc Graw Hill, Atul Kahate
3) Cryptography & Network Security", PHI 4, Forouzan

REFERENCE BOOKS:
1) Modern Cryptography, Theory & Practice, Pearson Education, Wenbo Mao
2) An Introduction to Mathematical Cryptography", Springer, Hoffstein, Pipher, Silvermman.

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18CS52H4: CLOUD APPLICATION ARCHITECTURE

L-T-P-S: 3-0-0   **CREDITS: 3**   **PRE-REQUISITE: NIL**

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAM OUTCOMES (PO):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	identify and explain the function of core cloud computing technologies and services, such as virtualization, computing instances, virtual private clouds, storage, database, and identity and authentication management	PO1 PO3	1
CO2	build cloud computing solutions for several common application patterns, including web-tier applications and high availability solutions for computing, database, storage, and network systems.	PO2 PO3	3
CO3	Describe the tradeoffs of block versus object storage, the storage lifecycle, and how to select storage technologies that meet application requirements.	PO1 PO2 PO3	3
CO4	Formulate cloud solutions to several common types of application and enterprise problems.	PO5	4

SYLLABUS:

Introduction to Cloud Computing, Using a Cloud Platform, Security and Compliance, Cloud Financials, Migrating to the Cloud, History of Cluster, Grid, and Cloud Computing, Virtualization, Infrastructure: Compute, Storage, and Networking, Security, Identity and Access Management, Databases Management Tools, Cloud Basic Knowledge, Basic Cloud Services, Designing a Cloud Environment, Making a Cloud Environment Highly Available, Automating and Decoupling Cloud Infrastructure, Designing Web-Scale Media Hosting, Well-Architected Framework, Troubleshooting, Large-Scale Design Patterns and Case Studies, Cloud Computing Individual and/or Group project

TEXT BOOKS:

1. Cloud Computing, Theory and Practice,1st Edition, Dan C Marinescu, MK Elsevier publisher ,2013

2. Cloud Computing, A Practical Approach, 1st Edition, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH,2017.

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