Koneru Lakshmaiah Education Foundation
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Minutes of 21st Board of Studies Meeting

June15th, 2019

21stBOS meeting of Computer Science and Engineering Department was held on June15th, 2019 from 9:00 AM to 5:00 PM in Jasmine Hall.

The Following members were present:

1. Dr.K.Thirupathi Rao, Professor, BoS Chairman
2. Dr.P. Ranveer Singh Satvat, Dean Academics, Invitee
3. Mr.V. Hari Kiran, Assoc. Professor, I/C Hod -CSE, Member
4. Drl.S.S.Reddy, Vice Chancellor, Member
5. Dr.Madhu Muthyam, Professor, IIT Madras, External Member
6. Mr.Ramesh Kumar Dacha, Associate Director, Accenture Solutions India Pvt.Ltd., Hyderabad, External Member
7. Dr.Amaralingeswararao Kaka, Program Director, IBM, Hyderabad, External Member
8. Mr.Jaganmohan Chevvakula, Sr.QA Manager ,Nga HR Pvt Limited, Hyderabad, External Member
9. Dr.V.Srikanth, Professor, Member
10. Dr.Dr. Radhanat Raj, Professor, Member
11. Dr.A.Pranaynadh Reddy, Assoc. Professor, Member
12. Dr.K.Vinuthna, Assoc. Professor, Koneru Lakshmaiah Education Foundation - Hyderabad Campus, Member
13. Dr.Sabitha, Professor, Department of English, Member
14. Dr.Shanmukh Kumar, Professor, Department of Chemistry, Member
15. Dr.M.Kameswara Rao, Assoc. Professor, Department of ECM, Member
16. Dr.B. T. P.Madhav, Professor, Department of ECE, Member
17. Dr.M.V.V.K.Srinivas Prasad, Professor, Department of Physics, Member
18. Dr.V.Chandra Prakash, Professor, Member

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19. Dr.S.Venkateswarulu, Professor, Member
20. Dr.K.Subrahmanyam, Professor, Member
21. Dr.M. R.Narsinga Rao, Professor, Member
22. Dr.V.Krishna Redddy, Professor, Member
23. Dr.G.Pradeepini, Professor, Member
24. Dr.N.Srinivasu, Professor, Member
25. Dr.P.Raja Rajeswari, Professor, Member
26. Dr.K.Amarendra, Professor, Member
27. Dr.Md Asda Quehussain, Professor, Member
28. Dr.K. V.V.Satya Narayana, Professor, Member
29. Dr.Gandharbaswain, Professor, Member
30. Dr.Y Prashanth, Professor, Member
31. Dr.K. Bhanu Prakash, Professor, Member
32. Mr.M.Vishnu Vardhan, Assoc. Professor, Member
33. Mrs.V.Divya ,Asst. Professor, Member
34. Mr.A.Vpraveen Krishna, Asst. Professor, Member
35. Mrs.A.Roshini, Asst. Professor, Member
36. Ms.Naga Lakshmi, Student, Student Member
37. Ms.Indu, Student, Student Member
38. Mr.A.Roshan, Student, Student Member
39. Mr.Satyanaryan, Student, Student Member
40. Mr.Bhargav, Student, Student Member

The following members were Absent for the Meeting:

1. Mr.B.Tirupathi Reddy, Assoc.Professor, Member
2. Dr.B.V.Apparao, Professor, Department of Maths, Member
3. Ms.Raveena, Student, Student Member

BOS Chairman welcomed all the stake holders to the BOS meeting and started the meeting by highlighting the Vision & Mission statements of department and university. He also presented PEOs, POs and PSOs of the program.

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AGENDA and RESOLUTIONS

AGENDA ITEM-1

Consider and approve DAC minutes held on 28th May,2019at Jasmine Hall from 2:00 PM to 4:30 PM.	Resolution: Approved DAC minutes and recommended to 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 member of the Board of Studies.
- Chairman of the BOS informed the members present about the Department Academic Committee (DAC) meeting held on 28th May,2019 (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: 28-05-2019)**

AGENDA ITEM-2

Proposed to introduce additional mandatory, project, SDC, TBL courses for B. Tech 2019-20 admitted Batch based on the feedback received from stakeholders for approval.	Resolution: Approved for introduced courses for B.Tech 2019-20 admitted Batch and the same is recommended to Academic Council.

To consider and introduce the courses for 2019-20 admitted batch students based on the stake holder's feedback.

i. Ms.Pathuri Bindu, Assistant prof, Mathematics Dept. Faculty suggested to introduce 2 Mathematical Programming Courses one focusing on optimization techniques - linear, integer, and nonlinear programming - to equip students with problem-solving skills applicable across fields like economics, engineering, and computer science. Blend theory, software applications, and real-world projects to foster analytical thinking" and second course to offer advanced problem-solving skills and optimization techniques essential for tackling real-world challenges across various disciplines. This course enriches their quantitative abilities and analytical thinking.
   It is resolved to approve to introduce a course "Mathematical Programming-I" and Mathematical Programming-II" for 2019-20 admitted batch students.

ii. Dr. Vijaya Sri K, Faculty suggested to include a new course Mathematics for Computing to provide students with foundational mathematical skills vital for understanding complex computational concepts and algorithms.

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It is resolved to approve to introduce a course "Mathematics for Computing" to offer for 2019-20 admitted batch students, to bridge the gap between mathematics and computing and ensuring students grasp fundamental principles, enhancing their ability to excel in computational fields.

iii. Mr. Vishnu Vardhan, Industry person suggested Technical Skilling (SDP-3) to enhance employability by imparting relevant, adaptable technical skills, making graduates competitive in today's job market and fostering interdisciplinary problem-solving. This addition aligns with evolving industry demands and attracts prospective students, positioning our institution as a forward-thinking educational leader.

It is resolved to approve to introduce a course "Technical Skilling (SDP-3)" for 2019-20 admitted batch students.

iv. Dr.Kolla Bhanu Prakash, Faculty suggested to introduce a new course Digital Video Processing course to equip students with essential skills for today's digital world, fostering creativity and employability across various industries. This addition aligns our institution with the demands of the modern age and enhances our academic offerings.

It is resolved to approve to introduce a course "Digital Video Processing" for 2019-20 admitted batch students.

v. Mr. Suhas Achanta, Alumni suggested the TS-SDP4 (CLOUD DEVOPS) course to bridges the gap between development and operations in the cloud, enabling streamlined software delivery and meeting the growing industry need for cloud-centric DevOps expertise.

It is resolved to approve to introduce a course "TS-SDP4 (CLOUD DEVOPS)" for 2019-20 admitted batch students.

vi. Mr. Gopi Chigurupati, Alumni recommended "TS-SDP4 Cloud Based Solutions Architect" course to provide a well-rounded education in cloud architecture, meeting industry demand for professionals skilled in designing and optimizing cloud solutions.

It is resolved to approve to introduce a course "TS-SDP4 Cloud Based Solutions Architect" for 2019-20 admitted batch students.

vii. Mr. Madhu Bodapati, Industry Person recommended "TS-SDP4 Cloud Based Security Speciality" course because it equips individuals with specialized skills to fortify cloud environments, aligning with the increasing demand for cloud security expertise, ensuring data protection and compliance in the digital landscape.

It is resolved to approve to introduce a course "TS-SDP4 Cloud Based Security Speciality" for 2019-20 admitted batch students.

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viii. Mr. Sai Anil Muthyala, Industry Person suggested "TS-SDP4 Certified Game Developer" course to nurture expertise in game development, covering essential skills, tools, and industry insights for aspiring game creators is required.
It is resolved to approve to introduce a course "TS-SDP4 Certified Game Developer" for 2019-20 admitted batch students.

ix. Mr. Hemanth Duriseti, Alumni suggested the course CLOUD BASED AI/ML SPECIALITY because the students should master in cloud-based AI/ML tools, frameworks, and deployment strategies, enabling them to develop intelligent applications and solutions on cloud platforms.
It is resolved to approve to introduce acourse "TS-SDP4 Cloud Based AI/ML Speciality" for 2019-20 admitted batch students.

x. Kavitha Avula, Industry Person suggested that its appreciable if a specialized training program dedicated to fostering expertise in securing cloud environments is introduced. It is resolved to approve new course "TS-SDP4 Cloud Based Data Analytics Speciality" for 2019-20 admitted batch students.
It is resolved to approve to introduce a course "TS-SDP4 Cloud Based Data Analytics Speciality" for 2019-20 admitted batch students.

xi. Abhinay Irala, Industry Person, suggested that there is a need for a specialized program dedicated for equipping individuals with the knowledge and skills needed to excel in developing Internet of Things (IoT) solutions on cloud platforms.
It is resolved to approve to introduce a course "TS-SDP4 Cloud Based IoT Developer" For 2019-20 Admitted Batch Students.

xii. Mr.Konkimalla Venkata Ranga Rao, Academic peer suggested the course "Parallel & Distributed Computing" into the curriculum for preparing the students with the cutting-edge skills needed to harness the power of modern computing, enabling them to design and optimize high-performance systems for complex real-world challenges.
It is resolved to approve to introduce a course "Parallel & Distributed Computing" for 2019-20 admitted batch students.

xiii. Sreeja Girija R, Industry person suggested to incorporate Artificial Neural Networks into the curriculum. It would offer students a cutting-edge perspective on machine learning.
It is resolved to approve to introduce a course "Artificial Neural Networks" for 2019-20 admitted batch students.

xiv. Mr.Sagireddy Pulla Reddy, Industry person suggested to include a cloud and machine learning related course which empowers organizations to efficiently

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process and analyze vast datasets, enabling data-driven insights and innovation at scale.

It is resolved to approve to introduce a course "Machine Learning on Cloud" for 2019-20 admitted batch students.

xv. Dr.A Chandran Sekhar, Academic Peer suggested to introduce a course which focuses on Equipping students with HPC skills. It will empower students to tackle intricate computational challenges across various fields, ensuring their preparedness for cutting-edge research and industry demands. By providing hands-on experience with parallel computing, optimization techniques, and utilization of HPC clusters, this course will foster a deeper understanding of advanced computing paradigms, ultimately enhancing students' competitiveness and versatility in the technology landscape.

It is resolved to approve to introduce a course "High Performance Computing" for 2019-20 admitted batch students.

xvi. Mr.T.Vamsidhar, Faculty suggested to include "Functional & Concurrent Programming" as a Professional Elective for both Data Science and Cloud Specializations. This course offers students valuable skills in programming paradigms that are essential for navigating contemporary technological domains.

It is resolved to approve to introduce a course "Functional & Concurrent Programming" course for 2019-20 admitted batch students.

xvii. Rajshekar Botcha, Industry person suggested to incorporate a course into curriculum that provides a detailed understanding of the programming languages used in embedded systems, such as C and C++, along with software design principles and real-time operating systems.

It is resolved to approve to introduce a course "Embedded Systems" for 2019-20 admitted batch students.

xviii. Bandaru Ravi Teja, Industry Personnel recommended integrating a comprehensive study of signal processing into the curriculum, emphasizing foundational concepts, mathematical rigor, practical implementations, and real-world applications.

It is resolved to approve to introduce a course "Signal Processing" for 2019-20 admitted batch students.

xix. Sonal Dipak Mali, Academic Peer recommend incorporating "Application Development on Cloud" in the curriculum to equip students with essential skills in leveraging cloud computing services for building scalable, cost-effective, and globally accessible applications.

It is resolved to approve to introduce a course "Application Development on Cloud" for 2019-20 admitted batch students.

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xx. Vijay Krishna Pala, Industry Person suggested to introduce new course "Solutions Architecting on Cloud" that covering key cloud platforms, architectural design principles, security, scalability, and best practices for building resilient and efficient cloud solutions through skilling is recommended.

It is resolved to approve to introduce a course "Solutions Architecting on Cloud" for 2019-20 admitted batch students.

xxi. Mr. Vamsi Yelamarthi, Industry person suggested to introduce Visual Programming Course for 2019-20 admitted batch as this course would empower students to create applications using intuitive graphical interfaces, fostering creativity and accessibility in software development.

It is resolved to approve to introduce a course "Visual Programming" for 2019-20 admitted batch students.

xxii. Dr. Shashi Melhothra, Faculty suggested to introduce a course that will empower students to master the art of creating applications that transcend platform constraints, utilizing frameworks such as React Native.

It is resolved to approve to introduce a course "Cross Platform Development Frameworks" for 2019-20 admitted batch students.

xxiii. Dr.Y.Prasanth, Professor & Associate Dean strongly recommended the incorporation of a dedicated "Software Reliability" course in the curriculum. This course would provide students with a comprehensive understanding of techniques for designing, developing, and testing reliable software systems. By addressing the critical need for dependable software in various industries, this course equips students to excel as software engineers and contribute to the creation of resilient applications.

It is resolved to approve to introduce a course "Software Reliability" for 2019-20 admitted batch students.

xxiv. Ms.K.Srinidhi, Faculty suggested to introduce a course it helps students with essential knowledge and skills to identify, prevent, and mitigate security vulnerabilities in web applications and online environments. Given the increasing reliance on digital platforms, this course is crucial for producing graduates well-equipped to safeguard sensitive information and uphold the integrity of web-based systems.

It is resolved to approve to introduce a course "Web Security" for 2019-20 admitted batch students.

xxv. Prathusha Assistant Professor, VNR college Hyderabad, Academic peer recommended "Computational epidemiology" course as it employs data-driven techniques and mathematical models to analyse and predict disease patterns,

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offering vital insights for public health and outbreak control which helps students at the forefront of health research and crisis response.

It is resolved to approve to introduce a course "Computational Epidemiology" course for 2019-20 admitted batch students.

xxvi. Lova Kumari Assistant professor, Academic Peer suggested to include "Speech processing" course in curriculum because it involves the analysis, recognition, and synthesis of human speech, driving advancements in communication technology, voice assistants, and more.

It is resolved to approve to introduce course "Speech Processing" for 2019-20 admitted batch students.

xxvii. Ms. M.V.B.T. Santhi, Faculty recommended a new course which explores advanced database concepts that are essential for students to get full potential of data bases in today's information-driven world, enabling innovation and informed decision-making.

It is resolved to approve to introduce a course "Advanced Databases" as professional elective for 2019-20 admitted batch students.

xxviii. Dr. K.V Raju Faculty suggested to incorporating Cloud & Serverless Computing into the curriculum to equip students with essential skills for modern technology landscapes.

It is resolved and approved course "Cloud & Serverless Computing" for 2019-20 admitted batch students.

xxix. Mr.Pallapothula Anvesh, Industry Person highly recommended the integration of a comprehensive "Data Analytics on Cloud" course, combining the power of advanced data analysis techniques with cloud computing.

It is resolved to approve to introduce a course "Data Analytics on Cloud" for 2019-20 admitted batch students.

xxx. Meenakshi Sharma, Assistant Director - PR & Media, Industry person suggested to include Architecting Cloud Solutions into curriculum as it will empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services, preparing them for in-demand roles in cloud architecture and technology.

It is resolved to approve to introduce a course "Architecting Cloud Solutions" for 2019-20 admitted batch students.

xxxi. Suhas Achanta, Alumni suggested to introduce a comprehensive training program that must be designed to equip individuals with the essential skills and knowledge required to excel in Cloud DevOps practices.

It is resolved to approve to introduce a course "Cloud Devops" as a professional Elective Course for 2019-20 admitted batch students.

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xxxii. Mr.Akhandam Venkat Aditya, Industry Person suggested to include Security solutions in the cloud offer robust protection against cyber threats, ensuring the integrity and confidentiality of data in cloud environments.
It is resolved to approve to introduction of a course "Security Solutions in Cloud" for 2019-20 admitted batch students.

xxxiii. Mr.Digallinte Sreenivasulu, Academic Peer recommended to include a course where they can learn market-demanding coding skills like PFSD for comp.Coding.
It is resolved to approve to introduce a course "Technical Skills (JAVA PBL)" for 2019-20 admitted batch students.

xxxiv. Dr. A. Srinath, Dean-Skill Development recommended to offer Design Tools Workshop course that offers a foundational learning experience for aspiring designers, introducing essential design software and techniques to unleash creativity.
It is resolved and approve to offer two courses "Design Tool Workshop-1" and "Design Tool Workshop-2" course for 2019-20 admitted batch students in their first year.

xxxv. Dr. Suman Maloji, Professor& HOD, ECE Dept suggested to introduce Digital Logic & Processors in place of Digital System Design as it involves the fundamentals of electronic circuits and microprocessors, forming the backbone of modern computing systems and innovation.
It is resolved to approve to introduce a course "Digital Logic & Processors" for 2019-20 admitted batch students.

xxxvi. Dr.CH V Ramana Murthy, Professor, Faculty suggested to introduce a course that provides the essential analytical tools and problem-solving skills required for engineering professionals to excel in their field.
It is resolved to approve to introduce a course "Mathematics for Engineers" for 2019-20 admitted batch students.

xxxvii. Dr.A.S.C.S.Sastry, Professor, ECE Dept. Faculty suggested to introduce new course which helps as building blocks of modern electronics, enabling the creation of countless devices and innovations that shape our daily lives.
It is resolved to approve to introduce a course "Basic Electronic Circuits" for 2019-20 admitted batch students.

xxxviii. Dr. Indranil sarkar, Academic peer suggested to introduce new course "Chemistry for Engineers" it helps to empower students with a profound understanding of chemical processes, enabling them to design safer, more efficient, and environmentally conscious technologies.

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It is resolved to approve course "Chemistry for Engineers" for 2019-20 admitted batch students and to 2018-19 admitted batch students with the course code 18CY1005.

S. No	Course Code	Course Title	Course Type	Credits	Remarks
1	19CS2204	MATHEMATICAL PROGRAMMING -II	Mandatory	4	Introduced in place of Discrete Mathematics Course
2	19CS2104	MATHEMATICAL PROGRAMMING-1	Mandatory	4	Introduced in place of Multivariate Calculus Course
3	19MT1101	MATHEMATICS FOR COMPUTING	Mandatory	5	Introduced in place of Foundations of Computational Mathematics Course
4	19TS3101S	TECHNICAL SKILLING (SDP-3)	SDC	2	Introduced as a skill development course
5	19CS3278R	DIGITAL VIDEO PROCESSING	Elective	3	Introduced as an Elective Course
6	19TS3291S	TS-SDP4 (CLOUD BASED SOLUTIONS ARCHITECT)	Technical Skill-4 (SDP4)	2	Introduced as a skill development course
7	19TS3292S	TS-SDP4 (CLOUD DEVOPS)	Technical Skill-4 (SDP4)	2	Introduced as a skill development course
8	19TS3293S	TS-SDP4 (CLOUD BASED SECURITY SPECIALITY)	Technical Skill-4 (SDP4)	2	Introduced as a skill development course
9	19TS3295S	TS SDP-4 (CLOUD BASED AI/ML SPECIALITY)	Technical Skill-4 (SDP4)	2	Introduced as a skill development course
10	19TS3296S	TS SDP-4 (CLOUD BASED DATA ANALYTICS SPECIALITY)	Technical Skill-4 (SDP4)	2	Introduced as a skill development course
11	19TS3294R	TS SDP-4 (CERTIFIED GAME DEVELOPER)	Technical Skill-4 (SDP4)	2	Introduced as a skill development course
12	19TS3290R	TS SDP-4 (CLOUD BASED IOT DEVELOPER)	Technical Skill-4 (SDP4)	2	Introduced as a skill development course
13	19CS2210R	PARALLEL & DISTRIBUTED COMPUTING	Flexi Core	4	Introduced as a Flexi Core Course
14	19CS3026R	ARTIFICIAL NEURAL NETWORKS	Professional Elective	3	Introduced as an Elective Course
15	19CS3036R	CLOUD INFRASTRUCTURE & SERVICES	Professional Elective	3	Introduced as an Elective Course
16	19CS3038R	HIGH PERFORMANCE COMPUTING	Professional Elective	3	Introduced as an Elective Course
17	19CS3056S	FUNCTIONAL & CONCURRENT PROGRAMMING	Professional Elective	3	Introduced as a Elective Course
18	19CS3115R	EMBEDDED SYSTEMS	Professional Elective	3	Introduced as an Elective Course

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S. No	Course Code	Course Title	Course Type	Credits	Remarks
19	19CS3116R	SIGNAL PROCESSING	Professional Elective	3	Introduced as an Elective Course
20	19CS3234R	APPLICATION DEVELOPMENT ON CLOUD	Professional Elective	3	Introduced as an Elective Course
21	19CS2210R	PARALLEL & DISTRIBUTED COMPUTING	Professional Elective	3	Introduced as an Elective Course
22	19CS3026R	ARTIFICIAL NEURAL NETWORKS	Professional Elective	3	Introduced as an Elective Course
23	19CS3038R	HIGH PERFORMANCE COMPUTING	Professional Elective	3	Introduced as an Elective Course
24	19CS3056S	FUNCTIONAL & CONCURRENT PROGRAMMING	Professional Elective	4	Introduced as an Elective Course
25	19CS3115R	EMBEDDED SYSTEMS	Flexi Core	4	Introduced as a Flexi Course
26	19CS3116R	SIGNAL PROCESSING	Flexi Core	5	Introduced as a Flexi Course
27	19CS3234R	APPLICATION DEVELOPMENT ON CLOUD	Flexi Core	4	Introduced as a Flexi Course
28	19CS3235R	SOLUTIONS ARCHITECTING ON CLOUD	Flexi Core	4	Introduced as a Flexi Course
29	19CS3254R	VISUAL PROGRAMING	Professional Elective	3	Introduced as an Elective Course
30	19CS3255R	CROSS-PLATFORM DEVELOPMENT FRAMEWORKS	Professional Elective	3	Introduced as an Elective Course
31	19CS3258R	SOFTWARE RELIABILITY	Professional Elective	3	Introduced as an Elective Course
32	19CS3264R	WEB SECURITY	Professional Elective	3	Introduced as an Elective Course
33	19CS3272R	COMPUTATIONAL EPIDEMIOLOGY	Professional Elective	3	Introduced as an Elective Course
34	19CS3274R	SPEECH PROCESSING	Professional Elective	3	Introduced as an Elective Course
35	19CS3279R	ADVANCED DATABASES	Professional Elective	3	Introduced as an Elective Course
36	19CS3281S	CLOUD & SERVERLESS COMPUTING	Professional Elective	4	Introduced as an Elective Course
37	19CS3283R	DATA ANALYTICS ON CLOUD	Professional Elective	3	Introduced as an Elective Course
38	19CS3285R	ARCHITECTING CLOUD SOLUTIONS	Professional Elective	3	Introduced as an Elective Course
39	19CS3286R	CLOUD DEVOPS	Professional Elective	3	Introduced as an Elective Course

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S. No	Course Code	Course Title	Course Type	Credits	Remarks
40	19CS3282R	MACHINE LEARNING ON CLOUD	Professional Elective	3	Introduced as an Elective Course
41	19CS3284R	SECURITY SOLUTIONS IN CLOUD	Professional Elective	3	Introduced as an Elective Course
42	19EC1101	DIGITAL LOGIC & PROCESSORS	Mandatory	4	Introduced in place of Digital System Design Course
43	19EC1213	BASIC ELECTONIC CIRCUITS	Mandatory	3	Introduced in place of Microprocessors Course
44	19ME1103	DESIGN TOOLS WORKSHOP - I	Mandatory	2	Introduced in place of Engineering Graphics & Design for Electronic & Computer Engineers course
45	19MT2102	MATHEMATICS FOR ENGINEERS	Mandatory	3	Introduced in place of Single Variable Calculus and Matrix Algebra Course
46	19SC1209	DESIGN TOOLS WORKSHOP - II	Mandatory	2	Introduced in place of Placement Training Course
47	19TS3001	JAVA-PBL	Skill development course	2.5	Introduced as a skill development course
48	18CY1005	CHEMISTRY FOR ENGINEERS	Mandatory	3	Introduced as a Science Elective Course

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

AGENDA ITEM-3

Proposed to revise the syllabus syllabus for 2019-20 B.Tech admitted Batch based on the feedback received from stakeholders.	Resolution: Approved the revision of syllabus for B.Tech 2019-20 admitted Batch and the same is recommended to Academic Council.

To consider and approve the revision of syllabus for 2019-20 admitted batch students based on the stake holders feedback.

i. Dr.Balakrishna, Academic Peer suggested to revise "Bioinformatics" to equip students with interdisciplinary skills in biology and data science. This course will enable them to analyze complex biological data, fostering innovations in fields such as genomics, drug discovery, and personalized medicine.

It is resolved to approve to revise "Bioinformatics" for 2019-20 admitted batch students.

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i. Hanumanth Yaganti, Alumni suggested to revise Advanced Computer Architecture course to aligns the curriculum with industry demands, enhances students' competitiveness in the job market, and fosters a deeper understanding of complex architectural paradigms.

It is resolved to approve the revision of syllabus in "Advanced computer architecture" course to 2019-20 admitted batch.

ii. Dr. V. Ramalingam, Academic Peer recommended the syllabus for Cloud Infrastructure & Services should be updated to incorporate recent advancements in cloud technologies, ensuring students receive the most relevant and practical knowledge.

It is resolved to approve the revision of syllabus in Cloud Infrastructure & Services course to 2019-20 admitted batch.

iii. N Lakshmi Narayana, Academic Peer suggested to update the syllabus for Business of Games & Entrepreneurship to include contemporary industry trends and practical case studies.

It is resolved to approve the revision of syllabus "Business of Games & Entrepreneurship" course to 2019-20 admitted batch.

S. No	Course Code	Course Title	Course Type	Percentage of Revision	Remarks
1	19CS3277R	BIOINFORMATICS	Professional Elective	30%	Based on Academic Peer Feedback
2	19CS3251R	ADVANCED COMPUTER ARCHITECTURE	Professional Elective	30%	Based on Alumni Peer Feedback
3	19CS3036R	CLOUD INFRASTRUCTURE & SERVICES	Professional Elective	30%	Based on Academic Peer Feedback
4	19CS3267R	BUSINESS OF GAMES & ENTREPRENEURSHIP	Professional Elective	30%	Based on Academic Peer Feedback

The detailed comparison for the old syllabus and revised syllabus is given in Annexure-3(a)

The detailed feedback and action taken report is presented in Annexure-3(b)

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AGENDA ITEM-4

To consider and approve the curriculum of B. Tech-CSE & M.Tech-CSE, M.Tech-DFCS, M.Tech-MLC programs offered for 2019-20 admitted batch students.	Resolution: Approved the curriculum of B. Tech-CSE & M.Tech-CSE, M.Tech-DFCS, M.Tech-MLC programs offered for 2019-20 admitted batch students and recommended to Academic Council for approval.

The BOS members discussed the proposed course structure of B. Tech and M. Tech 2019-20 admitted batches of Computer Science and Engineering.

i. Dr. K Thirupathi Rao , chairman BOS proposed changes to the Course structure of B. Tech CSE that Y19 admitted batch of students.

ii. New Course Category "Flexi Course" is introduced from B.Tech 2019-20 admitted batch students, to offer flexibility for the students to opt other specialization courses also.

iii. A student graduating with B.Tech CSE degree MUST - complete 59 courses and acquire a minimum of total 163 credits and meet minimum credit requirement in each category of courses and complete 4 Value Added Courses & 1 sports certification and spend a recorded 40 hours in social service activities during the four years of under-graduate studies and get a minimum CGPA of 5.25.

iv. A specialization degree is awarded if a student meets all requirements of B.Tech. CSE and acquires a minimum total of 165 credits with two additional credits being obtained from Basic Sciences, Professional Core or Professional Elective Course categories and take all professional electives from the same specialization.

v. An honours degree is awarded if a student meets all requirements of a B.Tech. CSE degree and acquires a total of minimum 183 credits by taking courses highlighted above with A or P suffix in the course codes and takes up advanced project in a multi-disciplinary domain and secures a minimum CGPA of 8.5 and has no history of F grade or DT grade in any course.

vi. The Bos members approved the proposed changes and agreed that they are necessary to ensure that the B. Tech Computer Science and Engineering Program is preparing students for industry ready.

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vii. Dr K. Thirupathi Rao proposed curriculum of All M. Tech program (M. Tech-CSE, M. Tech - MLC, M. Tech-DFCS) course structures and all the BOS members are agreed that it is well designed and covers wide range of topics.

The detailed Course Structure of B. Tech 2019-20 admitted batch is given in Annexure-4(a)

The detailed Course Structure of M. Tech -CSE 2019-20 admitted batch is given in Annexure-4(b)

The detailed Course Structure of M. Tech -MLC 2019-20 admitted batch is given in Annexure-4(c)

The detailed Course Structure of M. Tech -DFCS 2019-20 admitted batch is given in Annexure-4(d)

AGENDA ITEM-5

To consider and approve the Program Development Document for syllabus of B. Tech &M. Tech programs offered for 2019-20 admitted batch students.	Resolution: Approved the PDD for syllabus of B. Tech &M. Tech programs offered for 2019-20 admitted batch students.

i. By considering all the changes in curriculum PDDs for 2019-20 B. Tech and M. Tech admitted batches are proposed

ii. It is resolved to approve the PDDs for syllabus of B. Tech and M. Tech programs of 2019-20 admitted batch students.

The detailed Program Development Document for 2019-20 admitted batch students B. Tech Computer Science and Engineering Program is given in Annexure-5(a).

The detailed Program Development Document for 2019-20 admitted batch students M. Tech Computer Science and Engineering Program is given in Annexure-5(b).

The detailed Program Development Document for 2019-20 admitted batch students M. Tech Machine Learning and Computing Program is given in Annexure-5(c).

The detailed Program Development Document for 2019-20 admitted batch students M. Tech Digital Forensics and Cyber Security Program is given in Annexure-5(d).

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AGENDA ITEM-6

To consider and approve the list of MOOCS courses offering to 2019-20 admitted batch students.	Resolution: Approved the list of MOOCS courses offering to 2019-20 admitted batch students.

All the Bos members are proposed to offer Open Electives, Management Electives, Foreign Languages though MOOCS Courses to provide academic flexibilities and to develop more effective learning experiences for the students.

It is resolved to offer proposed MOOCs courses for the students of 2019-20 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

To consider and approve the certification courses offered to 2019-20 admitted batch.	Resolution: Approved the list of Value-Added Courses offering to 2019-20 admitted batch students.

To enrich the curriculum and to provide students with the skills they need to succeed in the workforce, all the Bos members are recommended to offer a list of value-added courses to Y19 admitted batch students.

It is resolved to offer proposed list of value-added courses to 2019-20 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

Any other points with the permission of the chair.	Resolution: Approved to conduct open book examination for the proposed list of courses in A.Y2019-20 and recommended to the Academic Council for approval.

Based on industry peers feedback it is resolved to conduct an open book examination for the following list of courses in A.Y2019-20, evaluation process of these courses is similar to other courses.

II B.Tech (2 Courses):

1. Object Oriented Programming (Regular, Optional and Advanced)

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2. Operating Systems (Regular, Advanced)

III B.Tech (3 Courses):

1. Distributed Computing (Regular, Advanced)

2. Enterprise Programming (Regular, Advanced)

3. Algorithm Design & Analysis (Regular, Advanced)

BoS Meeting Screenshots:

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Annexure-1

DEPARTMENT ACADEMIC COMMITTEE MEETING MINUTES

The Department Academic Council Meeting of Computer Science and Engineering was conducted in Jasmine HALL, on 28th May 2019 from 2.00 PM to 4.30 PM.

The head of the department welcomed DAC members and started the meeting by highlighting the vision & and mission statements of the university and department as well as PEOs, POs, and PSOs of the program.

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 2019-20 admitting batch
2. To discuss on proposed syllabus and course structure for M. Tech-CSE, M.Tech DFCS and M.Tech-MLC 2019-20 admitting batch students
3. To discuss feedback obtained from various stake holders (students, Academic Peers, Parents, Course Coordinators, Alumni, industry)
4. To discuss on conducting open book examination for selected set of courses in A.Y 2019-20
5. To discuss on 2018-2019 Even Semester Course Closure Minutes
6. To discuss on CO-PO Attainment of courses in 2018-2019 Even Semester
7. To discuss on Gap Analysis report on CO-PO Attainment and Teaching Pedagogy
8. To discuss on Result analysis on following courses:
    a. 2018-19 B.Tech Even Semester End Exam
    b. 2018-19 M.Tech Even Semester End Exam

The following members were present:

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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002 Ph: +91 - 866 - 3500122, 2576129

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1. Dr.V. HARI KIRAN
2. Dr.D. RAJESWARA RAO
3. Dr.M. R. NARSINGA RAO
4. Dr. G. SWAIN
5. Dr.M. S. R. PRASAD
6. Dr. G. SYAM PRASAD
7. Dr. E. VAMSIDHAR
8. Dr. MOULANA
9. DR. J. RAM KUMAR
10. Ms. M.V.B.T SANTHI
11. Mrs. T. SANTHI SRI
12. Mr. ARUN KUMAR
13. Mr. B.N. SHESHANK
14. Mr. T. RAVI KUMAR
15. Mr. GOUSE
16. Mr. A.V.PRAVEEN KRISHNA
17. Mrs. A. ROSHINI
18. Mrs. M. PRAVEENA
19. Mr. M.V. NARESH
20. Mr. K. ASHESH
21. Ms. P. AKHILA(170030961)
22. Mr. M.V.SAI BHARADWAJ(170030861)
23. Mr. D. BHARGAV(170030333)
24. Mr. A. ROSHAN CHNADRA(170030088)
25. Mr. G. SRIRAM CHNADRA(170030441)
26. Mr. K.NAGA LAKSHMI(170030608)
27. Mrs. CH. YAMINI KRISHNA(170031429)
28. Mrs. HIMANI AGARWAL(170030452)
29. Mrs. K. VYSHNAVI(170030547)

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30. Mr. G.ROHIT KUMAR(170031134)
31. Mr. G. ANIL KUMAR(180031050)
32. Mr. SAMBHAV KR. THAKUR(180031058)
33. Mr. N. B. PRAVEEN(180030026)
34. Mr. J. K. NAYANA (180030191)

The following points were discussed and resolved:

i) In First Semester, Problem solving through programming in C should be included.

ii) It is suggested to incorporate the subjects Problem solving through C and Python in Coding skills in First semester, OOPs through Java and Data structures using C Language in Second Semester, CN through python and Enterprises programming using Java in Third Semester.

iii) For 2019-20 admitted batch, Programming in C is in First semester and OOPs through Java, Data structures through C in Second Semester. If this is the case students will miss python which is very import for students to learn.

iv) If python is added in skilling, it is difficult for the students to learn three different languages in a single semester according to curriculum of Y 2019-20 batch.

v) Python should be mandatory in First year second semester.

vi) Python should be included as core course along with java.

vii) Instead of C language, introduce python which is a productive language.

viii) Based on industry peers feedback it is resolved to conduct an open book examination for the following list of courses in A.Y 2019-20

a. II B.Tech (2 Courses):
    1. Object Oriented Programming (Regular, Optional and Advanced)
    2. Operating Systems (Regular, Advanced)

b. III B.Tech (3 Courses):
    1. Distributed Computing (Regular, Advanced)
    2. Enterprise Programming (Regular, Advanced)
    3. Algorithm Design & Analysis (Regular, Advanced)

ix) CO-PO Attainment of 2018-2019 Even Semester courses and gap analysis report on

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CO-PO attainment and teaching pedagogy are discussed.

x) Result analysis on 2018-19 Even semester courses are discussed.

xi) Stake holder feedback collected on 2019-20 Admitted batches proposed curriculum is discussed.

xii) Based on the feedback from 2018-19 Course Coordinators the following points were discussed and resolved

a. Dr. Vijaya Sri K, Faculty suggested to include a new Mathematics for Computing course to provide students with foundational mathematical skills vital for understanding complex computational concepts and algorithms.

b. Dr. A. Srinath, Dean-Skill Development recommended to offer Design Tools Workshop course that offers a foundational learning experience for aspiring designers, introducing essential design software and techniques to unleash creativity.

c. Dr. Suman Maloji, Professor& HOD, ECE Dept suggested introducing Digital Logic & Processors in place of Digital System Design as it delves into the fundamentals of electronic circuits and microprocessors, forming the backbone of modern computing systems and innovation.

d. Dr.CH V Ramana Murthy, Professor, Faculty suggested to introduce a course that provides the essential analytical tools and problem-solving skills required for engineering professionals to excel in their field.

e. Dr.A.S.C.S.Sastry, Professor, ECE Dept. Faculty suggested to introduce new course which helps as building blocks of modern electronics, enabling the creation of countless devices and innovations that shape our daily lives.

f. Ms.Pathuri Bindu, Assistant prof, Mathematics Dept. Faculty suggested to introduce 2 Mathematical Programming Courses one focusing on optimization techniques—linear, integer, and nonlinear programming—to equip students with problem-solving skills applicable across fields like economics, engineering, and computer science. Blend theory, software applications, and real-world projects to foster analytical thinking" and second course to offer

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advanced problem-solving skills and optimization techniques essential for tackling real-world challenges across various disciplines. This course enriches their quantitative abilities and analytical thinking.

g. Dr.Kolla Bhanu Prakash, Faculty suggested to introduce a new course Digital Video Processing course to equip students with essential skills for today's digital world, fostering creativity and employability across various industries. This addition aligns our institution with the demands of the modern age and enhances our academic offerings.

h. Prathusha Assistant Professor, VNR college Hyderabad, Academic peer recommended "Computational epidemiology" course as it employs data-driven techniques and mathematical models to analyze and predict disease patterns, offering vital insights for public health and outbreak control which helps students at the forefront of health research and crisis response.

i. Mr.T.Vamsidhar, Faculty suggested to include "Functional & Concurrent Programming" as a Professional Elective for both Data Science and Cloud Specializations. This course offers students valuable skills in programming paradigms that are essential for navigating contemporary technological domains.

j. Lova Kumari Assistant professor, suggested to include "Speech processing" course in curriculum because it involves the analysis, recognition, and synthesis of human speech, driving advancements in communication technology, voice assistants, and more.

k. Ms. M.V.B.T. Santhi, Faculty recommended a new course which explores advanced database concepts that are essential for students to get full potential of data bases in today's information-driven world, enabling innovation and informed decision-making.

l. Ms.K.Srinidhi, Faculty suggested to introduce a course it helps students with essential knowledge and skills to identify, prevent, and mitigate security vulnerabilities in web applications and online environments. Given the

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increasing reliance on digital platforms, this course is crucial for producing graduates well-equipped to safeguard sensitive information and uphold the integrity of web-based systems.

m. Dr.Y.Prasanth, Professor & Associate Dean strongly recommended the incorporation of a dedicated "Software Reliability" course in the curriculum. This course would provide students with a comprehensive understanding of techniques for designing, developing, and testing reliable software systems. By addressing the critical need for dependable software in various industries, this course equips students to excel as software engineers and contribute to the creation of resilient applications.

n. Dr. Shashi Melhothra, Faculty suggested to introduce a course that will empower students to master the art of creating applications that transcend platform constraints, utilizing frameworks such as React Native.

o. Dr. K.V Raju Faculty suggested to incorporating Cloud & Serverless Computing into the curriculum to equip students with essential skills for modern technology landscapes.

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

a. Sreeja Girija R, Industry person suggested to incorporate Artificial Neural Networks into the curriculum. It would offer students a cutting-edge perspective on machine learning.

b. Mr.Sagireddy Pulla Reddy, an Industry person suggested including a cloud and machine learning-related course that empowers organizations to efficiently process and analyze vast datasets, enabling data-driven insights and innovation at scale.

c. Meenakshi Sharma, Assistant Director - PR & Media, Industry person suggested to include Architecting Cloud Solutions into curriculum as it will empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services,

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preparing them for in-demand roles in cloud architecture and technology.

d. Prathusha Assistant Professor, VNR college Hyderabad, Academic peer recommended "Computational epidemiology" course as it employs data-driven techniques and mathematical models to analyze and predict disease patterns, offering vital insights for public health and outbreak control which helps students at the forefront of health research and crisis response.

e. Dr.Balakrishna, Academic Peer suggested to revise "Bioinformatics" to equip students with interdisciplinary skills in biology and data science. This course will enable them to analyze complex biological data, fostering innovations in fields such as genomics, drug discovery, and personalized medicine.

f. Mr.Pallapothula Anvesh, Industry Person highly recommended the integration of a comprehensive "Data Analytics on Cloud" course, combining the power of advanced data analysis techniques with cloud computing.

g. Mr.Akhandam Venkat Aditya, Industry Person suggested to include Security solutions in the cloud offer robust protection against cyber threats, ensuring the integrity and confidentiality of data in cloud environments.

h. Mr. Vamsi Yelamarthi, Industry person suggested to introduce Visual Programming Course for 2019-20 admitted batch as this course would empower students to create applications using intuitive graphical interfaces, fostering creativity and accessibility in software development.

i. Suhas Achanta, Alumni suggested to introduce a comprehensive training program that must be designed to equip individuals with the essential skills and knowledge required to excel in Cloud DevOps practices.

j. Dr.A Chandran Sekhar, Academic Peer suggested to introduce a course which focuses on Equipping students with HPC skills. It will empower students to tackle intricate computational challenges across various fields, ensuring their preparedness for cutting-edge research and industry demands. By providing hands-on experience with parallel computing, optimization techniques, and utilization of HPC clusters, this course will foster a deeper understanding of

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advanced computing paradigms, ultimately enhancing students' competitiveness and versatility in the technology landscape.

k. Rajshekar Botcha, Industry person suggested to incorporate a course into curriculum that provides a detailed understanding of the programming languages used in embedded systems, such as C and C++, along with software design principles and real-time operating systems.

l. Sonal Dipak Mali, Academic Peer recommend incorporating "Application Development on Cloud" in the curriculum to equip students with essential skills in leveraging cloud computing services for building scalable, cost-effective, and globally accessible applications.

m. Vijaya Krishna Pala, industry person recommended to introduce a course which covers key cloud platforms, architectural design principles, security, scalability, and best practices for building resilient and efficient cloud solutions through skilling is recommended.

n. Mr.Konkimalla Venkata Ranga Rao, Academic peer suggested the course "Parallel & Distributed Computing" into the curriculum for preparing the students with the cutting-edge skills needed to harness the power of modern computing, enabling them to design and optimize high-performance systems for complex real-world challenges.

o. Bandaru Ravi Teja, Industry Personnel recommended integrating a comprehensive study of signal processing into the curriculum, emphasizing foundational concepts, mathematical rigor, practical implementations, and real-world applications.

p. Mr.Digallinte Sreenivasulu, Academic Peer recommended to include a course where they can learn market demanding coding skills like PFSD for comp.Coding.

q. Mr. Vishnu Vardhan, Industry person suggested Technical Skilling (SDP-3) to enhance employability by imparting relevant, adaptable technical skills, making graduates competitive in today's job market and fostering

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interdisciplinary problem-solving. This addition aligns with evolving industry demands and attracts prospective students, positioning our institution as a forward-thinking educational leader.

r. Mr. Suhas Achanta, Alumni suggested the TS-SDP4 (CLOUD DEVOPS) course to bridges the gap between development and operations in the cloud, enabling streamlined software delivery and meeting the growing industry need for cloud-centric DevOps expertise.

s. Mr. Gopi Chigurupati, Alumni recommended "TS-SDP4 Cloud Based Solutions Architect" course to provide a well-rounded education in cloud architecture, meeting industry demand for professionals skilled in designing and optimizing cloud solutions.

t. Mr. Madhu Bodapati, Industry Person recommended "TS-SDP4 Cloud Based Security Speciality" course because it equips individuals with specialized skills to fortify cloud environments, aligning with the increasing demand for cloud security expertise, ensuring data protection and compliance in the digital landscape.

u. Mr. Sai Anil Muthyala, Industry Person suggested "TS-SDP4 Certified Game Developer" course to nurture expertise in game development, covering essential skills, tools, and industry insights for aspiring game creators is required.

v. Mr. Hemanth Duriseti, Alumni suggested the course CLOUD BASED AI/ML SPECIALITY because the students should master in cloud-based AI/ML tools, frameworks, and deployment strategies, enabling them to develop intelligent applications and solutions on cloud platforms.

w. Dr. V. Ramalingam , Academic Peer recommended the syllabus for Cloud Infrastructure & Services should be updated to incorporate recent advancements in cloud technologies, ensuring students receive the most relevant and practical knowledge.

x. Kavitha Avula, Industry Person suggested that its appreciable if a specialized

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training program dedicated to fostering expertise in securing cloud environments is introduced. It is resolved to approve new course "TS-SDP4 Cloud Based Data Analytics Speciality" for 2019-20 admitted batch students.

y. Abhinay Irala, Industry Person, suggested that there is a need for a specialized program dedicated for equipping individuals with the knowledge and skills needed to excel in developing Internet of Things (IoT) solutions on cloud platforms.

z. Balakrishna, Academic Peers suggested to revise "Bioinformatics" course to equip students with interdisciplinary skills in biology and data science. This course will enable them to analyze complex biological data, fostering innovations in fields such as genomics, drug discovery, and personalized medicine.

aa. Hanumanth Yaganti, Alumni suggested to revise Advanced Computer Architecture course to aligns the curriculum with industry demands, enhances students' competitiveness in the job market, and fosters a deeper understanding of complex architectural paradigms.

bb. N Lakshmi Narayana, Academic Peer suggested to update the syllabus for Business of Games & Entrepreneurship to include contemporary industry trends and practical case studies.

cc. Dr. Indranil sarkar, Academic peer suggested to introduce new course "Chemistry for Engineers" it helps to empower students with a profound understanding of chemical processes, enabling them to design safer, more efficient, and environmentally conscious technologies.

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Annexure-2

Course Code: 19CS2104 **Course Name: MATHEMATICAL PROGRAMMING-1**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Solve linear programming problems in engineering and business decision making problems	PSO2, PO1, PO2	3
CO2	Make use of Duality and Sensitivity Analysis in Linear Programming models.	PSO2, PO1, PO2	3
CO3	Solve network models and LINEAR PROGRAMMING PROBLEMS using interior point methods	PSO2, PO1, PO2	3
CO4	Apply Cutting plane and Branch and Bound methods to solve Discrete optimization problems.	PO2, PSO2, PO1	3

Syllabus:

Linear programs formulation through examples from engineering / business decision making problems; Linear Programming in Matrix Form. Preliminary theory and the geometry of linear optimization, Solving Linear Programs, Simplex method, Sensitivity Analysis Duality in Linear Programming. Karmarkar's interior point method, Interior point methods. Network Models, Transportation problems. Discrete optimization formulations and algorithms. Integer Programming: Cutting plane and Branch and Bound methods. Solving real world problems with computer software.

Textbooks:

1. Applied Mathematical Programming by Bradley, Hax, and Magnanti (Addison-Wesley, 1977)

2. Introduction to Linear Optimization by Bertsimas, Dimitris, and John Tsitsiklis. Belmont, MA: Athena Scientific, 1997.

Reference books:

1. Numerical Recipes, The art of Scientific Computing by William H. Press, Saul A. Teukolsky, W.T. Vetterling, Brian P. Flannery, 3rd Edition, Cambridge University Press, 2007, UK.

2. Operations Research: An Introduction by H. A. Taha, Prentice Hall.

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3. Operations Research by S. D. Sharma, Kedar Nath Ram Nath & Co.

4. LINEAR PROGRAMMING and Network flows by MOKHTAR S. BAZARAA, John J. Jarvis and HANIF D. SHERALI

5. Introduction to Linear Optimization by Dimitris Bertsimas and John Tsitsiklis

MOOCS/Web Links:

1. http://web.mit.edu/15.053/www/AMP.htm

2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-251j-introduction-to-mathematical-programming-fall-2009/index.htm

3. https://www.coursera.org/learn/discrete-optimization

4. https://www.coursera.org/learn/solving-algorithms-discrete-optimization

5. https://www.edx.org/course/convex-optimization

6. http://people.brunel.ac.uk/~mastjjb/jeb/or/ip.html

7. https://ocw.mit.edu/courses/mathematics/18-433-combinatorial-optimization-fall-2003/

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Course Code: 19CS2204 **Course Name: MATHEMATICAL PROGRAMMING-2**

L-T-P-S: 2-2-0-0 **Credits: 4** **Prerequisite: MATHEMATICAL PROGRAMMING-1**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Solve optimization problems for large scale systems, network models, dynamic programming, and robustness	PSO2, PO2	3
CO2	Model and solve Non-linear programming problems for decision-making problems	PO2, PSO2	3
CO3	Demonstrate the combinatorial optimization problems and their applications	PSO2, PO2	3
CO4	Demonstrate stochastic optimization and nature-inspired algorithms	PSO2, PO2	3

Syllabus:

Robust optimization, Large scale optimization, network flows, Dynamic Programming, Nonlinear Programming, Decomposition methods for linear optimization, Farkas lemma • Decomposition methods for non-linear optimization. Lagrange multipliers, Constraint qualification, KKT optimality conditions, Quadratic programs - Wolfe method, Applications of quadratic programs in some domains like portfolio optimization and Support Vector Machine • Combinatorial Optimization: Approximation Algorithms, Submodular functions, Matroids, multilinear extensions, convex and conclave closures, Continuous approximation algorithms, Rounding techniques • Stochastic Programming with Optimization: Monte Carlo Sampling, Heuristics & Metaheuristics: Single solution vs. population-based, Parallel Metaheuristics, Nature-inspired Metaheuristics: Ant-colony optimization, Particle swarm optimization, Simulated annealing, Evolutionary algorithms, Workforce modelling

Textbooks:

1. Applied Mathematical Programming by Bradley, Hax, and Magnanti (Addison-Wesley, 1977)

2. Aharon Ben-Tal, Laurent El Ghaoui, and ArkadiNemirovski. Robust Optimization. Princeton University Press, 2009.

Reference books:

1. Linear Programming by Howard Karloff

2. Understanding and Using Linear Programming by Ji˘ríMatoušek and Bernd Gärtner

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3. LINEAR PROGRAMMING and Network flows by MOKHTAR S. BAZARAA, John J. Jarvis and HANIF D. SHERALI

4. NONLINEAR PROGRAMMING Theory and Algorithms by MOKHTAR S. BAZARAA, HANIF D. SHERALI and C. M. SHETTY

5. Ant Colony Optimization by Marco Dorigo and Thomas StutzleA Bradford book, The MIT Press

6. Evolutionary Optimization Algorithm by Dan Simon, Willey Edition

7. Complexity and Approximation: Combinatorial Optimization Problems and Their Approximability Properties by Alberto Marchetti-Spaccamela, Giorgio Ausiello, Giorgio Gambosi, Marco Protasi, Pierluigi Crescenzi, and Viggo Kann

8. Introduction to Linear Optimization by Dimitris Bertsimas and John Tsitsiklis

9. Convex Optimization by Stephen Boyd and Lieven Vandenberghe

Web Links:

1. http://web.mit.edu/15.053/www/AMP.htm
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-251j-introduction-to-mathematical-programming-fall-2009/index.htm
3. https://www.coursera.org/learn/discrete-optimization
4. https://www.coursera.org/learn/solving-algorithms-discrete-optimization
5. https://www.edx.org/course/convex-optimization
6. http://people.brunel.ac.uk/~mastjjb/jeb/or/ip.html
7. https://ocw.mit.edu/courses/mathematics/18-433-combinatorial-optimization-fall-2003/
8. https://people.seas.harvard.edu/~yaron/AM221-S16/schedule.html

MOOCS

1. https://www.coursera.org/programs/coursera-response-program-for-kl-university-dkj6o/browse?productId=qvkru5bqEeigcQ6ACV18LA&productType=course&query=optimization+algorithms&showMiniModal=true
2. https://www.udemy.com/course/mathematics-for-machine-learning/
3. https://www.edx.org/course/convex-optimization
4. https://www.coursera.org/programs/coursera-response-program-for-kl-university-dkj6o/browse?productId=bNfKJYcIEemsaArI-
5. https://www.udemy.com/course/optimisation/
6. https://www.edx.org/course/introduction-to-computational-thinking-and-data-4

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19MT1101 **Course Name: MATHEMATICS FOR COMPUTING**

L-T-P-S: 3-1-0-4 **Credits: 5** **Prerequisite: NIL**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Set relations, functions, probability, permutaions and combinations	PO1	1
CO2	matrix algebra, game theory	PO1	1
CO3	Mathematical logic ,Applications of Number theory, ,counting teqniques,lattice theory	PO1	1
CO4	Graphs & Trees,Statistics	PO1	1
CO5	LOGIC AND REASONING,Foundations in Arithmetic,Geometry	PO1	1

Syllabus:

(A)Foundations of Computational Mathematics-I 10hoursBasic Structures: Sets, Functions, Sequences and Summations, Cardinality of Sets , Relations and their Properties, Equivalence Relations. Permutations and combinations probability: Linear Permutations, Circular Permutations and combinations, addition theorem, conditional probability, multiplication theorem. (B)Foundations of Computational Mathematics-II Matrix Algebra: Introduction, Types of Matrices, Rank of matrix, Solutions of linear Equations -Gauss elimination, Jacobi and Gauss Seidal, Eigen values, Eigen vectors. Game Theory: Pay off Matrix, Mini-Max criteria, Saddle points and dominance property Optimal Strategy, Mixed Strategy, Value of a game, Decision under uncertainty (C)Discrete Mathematics-I Logic and Proofs: Propositional Logic, Applications of Propositional, Propositional Equivalences, Predicates and Quantifiers, Rules of Inference Predicate logic, Consequences, Introduction to proofs, Proof methods and strategy. Applications of .Number theory: Fermat's theorem, Euclidean Algorithm, Counting Techniques: Recursive definitions, Solving Linear Recurrence Relations, Fibonacci series, Divide-and-Conquer Algorithms, Generating Functions, Inclusion–Exclusion Lattices: Introduction, Properties of Lattices, Sub lattices, Partial order relation, Homomorphism and Isomorphism, Hasse diagrams. (D)Discrete Mathematics-II& Statistics Graphs & Trees: Terminology, Types of Graphs, Bipartite graphs, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path, Planar Graphs, Trees, Tree traversal and application of trees, spanning trees and Minimal spanning trees 6 hours Statistics: Curve fitting, Correlation, Linear Regression. LOGIC AND REASONING: Deductions, Logical Connectives, Linear and circular arrangements, Ordering and sequencing, Clocks, Calendars, Blood Relations, Cubes, Direction sense, Number and letter series, Number and letter Analogy, Odd man out, Coding and Decoding, Symbolic representations of given data, Binary Logic, Non Verbal reasoning. 26hoursFoundations in Arithmetic: Numbers, Ratio, Proportion, Variation, Averages, Percentages, Profit & loss, Time & Distance, Time & Work. Geometry: Lines, Triangles, Quadrilaterals, Polygons, Practical applications of common solids, irregular solids and their application in various engineering problems.

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Textbooks:

1. ohn Bird, Basic Engineering Mathematics, Sixth edition, Taylor & Francis Ltd., 2017, UK.

2. Kenneth H Rosen, Discrete Mathematics and its Applications, Seventh edition,McGraw Hill, 2007, USA.

Reference Books:

1. R.E. Walpole, R.H. Myers, S.L. Myes, Keying Ye, Probability and Statistics for engineers and scientist, Ninth edition, Pearson publications, 2012, USA.

2.Erwin Kreyszig, Advanced Engineering Mathematics, 10thedition, Wiley,

3.Tremblay J P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", First edition, TataMcGraw Hill, 1975, India.

4.R. S. Agarwal,A Modern Approach to Verbal and Non-verbal Reasoning,S Chand Publications, 2018, New Delhi, India.

5.S.D.Sarma , Operations Research, Theory methods & Applications, 18thedition (2017) ISBN: 978-93-80803-38-8WEB James Turley "Advanced 80386 Programming Techniques", TMH.

MOOCS/Web Links:

1.https://www.youtube.com/watch?v=PmO_QdLrRZg
2.https://nptel.ac.in/noc/individual_course.php?id=noc18-cs53
3.https://www.khanacademy.org/partner-content/pixar/crowds/crowds2/v/combinatorics11
4.https://www.khanacademy.org/partner-content/pixar/crowds/crowds2/v/combinatorics11
5.https://nptel.ac.in/courses/106106094/16 6.https://onlinecourses-archive.nptel.ac.in/

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3101S **Course Name: TECHNICAL SKILLING (SDP-3)**

L-T-P-S: 0-0-0-8 **Credits: 2**

Prerequisite: PROBLEM SOLVING & COMPUTER PROGRAMMING

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Apply JDBC API, JUnit Testing Framework and XML Concepts to build Console and Web Applications	PSO1, PO1	3
CO2	Implement Servlets, JSP, Hibernate, Spring and Spring Boot to build web applications and Enterprise Level applications.	PO3, PSO1	3
CO3	Analyze the design of linear data structures for real world problems.	PSO2, PO3	4
CO4	Analyze alternate algorithm techniques to solve optimization related problems in the real-world scenario.	PSO2, PO3	4
CO5	Analyse and apply suitable design technique to solve given real world problems.	PSO2, PO2	3

Syllabus:

JDBC API - Introduction to JDBC API, Type of Drivers in JDBC, Statement, Prepared Statement, Callable Statement, Result Set Metadata, Database Metadata, Scrollable and updatable Result Set, Transaction Management in JDBC. JUnit - Introduction to JUnit framework, JUnit Environment Setup, Features of Junit Framework, Junit Framework and its Implementation. XML - Introduction to XML, Advantages of XML, XML Tree, XML Attributes, XML DOM, DTD, XSD, XML with CSS, XSLT. Servlets - Introduction to Servlets, Lifecycle, Init and context parameters, Servlet Collaboration, Session Tracking Techniques, Servlet CRUD Operations. JSP – Servlets Vs JSP, JSP Architecture and Lifecycle, JSP Scripting Elements, Session Tracking Techniques, JSP Implicit Objects, JSP Directive Elements, JSP Action Tags, JSP MVC Architecture, JSP CRUD Operations. Hibernate – JDBC Vs Hibernate, Introduction to Hibernate Framework, Advantages, XML & Annotation based Hibernate CRUD Operations, Generator Classes in Hibernate, HQL, HCQL. Spring and Spring Boot – Introduction to Spring, Spring Architecture, Spring Vs Spring Boot, Maven Repository, Introduction to Spring Boot, Advantages of Spring Boot over Spring, Dependency Injection (DI), Inversion of Control (IoC), Creating Spring starter project, Hello World Application using Spring Boot, Spring Boot Auto wire, Web Application MVC using Spring Boot, Spring Boot CRUD Operations with Spring MVC, Spring Boot with RESTful Web Service, Spring Boot and RESTful API Vs REST API with JSON, Spring Boot, and Hibernate CRUD Operations, Microservices with Spring – monolithic vs micro-service Architecture, SOA vs Microservices, Spring Boot Microservices with Spring Cloud. Arrays, linked lists, Stack, Queue, Recursion, Divide and conquer technique, Greedy method, Dynamic Programming Technique, String, Sort, Binary search.

Textbooks:

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1. Web Technologies: Concepts, Methodologies, Tools, and Applications, Information Science Reference,4th edition, Arthur Tatnall
2. Spring and Hibernate, Tata McGraw-Hill Education,2009, Santosh Kumar k
3. Beginning Spring Boot 2 Applications and Microservices with the Spring Framework, Apress,1st edition, K. Siva Prasad Reddy
4. Java Persistence with Hibernate, Manning Publications,2nd edition, Christian Bauer, Gavin King, Gary Gregory
5. Java: A Beginner's Guide, Herbert Schildt, 8th edition, McGraw Hill Education.
6. Java-The complete reference, Herbert Schildt, 11th edition, McGraw Hill Education.
7. Learn Python 3 The Hard Way, by Zed A. Shaw
8. Headfirst Python: A Brain-Friendly Guide, by Paul Barry

Reference books:

1. XSLT: Working with XML and HTML, Khun Yee Fung, Addison-Wesley, 2001.
2. J2EE: The complete reference by James Keogh, publisher: McGraw-Hill Osborne Media, 1st Edition, 2002.
3. Spring in Practice by Willie Wheeler with Joshua White, publisher: Manning, shelter Island
4. Beginning Hibernate for Hibernate 5 by Joseph B.Ottinger, Jeff Liwood, Dave Minter, publisher: Apress, 4th Edition

MOOCS:

1. Become a Spring Developer https://www.linkedin.com/learning/paths/become-a-spring-developer
2. Building Scalable Java Microservices with Spring Boot and Spring https://www.coursera.org/learn/google-cloud-java-spring
3. Building Cloud Services with the Java Spring Framework https://www.coursera.org/learn/cloudservices-java-spring-framework
4. Microservices Foundations https://www.linkedin.com/learning/microservices-foundations
5. Microservices: Asynchronous Messaging https://www.linkedin.com/learning/microservices-asynchronous-messaging/getting-work-donein-microservices
6. Serverless and Microservices for AWS https://www.linkedin.com/learning/serverless-and-microservices-for-aws/why-serverless-whymicroservices
7. Introduction-to-graduate-algorithms—ud401 https://www.udacity.com/course/introduction-to-graduate-algorithms--ud401

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3278R **Course Name: DIGITAL VIDEO PROCESSING**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: Mathematics For Computing**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understanding the video signals and its characteristics	PSO2, PO1	2
CO2	Understanding the motion analysis, its detection and restoration of video with quality	PO1, PO2, PSO2	2
CO3	Understanding video segmentation and motion segmentation using different methods	PSO2, PO2	2
CO4	Learning to analyse the signals using different algorithms	PSO2, PO1	4
CO5	Applying the machine learning algorithms to video signals for the analysis, segmentation and restoration.	PO2, PSO2, PO1	4

Syllabus:

Video Sampling and Interpolation, Basic Linear Filtering with Application to Image Enhancement, Computational Models of Early Human Vision, Motion Analysis, GMM model with EM, Motion Detection and Estimation, Optical Flow Methods, Motion Compensated Filtering, Video Enhancement and Restoration, Video Quality Assessment, Restoration, Super- resolution. Video Segmentation, Motion segmentation, motion tracking in video, 2D and 3D Motion Tracking in digital video methods using point correspondences, optical flow and direct methods, Pel-Recursive methods, Bayesian Methods, Video Stabilization and Mosaicing, Unified Framework for video indexing, Summarization, browsing and retrieval, video surveillance

Textbooks:

1. Al Bovik "The Essential Guide to Video Processing" Academic Press (2009)

2. A. Murat Tekalp "Digital Video Processing" Prentice Hall (1995)

Reference books:

1. Al Bovik "Handbook of Image and Video Processing" Academic Press (2005)

2. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer (2010)

3. Yao Wang, Jôrn Ostermann, Ya-Qin Zhang "Video Processing and Communications" Prentice Hall (2001)

MOOCS/Web Links:

1. Fundamentals of Digital Image and Video Processing - Coursera

2. Image and Video Processing: From Mars to Hollywood with a Stop at the Hospital - Coursera

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3292S **Course Name: TS-SDP4 (CLOUD DEVOPS)**

L-T-P-S: 0-0-0-8 **Credits: 2**

Prerequisite: SOFTWARE ENGINEERING, OOP

CO#	Course Outcome (CO)	PO / PSO	BTL
CO5	Analyze and predict the correct cloud services which fit the needs and apply the configurations over the the cloud services to host the application.	PSO2,PO5,PO11	4

Syllabus:

AWS Cloud Technical Essentials: Cloud Infrastructure, Creating an Account, Security in Cloud, Security Shared Responsibility Model - Identity and Access Management, Role based management - Compute Services and Life cycles - Container Services - Serverless Services - Hosting the application - Cloud Network, Storage and Hosting App: Virtual Private Cloud, Subnet, Routing Table, Security groups - Storage & Database on Cloud - Hosting the application with Network and Storage - Optimization in AWS: Route Traffic with ELB - Computing Instance Auto Scaling - Running the Application in Auto Scaled Instances - SDLC Automation: Apply concepts required to automate a CI/CD Pipe Line - Determine Source control strategies and how to implement them - Apply concepts required to automate and integrate testing - Apply concepts required to build and manage artifacts securely - Determine deployment / delivery strategies (e.g. A/B, Blue/Green, Canary, Red/Black) and How to implement them using cloud Services - Configuration MGT and Infrastructure as Code: Determine deployment service based on deployment needs - Determine application and infrastructure deployment mode based on business need - Apply security concepts in automation of resource provisioning - Determine how to implement Lifecycle hooks on a development - Apply concepts required to manage systems using AWS configuration management tools and service - Monitoring and Logging: Determine how to set up a aggregation, storage and analysis of logs and metrics - Apply concept required to automate monitoring and event management of an environment - Apply concepts required to audit, log and monitor operating systems, infrastructure and applications - Determine how to implement tagging and other meta data strategies - Polices and Standards automation: Apply concepts required to enforce standard for logging, metrics, monitoring, testing and security - Determine how to optimize cost through automation - Apply concept required to implement governance strategies - Incident and Event response: trouble shoot issues and determine how to restore operations - Determine how to automate event management and alerting - Apply concepts required to implement automated healing - Apply concepts required to setup event driven automated actions - High Availability, Fault Tolerance and Disaster Recovery: Determine appropriate use of multi-AZ Versus Multi region architectures - Determine how to implement high availability, scalability and fault tolerance - Determine the right services based on the business needs (eg. RTO/RPO, COST) - Determine how to design and automate disaster recovery strategies - Evaluate a deployent for points of failure.

Textbooks:

1. Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud, First Edition, By Pearson, 2019, Mark Wilkins.

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2. AWS Certified Cloud Practitioner Study Guide: CLF-C01 Exam, by Ben Piper and David Clinton, 2 August 2019.

3. Implementing Azure DevOps Solutions: Learn about Azure DevOps Services to successfully apply DevOps strategies by Henry Been and Maik van der Gaag,11 June 2020

4. Azure DevOps Explained: Get started with Azure DevOps and develop your DevOps practices by Sjoukje Zaal , Stefano Demiliani , et al.,11 December 2020

Reference books:

1. AWS Lambda Developer Guide by Documentation Team, 26 June 2018

2. Agile, Devops And Cloud Computing With Microsoft Azure: Hands-On Devops Practices Implementation Using Azure Devops by Mitesh Soni, 1 January 2019

3. Hands-on DevOps with Linux: Build and Deploy DevOps Pipelines Using Linux Commands, Terraform, Docker, Vagrant, and Kubernetes (English Edition) by Alisson Machado de Menezes, 24 March 2021

4. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) by Mitesh Soni, 1 January 2020

Weblinks:

1. Create an AWS account https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-1-account.html

2. Following IAM Best Practices https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-2-iam.html

3. Launch the Employee Directory Application on Amazon EC2 https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-3-compute.html

4. Resize Images on the Fly with Amazon S3, AWS Lambda, and Amazon API Gateway https://aws.amazon.com/blogs/compute/resize-images-on-the-fly-with-amazon-s3-aws-lambda-and-amazon-api-gateway/

5. Create your first S3 bucket https://docs.aws.amazon.com/AmazonS3/latest/userguide/creating-bucket.html

6. Creating a VPC and Relaunching the Employee Directory Application on Amazon EC2 https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-4-networking.html

7. Create an Amazon S3 Bucket https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-5-storage.html

8. Amazon DynamoDB https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-6-databases.html

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9. Configure High Availability for your Application https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-7-elb.html

10. Source Control https://aws-tc-largeobjects.s3.us-west-2.amazonaws.com/DEV-AWS-MO-DevOps-C1/exercise-1.html

MOOCS:

1. Linkedin - Prepare for the Designing and Implementing Microsoft DevOps Solutions Exam (AZ-400) - https://www.linkedin.com/learning-admin/content/learning-paths/5f19c986498e5ee83df60efe

2. Coursera - DevOps on AWS Specialization - https://www.coursera.org/specializations/aws-devops

3. Linkedin - DevOps with AWS - https://www.linkedin.com/learning/devops-with-aws/first-deployment

4. Linkedin - Prepare for AWS DevOps Engineer (Professional) Certification - https://www.linkedin.com/learning/paths/prepare-for-aws-devops-engineer-professional-certification

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3291S **Course Name: TS-SDP4 (CLOUD BASED SOLUTIONS ARCHITECT)**

L-T-P-S: 0-0-0-8 **Credits: 2**

Prerequisite: CLOUD INFRASTRUCTURE AND SERVICES

CO#	Course Outcome (CO)	PO / PSO	BTL
CO5	Designing solutions to the architecture of Cloud	PSO1,PO3,PO5	3

Syllabus:

Design Resilient Architectures: Design a multi-tiler architecture solution. Design highly available and/or fault-tolerant architectures. Design decoupling mechanisms using AWS services. Choose appropriate resilient storage. Design High-Performing Architectures: Identify elastic and scalable compute solutions for a workload. performing and scalable storage solutions for a workload. Select high-performing networking solutions for a workload. Choose high-performing database solutions for a workload. Design Secure Applications and Architectures: Design secure access to AWS resources. Design secure application tiers. Select appropriate data security options. Design Cost-Optimized Architectures: Identify cost-effective storage solutions. Identify cost-effective compute and database services. Design cost-optimized network architectures.

Textbooks:

1. Cloud Computing Solutions Architect: A Hands-On Approach.: A Competency-based Textbook for Universities and a Guide for AWS Cloud Certification and Beyond, Arshdeep Bahga and Vijay Madisetti

2. Architecting Cloud Computing Solutions: Build cloud strategies that align technology and economics effectively managing risk, Scott Goessling

Reference books:

1. Architecting the Cloud: Design Decisions for Cloud Computing Service Models, Michaell Kavis

2. AWS for Solutions Architects; Design your cloud infrastructure by implementing DevOps, containers, and Amazon Web Services Alberto Artasanchez.

3.Learning Amazon Web Services (AWS}: A Hands-On Guide to the Fundamentals ofAWS Cloud, Mark wilkins

MOOCS:

1. AWS Fundamentals: Migrating to the Cloud: https://www.coursera.org/learn/aws-fundamentals-cloud-migration

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2. Exam Prep: AWS Certified Solutions Architect - Associate Building Cloud Computing : https://www.coursera.org/learn/aws-certified-solutions-architect-associate

3. Solutions at Scale Specialization Modern Application: https://www.coursera.org/specializations/building-cloud-computing-solutions-at-scale

4. Development with Python on AWS Specialization: https://www.coursera.org/specializations/aws-python-serverless-development

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3293S **Course Name: TS-SDP4 (CLOUD BASED SECURITY SPECIALITY)**

L-T-P-S: 0-0-0-8 **Credits: 2** **Prerequisite: COMPUTER NETWORKS & SECURITY**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	to apply generic computational skills like cloud, Full Stack Web Development Skills to specialization-based domains	PSO1,PO1	3
CO2	to apply the knowledge of secure network infrastructure, Logging and Monitoring for real time problems.	PO1,PSO1	3
CO3	to apply deeper understanding of system design with security and Access Management for project development.	PSO1,PO3	3
CO4	to apply deeper understanding of system design with security and performance optimization for project development	PSO1,PO3	3

Syllabus:

Incident Response: Given an AWS abuse notice, evaluate the suspected compromised instance or exposed access keys. Verify that the incident response plan includes relevant AWS services. Evaluate the configuration of automated alerting, and execute possible remediation of security related incidents and emerging issues. Logging and Monitoring: Design and implement security monitoring and alerting. Troubleshoot security monitoring and alerting. Design and implement a logging solution. Troubleshoot logging solutions. Infrastructure Security: Design edge security on AWS. Design and implement a secure network infrastructure. Disable any unnecessary network ports and protocol. Troubleshoot a secure network infrastructure. Design and implement host-based security. Identify and Access Management: Design and implement a scalable authorization and authentication system to access AWS resources. Trobleshoot an authorization and authentication system to access AWS resources. Data Protection: Design and Implement key management and use. Trobleshoot key management. Design and implement a data encryption solution for data at rest and data in transit.

Textbooks:

1. A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, ASIN : B0041N3GW6, ISBN: 978-0-470-93894-2, Wiley; 1st edition, 2010.

2. CSA Guide to Cloud Computing: Implementing Cloud Privacy and Security 1st Edition,Raj Samani , Jim Reavis , Brian Honan. ISBN-13: 978-0124201255, ISBN-10: 0124201253, 2015.

Reference books:

1. Practical Cloud Security, Chris Dotson, O'Reilly Media, Inc., ISBN: 9781492037514 , March 2019.

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2. Cloud Security: Concepts, Applications and Perspectives,1st Edition, Brij B. Gupta, Copyright Year 2021, ISBN 9780367407155, Published May 26, 2021 by CRC Press.

3. Mastering AWS Security: Create and maintain a secure cloud ecosystem, Albert Anthony, ISBN-13: 978-1788293723, ISBN-10: 9781788293723, ASIN : 178829372X, Publisher : Packt Publishing (October 26, 2017).

Weblinks:

1. https://www.iisecurity.in/courses/cloud-computing-security-course.php

MOOCS:

1. https://www.linkedin.com/learning/paths/become-a-certified-cloud-security-professional-ccsp?u=89447330

2. https://www.coursera.org/professional-certificates/google-cloud-security

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3294S **Course Name: TS-SDP4 (CERTIFIED GAME DEVELOPER)**

L-T-P-S: 0-0-0-8 **Credits: 2**

Prerequisite: PROGRAMMING FOR GAME DEVELOPMENT

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Apply the methods involved in the concept of a Game Plan	PO2,PO4, PSO1	3
CO2	Apply the Classification models of a Game Design	PO2,PO4, PSO2	3
CO3	Apply the concept of a Game Development in a Strategical Plan	PO2,PO4, PSO2	3

Syllabus:

Animation: Simple Unity Animation, Animator States, Scripting Animations, Animations and Colliders, Advanced Game Physics: Applying Forces, Unity Physics Joints, Unity2DEffectors, User Interfaces: Unity Buttons, Other UI Controls, UI Design Concepts, Project Publishing: Splash Screens, Credit Scenes and Icons, Publishing to PC, Mac and Linux Computers, Publishing to Smartphones, Publishing to Game Consoles, Entity component system. Unity Colliders, Physics Materials, Scripting Collision Events, Organizing Game Objects Parent-Child Objects, Sorting Layers, Tagging Game Objects, Collision Layers, Managing Game Objects: Prefabs, Creating and Destroying Objects Designing games in UNITY 3D(OPEN SOURCE)

Textbooks:

1. Jason Gregory,Game Engine Architecture, Second Edition, Jason Gregory ,2010.

2. Tomas Akenine Mollar,Eric Haines,Naty Hoffman,Real Time Rendering,Third Edition , Tomas Akenine Mollar,Eric Haines,Naty Hoffman ,2020.

Reference books:

1. James M Van Verth,Lars M Bishop,Essential Mathematics for Games and Interactive Applications,Third Edition, James M Van Verth,Lars M Bishop,2022.

2. Jesse Schell,The Art of Game Design,A Book of Lenses, Fourth Edition, Jesse Schell

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3295S **Course Name: TS SDP-4 (CLOUD BASED AI/ML SPECIALITY)**

L-T-P-S: 0-0-0-8 **Credits: 2** **Prerequisite: ARTIFICIAL INTELLIGENCE**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Identify the need of Data Engineering in AWS	PSO2,PO1	3
CO2	Visualize and analyze what is involved in learning models from data.	PO2,PSO1	4
CO3	Compare and contrast a wide variety of learning algorithms	PSO1,PO3,PO4	4
CO4	Apply principles and algorithms to evaluate models generated from data.	PSO2,PO3,PO5	3

Syllabus:

Data Engineering through Cloud: Create data repositories for machine learning. Identify and implement a data ingestion solution: Data job styles/types (batch load, streaming), Data ingestion pipelines (Batch-based ML workloads and streaming-based ML workloads). Identify and implement a data transformation solution. Exploratory Data Analysis through Cloud: Sanitize and prepare data for modeling, Perform feature engineering, Analyze and visualize data for machine learning, Graphing (scatter plot, time series, histogram, box plot), Interpreting descriptive statistics (correlation, summary statistics, p value), Clustering (hierarchical, diagnosing, elbow plot, cluster size) Modeling through Cloud: Frame business problems as machine learning problems, Select the appropriate model(s) for a given machine learning problem, Train machine learning models, Perform hyperparameter optimization, Evaluate machine learning models Machine Learning Implementation and Operations: Build machine learning solutions for performance, availability, scalability, resiliency, and fault tolerance, Recommend and implement the appropriate machine learning services and features for a given problem, apply basic AWS security practices to machine learning solutions, Deploy and operationalize machine learning solutions.

Textbooks:

1. Tom Michell, "Machine Learning", McGraw Hill 1997

2. Stephen Marsland, "Machine learning an algorithmic perspective", CRC press (2009)

3. Chun J Wesley, Core python programming, 2nd Edition Pearson 2007 Reprint.

Reference books:

1. AWS Certified Machine Learning Specialty

2. Pragmatic AI: An Introduction to Cloud-Based Machine Learning BY Noah Gift

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3. Cloud Computing for Machine Learning and Cognitive Applications (The MIT Press)

Weblinks:

1. https://www.udemy.com/course/aws-machine-learning/

MOOCS:

1. AWS Academy Machine Learning Foundation

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3296S Course Name: TS SDP-4 (CLOUD BASED DATA ANALYTICS SPECIALITY)

L-T-P-S: 0-0-0-8 Credits: 2 Prerequisite: DATA SCIENCE

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Apply Functions and Lambdas on purely functional programs using generic types, recursion, pattern matching and higher-order functions.	PSO2,PO4	3
CO2	Apply Algebraic Data Types to model and use infinite sequences with lazy evaluation, functional programming with objects and classes	PO4,PSO2	3
CO3	Apply Functional Data Structures, collections, Parallel Collections, Futures and Promises	PSO2,PO4	3
CO4	Apply the functional design of concurrent systems	PSO2,PO5	3

Syllabus:

Characteristics of Functional Programming Languages: The Basics of the Scala Language: DataTypes, Statements and Expressions, Statement Separator and Blocks, Declarations, Functions, Lists, Pattern Matching, Collections and Their Higher Order Functions. Functions and Lambdas, Functional Data Structures: Immutable Lists and Maps Lazy and Eager Evaluation: Parameter Passing, Lazy Val, Streams and Other Infinite Data Structures. Functions in Scala and Object-Oriented Programming, Scala: OOL and FP, classes and objects, Inheritance model, traits, Classes with Polymorphic Types. Monods:Monods, Functors, and Monads, Tail-Recursive Functions:Asynchronous Programming with Futures and Promises, Data-Parallel Collections. Concurrency with Akka, Introduction to the Actor Model, The Actor Model in Practice, Concurrent Programming with Reactive Extensions, Use Case - A Parallel Web Crawler

Textbooks:

1. Vicenç Torra - Scala_ From a Functional Programming Perspective_ An Introduction to the Programming Language, 2016, Springer.

2. Prokopec, Aleksandar - Learning Concurrent Programming in Scala (2017, Packt Publishing) 3. Anatolii Kmetiuk, Mastering Functional Programming: Functional techniques for sequential and parallel programming with Scala, (2018, Packt Publishing)

4. John Hunt - A Beginner's Guide to Scala, Object Orientation and Functional Programming (2018, Springer)

5. Mads Hartmann, Ruslan Shevchenko - Professional Scala (2018, Packt)

6. Slava Schmidt - Learn Scala Programming (2018, PacktPublishing)

Reference books:

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1. Pascal Bugnion - Scala for Data Science (2016, Packt Publishing)

2. Pascal Bugnion,Arun Manivannan, Scala: Guide for Data Science Professionals Packt, 2017

Weblinks:

1. https://www.scala-lang.org/

2. https://www.guru99.com/scala-tutorial.html

3.https://www.geeksforgeeks.org/scala-programming-language

4. OOL vs FP -https://www.educba.com/functional-programming-vs-oop/

5. Scala Object - https://dataflair.training/blogs/scala-singleton-object/

6. Scala Class - https://www.geeksforgeeks.org/class-and-object-inscala/

7. Inheritance and Traits - https://www.javatpoint.com/scala-inheritance

8.https://www.geeksforgeeks.org/scalapolymorphism/#:~:text=In%20Scala%20the%20function%20can,function%20or%20class%20are%20created%20.

9.https://www.scala-lang.org/api/current/scala/collection/immutable/ListMap.html

10.https://www.tutorialspoint.com/scala_collections/scala_collections_stream.htm

11.https://www.baeldung.com/scala/lazy-val

12.https://livebook.manning.com/book/get-programming-withscala/chapter-49/v-10/4
13.https://subscription.packtpub.com/book/application_development/9781783985845/4/ch04lvl1sec31/infinitesequences-scala-streams

14.https://blog.redelastic.com/a-guide-to-scala-collections-exploring-monads-in-scalacollections-ef810ef3aec3

15.https://www.baeldung.com/scala/functors-functional-programming
16.https://learning.oreilly.com/library/view/scala-reactive-programming/9781787288645/
17.https://learning.oreilly.com/library/view/learning-scala-programming/9781788392822/869dc5a2-99d6-4852-85e2-82582b09af8b.xhtml 18.https://akka.io/

19.https://www.jetbrains.com/help/idea/akkasupport.html#add_akka_to_sbt
20.ttps://doc.akka.io/docs/akka/current/typed/guide/introduction.html

MOOCS:

1. Big Data with Scala and Spark : https://www.coursera.org/projects/spark-scala-big-data

2.Scalable Machine leaning on bigdata using Apache and Spark: https://www.coursera.org/learn/machine-learning-bigdata-apache-spark

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3.Functional programming with scala specialiazation: https://www.coursera.org/specializations/scala

4.BigData Analysis with scala and spark: https://www.coursera.org/learn/scala-spark-big-data

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3290S **Course Name: TS-SDP4 (CLOUD BASED IOT DEVELOPER)**

L-T-P-S: 0-0-0-8 **Credits: 2** **Prerequisite: NIL**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Apply Functions and Lambdas on purely functional programs using generic types, recursion, pattern matching and higher-order functions.	PSO2,PO4	3
CO2	Apply Algebraic Data Types to model and use infinite sequences with lazy evaluation, functional programming with objects and classes	PO4,PSO2	3
CO3	Apply Functional Data Structures, collections, Parallel Collections, Futures and Promises	PSO2,PO4	3
CO4	Apply the functional design of concurrent systems	PSO2,PO5	3

Syllabus:

Characteristics of Functional Programming Languages: The Basics of the Scala Language: DataTypes, Statements and Expressions, Statement Separator and Blocks, Declarations, Functions, Lists, Pattern Matching, Collections and Their Higher Order Functions. Functions and Lambdas, Functional Data Structures: Immutable Lists and Maps Lazy and Eager Evaluation: Parameter Passing, Lazy Val, Streams and Other Infinite Data Structures. Functions in Scala and Object-Oriented Programming, Scala: OOL and FP, classes and objects, Inheritance model, traits, Classes with Polymorphic Types. Monods:Monods, Functors, and Monads, Tail-Recursive Functions:Asynchronous Programming with Futures and Promises, Data-Parallel Collections. Concurrency with Akka, Introduction to the Actor Model, The Actor Model in Practice, Concurrent Programming with Reactive Extensions, Use Case - A Parallel Web Crawler

Textbooks:

1. Vicenç Torra - Scala_ From a Functional Programming Perspective_ An Introduction to the Programming Language, 2016, Springer.

2. Prokopec, Aleksandar - Learning Concurrent Programming in Scala (2017, Packt Publishing) 3. Anatolii Kmetiuk, Mastering Functional Programming: Functional techniques for sequential and parallel programming with Scala, (2018, Packt Publishing)

4. John Hunt - A Beginner's Guide to Scala, Object Orientation and Functional Programming (2018, Springer)

5. Mads Hartmann, Ruslan Shevchenko - Professional Scala (2018, Packt)

6. Slava Schmidt - Learn Scala Programming (2018, PacktPublishing)

Reference books:

1. Pascal Bugnion - Scala for Data Science (2016, Packt Publishing)

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2. Pascal Bugnion,Arun Manivannan, Scala: Guide for Data Science Professionals Packt, 2017

Weblinks:

1. https://www.scala-lang.org/

2. https://www.guru99.com/scala-tutorial.html

3.https://www.geeksforgeeks.org/scala-programming-language

4. OOL vs FP -https://www.educba.com/functional-programming-vs-oop/

5. Scala Object - https://dataflair.training/blogs/scala-singleton-object/

6. Scala Class - https://www.geeksforgeeks.org/class-and-object-inscala/

7. Inheritance and Traits - https://www.javatpoint.com/scala-inheritance

8.https://www.geeksforgeeks.org/scalapolymorphism/#:~:text=In%20Scala%20the%20function%20can,function%20or%20class%20are%20created%20.

9.https://www.scala-lang.org/api/current/scala/collection/immutable/ListMap.html

10.https://www.tutorialspoint.com/scala_collections/scala_collections_stream.htm

11.https://www.baeldung.com/scala/lazy-val

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS2210R **Course Name: PARALLEL & DISTRIBUTED COMPUTING**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Analyze Distributed Computations, Graph Algorithms, Causality and Time, Message Ordering and group communication	PO2,PO4,PSO1	4
CO2	Analyze Coordination Algorithms, Consistency and Replication, Global state and snapshot recording algorithms, Self-stabilization, Fault-Tolerant Message-Passing Distributed Systems	PO2,PO4,PSO1	4
CO3	Understand parallel algorithm design. Demonstrate the ability to differentiate among parallel architectures and interconnection networks models by analyzing parallel sorting algorithms	PO2,PO4,PSO1	4
CO4	Design and analyze Parallel Computational algorithms	PSO1,PO2,PO4	4
CO5	Develop Parallel and Distributed computing programs using Hadoop Software tool and MapReduce Frame work.	PSO2	6

Syllabus:

Introduction to Parallel and distributed computing concepts through Hadoop and Map-Reduce frame work. Synchronous versus asynchronous executions, A Model of Distributed Computations, Causality and Time, Message Ordering and group communication, Graph Algorithms. Coordination Algorithms, Consistency and Replication, Global state and snapshot recording algorithms, Self-stabilization, Fault-Tolerant Message-Passing Distributed Systems. Parallel multiprocessor/multicomputer systems, Message-passing systems versus shared memory systems, Interconnection Networks: Linear and Ring, Mesh, Hypercube, Butterfly, Omega. Basic Communication Operations and its cost, Principles of Parallel Algorithm Design, Parallel global sum, tree sum. Parallel Algorithm Models, Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bitonic Sort, Bubble Sort and its Variants: odd-even transposition sort. Parallel Computational Algorithms: Prefix Computation, Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Gaussian Elimination, Vector Addition, Dot Product, Parallel Computation of π, Trapezoidal Integration, compute the Mandelbrot set, Pointer Jumping: List Ranking, Linked List Parallel Prefix, Euler tour.

Textbooks:

1. Attiya, Hagit, and Jennifer Welch. Distributed computing: fundamentals, simulations, and advanced topics. Vol. 19. John Wiley & Sons, 2004.

2. Ananth Grama, Vipin Kumar,"Introduction to Parallel Computing", 2nd Edition, Addison Wesley.

3. Tanenbaum, Andrew S Steen, Maarten van - Distributed systems: principles and paradigms. Pearson, 2017.

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4. Coulouris GF, Dollimore J, Kindberg T. Distributed systems: concepts and design. pearson education; 2005.

5. A.D. Kshemkalyani, M. Singhal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press, 2011

Reference books:

1. White, Tom. Hadoop: The definitive guide. " O'Reilly Media, Inc.", 2012.

2. Chapman, Barbara Jost, Gabriele Pas, Ruud van der, Using OpenMP: portable shared memory parallel programming, 2008, MIT Press.

3. Gadi Taubenfeld - Distributed Computing Pearls (2018, Morgan & Claypool Publishers)

4. Rathinaraja Jeyaraj, Ganeshkumar Pugalendhi, Anand Paul, Big Data with Hadoop MapReduce: A Classroom Approach, Apple Academic Press, 2020

5. Anmay Deshpande, Sandeep Karanth, Gerald Turkington, Hadoop: Data Processing and Modelling, Packt Publishing, 2017.

6. Michel Raynal - FaultTolerant Message-Passing Distributed Systems. An Algorithmic Approach (2018, Springer)

7. Wan Fokkink, Distributed Algorithms: An Intuitive Approach, 2013, MIT Press.

8. Russ Miller, Laurence Boxer, "Algorithms Sequential & Parallel: A Unified Approach", Cengage Learning, 3rd Edition.

9. Barry Wilkinson, Michael Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2nd Edition, 2005,Pearson.

10. Victor Eijkhout, Parallel Programming for Science and Engineering Using MPI, OpenMP, and the PETSc library, 2nd edition 2020.

Weblinks:

1. https://nptel.ac.in/courses/106/102/106102114/
2. https://nptel.ac.in/courses/106/106/106106107/

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3026R **Course Name: ARTIFICIAL NEURAL NETWORKS**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: Artificial Intelligence**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand and build basic network representations, topologies and models	PO1, PO2	2
CO2	Apply various techniques for training and optimizing neural networks	PO2, PO1	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
CO5	Evaluate different approaches and techniques for solving problems involving neural networks and their applications using python and develop knowledge on emerging software, tools and technologies related to these approaches	PO5, PO6	5

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, Radial Basis Function Networks. 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. Kohonen Self Organizing Maps – Learning Vector Quantization – Counter Propagation Networks, dynamically driven recurrent networks (RNN), Learning algorithms (BPTT, RTRL, Kalman Filter) Applications of neural networks. Advanced Topics in ANN: Support Vector Machines for classification & regression, Introduction to Generative Adversarial Networks (GANs) and its usage in for data augmentation privacy and anonymity, Convolutional neural networks

Textbooks:

1. B. Yegnanarayana "Artificial Neural Networks", PHI, 2006.

Reference books:

1. Simon Haykin, "Neural Networks: A Comprehensive Foundation", Pearson Prentice Hall, 2008. 2. Christopher M Bishop, "Neural networks for Pattern Recognition", Oxford, Indian Edition, 2010.

3. Ian Goodfellow, "Generative Adversarial Networks", NIPS Tutorial, https://arxiv.org/pdf/1701.00160.pdfLinear Programming by Howard Karloff

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Web Links:

1. Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization https://www.coursera.org/programs/cse-faculty-courses-an6zm/browse?currentTab=CATALOG&productId=BZ5quSvBEee6gA5XksfBbg&productType=course&query=neural+networks&showMiniModal=true 12/29/2020 3/19

2 COURSERA Convolutional Neural Networks

https://www.coursera.org/programs/cse-faculty-courses-an6zm/browse?currentTab=CATALOG&productId=kWGvJivBEeeW5RJUyz1uFA&productType=course&query=tensorflow+neural+network&showMiniModal=true

3 COURSERA Introduction to Tensorflow for Artificial Intelligence, Machine Learning and Deep Learning https://www.coursera.org/programs/cse-faculty-courses-an6zm/browse?currentTab=CATALOG&productId=YpwHVDb5EemE7gr4SGSAsA&productType=course&query=tensorflow&showMiniModal=true

4 COURSERA Convolutional Neural Networks in Tensorflow https://www.coursera.org/programs/cse-faculty-courses-an6zm/browse?currentTab=CATALOG&productId=5mAuak8zEemKoQ4qeYq26g&productType=course&query=tensorflow&showMiniModal=true

5 COURSERA Sequence Models https://www.coursera.org/programs/cse-faculty-courses-an6zm/browse?currentTab=CATALOG&productId=25Fh8ivBEee6gA5XksfBbg&productType=course&query=neural+networks&showMiniModal=true

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3038R **Course Name: HIGH PERFORMANCE COMPUTING**
L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: OPERATING SYSTEMS DESIGN**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Analyze the performance of GPU memory hierarchy and MPI programming	PO1	1
CO2	Develop parallel programs using OpenCL library and understand FPGA-Based Supercomputer	PO5	3
CO3	Develop mixed mode programs for Multicore, GPU and cluster optimization systems	PO5	3
CO4	Generate parallel programs for matrix, graph and sorting problems using CUDA, OpenMP library	PSO1, PO5	3
CO5	Implementation and analysis of pre-defined services in the online cloud platform	PO3, PO5	3

Syllabus:

Modern Processor, Basic optimization techniques Basic optimization techniques for serial code, Data access optimization, Parallel computers, Basics of parallelization, Shared-memory parallel programming with OpenMP, GPU memory Heirarchy Efficient openMP programming, Local optimization on ccNuma architecture, Distributed memory parallel programming with MPI, Efficient MPI programming, Hybrid parallelization with MPI and Open MP, Topology and affinity in multi-core environment, OpenCL Libraries History of GPU computing, CUDA, CUDA threads, CUDA memories, CUDA performance consideration, Floating point consideration, Parallel programming concepts, Computational Thinking, Introduction to Open CL, Hybrid- Core Architecture, Low cost High performance re-configurable computing FPGA- based super computer, FPGA- based super computer for statistical physics, Weird Case of Janus, High-speed torus interconnect using FPGA's, Re-architecting memory resources for clusters, High Speed Dynamic reconfiguration, Parameterization, Various kinds of models, Core optimization, Node and cluster optimization, Grid-level brokering to save energy.

Textbooks:

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Engineers and Scientists", CRC Press.

2. David B Krik, Wen-mei W Hwu, "Programming Massively Parallel Processors", Morgan Kaufmann.

Reference books:

1. Christian de Schryver, Norbert Wehn, "High-Performance Computing Using FPGAs",Springer, (2013).

2. Ralf Gruberc, Vincent Keller, "HPC @ Green IT, Green High Performance Computing Methods", Springer,(2010).

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3. John Levesque, Gene Wagenbreth ,"High Performance Computing: Programming and Applications", CRC Press.

4. Ananth Grama, Anshul Gupta and Vipin Kumar, "Introduction to Parallel Computing", 2nd Edition, Pearson Edition (2009).

5. Jason Sanders, Edward Kandrot, "CUDA by Example - An Introduction to General-Purpose GPU Programming", Addison Wesley, (2011).

6. Benedict R Gaster, Lee Howes, David R Kaeli Perhaad Mistry Dana Schaa, "Heterogeneous Computing with OpenCL", MGH, (2011)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3056S **Course Name: FUNCTIONAL & CONCURRENT PROGRAMMING**

L-T-P-S: 2-0-2-4 **Credits: 4** **Prerequisite: OBJECT ORIENTED PRORAMMING**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Apply Functions and Lambdas on purely functional programs using generic types, recursion, pattern matching and higher-order functions.	PSO2, PO4	3
CO2	Apply Algebraic Data Types to model and use infinite sequences with lazy evaluation , functional programming with objects and classes	PO4, PSO2	3
CO3	Apply Functional Data Structures, collections, Parallel Collections, Futures and Promises	PSO2, PO4	3
CO4	Apply the functional design of concurrent systems	PSO2, PO5	3
CO5	Apply the functional design of concurrent systems	PSO2	4

Syllabus:

Characteristics of Functional Programming Languages: The Basics of the Scala Language: DataTypes, Statements and Expressions, Statement Separator and Blocks, Declarations, Functions, Lists, Pattern Matching, Collections and Their Higher Order Functions. Functions and Lambdas, Functional Data Structures: Immutable Lists and Maps Lazy and Eager Evaluation: Parameter Passing, Lazy Val, Streams and Other Infinite Data Structures. Functions in Scala and Object-Oriented Programming, Scala: OOL and FP, classes and objects, Inheritance model, traits, Classes with Polymorphic Types. Monods:Monods, Functors, and Monads, Tail-Recursive Functions:Asynchronous Programming with Futures and Promises, Data-Parallel Collections. Concurrency with Akka, Introduction to the Actor Model, The Actor Model in Practice, Concurrent Programming with Reactive Extensions, Use Case - A Parallel Web Crawler

Textbooks:

1. Vicenç Torra - Scala_ From a Functional Programming Perspective_ An Introduction to the Programming Language, 2016, Springer.

2. Prokopec, Aleksandar - Learning Concurrent Programming in Scala (2017, Packt Publishing) 3. Anatolii Kmetiuk, Mastering Functional Programming: Functional techniques for sequential and parallel programming with Scala, (2018, Packt Publishing)

4. John Hunt - A Beginner's Guide to Scala, Object Orientation and Functional Programming (2018, Springer)

5. Mads Hartmann, Ruslan Shevchenko - Professional Scala (2018, Packt)

6. Slava Schmidt - Learn Scala Programming (2018, PacktPublishing)

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Reference books:

1. Pascal Bugnion - Scala for Data Science (2016, Packt Publishing)

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Web Links:

1. https://www.scala-lang.org/

2. https://www.guru99.com/scala-tutorial.html

3. https://www.geeksforgeeks.org/scala-programming-language

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6. Scala Class - https://www.geeksforgeeks.org/class-and-object-inscala/

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9. https://www.scala-lang.org/api/current/scala/collection/immutable/ListMap.html

10. https://www.tutorialspoint.com/scala_collections/scala_collections_stream.htm

11. https://www.baeldung.com/scala/lazy-val

12. https://livebook.manning.com/book/get-programming-withscala/chapter-49/v-10/4

13.https://subscription.packtpub.com/book/application_development/9781783985845/4/ch04lvl1sec31/infinitesequences-scala-streams

14.https://blog.redelastic.com/a-guide-to-scala-collections-exploring-monads-in-scalacollections-ef810ef3aec3

15.https://www.baeldung.com/scala/functors-functional-programming
16.https://learning.oreilly.com/library/view/scala-reactive-programming/9781787288645/
17.https://learning.oreilly.com/library/view/learning-scala-programming/9781788392822/869dc5a2-99d6-4852-85e2-82582b09af8b.xhtml 18.https://akka.io/
19.https://www.jetbrains.com/help/idea/akka 18..https://akka.io/
19.https://www.jetbrains.com/help/idea/akkasupport.html#add_akka_to_sbt
20.ttps://doc.akka.io/docs/akka/current/typed/guide/introduction.html

MOOCS:

1. Big Data with Scala and Spark : https://www.coursera.org/projects/spark-scala-big-data

2. Scalable Machine leaning on bigdata using Apache and Spark:
https://www.coursera.org/learn/machine-learning-bigdata-apache-spark

3. Functional programming with scala specialiazation: https://www.coursera.org/specializations/scala

4. BigData Analysis with scala and spark: https://www.coursera.org/learn/scala-spark-big-data

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3115R **Course Name: EMBEDDED SYSTEMS**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Able to apply the principle concept of embedded systems and the architecture of embedded system design.	PO2, PO3 & PSO1	3
CO2	Able to apply the role of controller, timer and interfaces for embedded system design	PO2, PO3 & PSO1	3
CO3	Able to design and analyze the various communication interface and protocols for efficient embedded systems.	PO3, PO4 & PSO1	4
CO4	Able to analyse an embedded system considering the trade-off between designing functionality in hardware versus software.	PO4, PO5 & PSO2	4
CO5	Able to apply and analyse the Embedded system design knowledge using the architecture and programming and Performance analysis for modular implementation for a complete system.	PO4, PO5 & PSO1	4

Syllabus:

Embedded systems: Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Design Challenges, Applications of embedded systems. Processor types, and selection: General Purpose and Domain Specific Processors, ASICs, PLDs. **Memory, Sensors, and Actuators:** ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors, and Actuators (I/O components): relay, Motors with PWM control, stepper motor. Other Sub-sub-systems: Timer, counter, Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, and Watchdog Timer. **Communication Interface:** Onboard and External Communication Interfaces. Communication protocols: Serial and parallel, ISA and PCI, DMA, USART, SPI, SCI (RS232, RS485), I2C, CAN, Parallel interface, Fieldbus (Profibus), USB (v2.0), infrared, Bluetooth, Zig-Bee, GPRS, GSM. Applications/ Examples of Embedded Systems: cameras, washing machines, automobiles, and other applications. **Design an embedded system:** Design Metrics Embedded System Development, Considering the trade-off between designing, functionality in hardware versus software, and Cooperation between the software and the hardware components. Software-Hardware co-design, performance-area trade-off analysis, and optimization Perform design analysis and modular implementation for a complete system.

Textbooks:

1. Introduction to Embedded Systems, E. A. Lee and S. A. Seshia, MIT Press, 2017

2. ARM system developer's guide: Designing and optimizing and system software, N. Sloss, D. Symes, and C Wright, Elsevier, 2008

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3. Introduction to Embedded Systems, Shibu K V, Tata McGraw Hill Education Private Limited, 2009

4. Embedded Systems: Architecture, Programming and design, Raj Kamal, Tata McGraw Hill publisher, 2010

5. An Embedded Software Primer, David E Simon, Addison Wesley, 2005

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3116R **Course Name: SIGNAL PROCESSING**

L-T-P-S: 3-2-0-0 **Credits: 5** **Prerequisite: NIL**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand the various types of signals, systems and their frequency domain transformation.	PSO1, PO1	2
CO2	Understand the design methodology of different filters and their realizations.	PO1, PO3, PSO1	2
CO3	Apply signal processing approaches for extraction of information present in the natural signals.	PSO1, PO1, PO2	3
CO4	Apply machine learning approaches for processing of signals.	PSO2, PO1, PO5	3

Syllabus:

Signals and Systems: Types of Signals: Analog, deterministic, non-deterministic, random signals, periodic, aperiodic signals, discrete time signals, digital signals. Elementary signals: impulse, unit step, ramp, sinusoidal signal, complex exponential. Systems: impulse response, Convolution, Difference Equations for representation of systems, properties of systems, linearity, superposition principle, shift invariance, causality, stability. Fourier series for periodic signals, Fourier transforms, properties of Fourier Transform, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transforms (DFT), Fast Fourier Transforms (FFT), Phase and group delays, Sampling and Quantization. Transforms and Filter Design: Z-Transforms, Region of convergence (ROC), Properties of Z-Transforms, Causality and stability of filters, Finite Impulse Response (FIR), Infinite Impulse Response (IIR), Pole-Zero representation, Digital filter design: FIR filter design by Fourier Transform, Linear Phase Characteristics, low pass, high pass, band pass and band reject filters, IIR filter design by coefficient calculation, Frequency response of filters, All pass filters, Hilbert Transform, Filter realizations. 1-Dimensional and 2-Dimensional Signal Processing: Windowing techniques: Rectangular, Bartlett, Hamming, Hanning, Blackwell, Kaisar. Shorttime analysis: Short Time Fourier Transform (STFT) of Speech signals, Enhancement (denoising) techniques such as Mean, Median, and Moving average filter for images. Feature extraction techniques: MelFrequency Cepstral Coefficients (MFCC), Linear Prediction Coefficients (LPC) for speech, Audio Reconstruction using Analysis by Synthesis approach. Wavelet based image decomposition, Image Reconstruction using Analysis by Synthesis approach. Machine Learning approaches for building Signal Processing based Intelligent Systems: Pre-processing, feature extraction and classification using Convolutional Neural Networks (CNN) and Deep Neural Networks (DNN). Data augmentation using Generative Adversarial Networks (GAN), synthesis of signals using Recurrent Neural Network (RNN).

Textbooks:

1. Alan V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, MIT press.

2. Simon Haykin and Barry Van Veen, "Signals and Systems", 2nd Ed. Wiley, 2007

3. LiTan, "Digital Signal Processing: Fundamentals and Applications", Academic Press, 2008.

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4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, " Deep Learning" , MIT Press, 2021

Reference books:

1. J. G. Proakis and M G , Monolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Prentice Hall, 2007.

2. Thomas F. Quatieri, Discrete-Time Speech Signal Processing: Principles and Practice, Pearson Prentice Hall, 2001.

3. Christopher Torrence and Gilbert P. Compo, A Practical Guide to Wavelet Analysis, Bulletin of the American Meteorological Society, 1997.

4. R. Gonzalez and R. Woods, "Digital Image Processing", 4 th Ed., Pearson, 2018.

5. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing Using MATLAB" , 3rd ed. Cengage Learning, 2010.

6. Alan C Bovik, Handbook of Image and Video Processing, Academic Press Series in Communications, Networking, and Multimedia, 2000

7. David Foster, "Generative Deep Learning", O'REILLY, 2019.

Web Links:

1. https://www.intechopen.com/books/from-natural-to-artificial-intelligence-algorithms-and-applications/some-commonly-used-speech-feature-extraction-algorithms.

MOOCS:

1. https://www.coursera.org/learn/dsp1 https://www.coursera.org/learn/dsp2

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3234R **Course Name: APPLICATION DEVELOPMENT ON CLOUD**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Analyze, predict and apply the server based computing for hosting the web application with appropriate database and storage.	PSO2, PO2, PO5	4
CO2	Implement the cloud services to monitor and secure the cloud infrastructure.	PSO2, PO5, PO11	3
CO3	Analyze, predict and apply the CI/CD services for hosting the web application.	PSO2, PO2, PO5	4
CO4	Analyze, predict and apply appropriate serverless, container based, work flow and messaging based services.	PO5, PSO2, PO2	4
CO5	Apply the knowledge and implement the cloud concepts in real time.	PSO2, PO3, PO5	3

Syllabus:

AWS Cloud overview: Cloud Security - Services Over View - Different ways of Interaction with Cloud (Console, CLI, SDK) - CloudWatch and Alarm, Managing Access to AWS: IAM Role – IAM User – MFA – Managing with Authentication, EBS – EFS – S3 Bucket – S3 Bucket Policies – S3 Glacier – Cloud Front – EC2 with RDS Hosting Application (Windows, Linux and Ubuntu) – DynamoDB – Amazon Arora – Elastic Cache – EC2 with ELB and its types – EC2 Auto Scaling (High Availability and Scalability) – Deploying Application with Cloud Formation and Elastic Beanstalk – Cloud9 - Securing Infrastructure in AWS: Ingress/Egress Filtering – VPC – Route Table – Subnet – IGW – Security Groups – NACL – NAT – VPC Peering – End Points – VPN, Route53 and Routing – Using Cloud Trail – Encrypting Data at Rest – Key Management System – CI/CD: Code Commit – Code Build – Code Deploy – Code Pipeline – Code Star – Code Guru – Code Artifact – Fault Injection, Serverless: Lambda Function – Serverless API Gateway and Kinesis, Monitoring Application with X-Ray and CloudWatch - ECR – ECS – EKS – Fargate - AWS Work Flow with SWF - Elastic Search – Event Bridge (Amazon CloudWatch Events) – SNS – SQS – AWS Step Function – Secret Manager – Environment Variables.

Textbooks:

1. Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud, First Edition, By Pearson, 2019, Mark Wilkins.

2. AWS Certified Cloud Practitioner Study Guide: CLF-C01 Exam, by Ben Piper and David Clinton, 2 August 2019.

3. Aws Certified Solution Architect Associate: The Complete Guide To The SSA C02 Exam, Training To Expand Your Knowledge Before Exams, Useful Tips On How To Start Your New Career and Approach A New Job by Derick Carter, 6 November 2020

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Reference books:

1. AWS Lambda Developer Guide by Documentation Team, 26 June 2018

2. Agile, Devops And Cloud Computing With Microsoft Azure: Hands-On Devops Practices Implementation Using Azure Devops by Mitesh Soni, 1 January 2019

3. Hands-on DevOps with Linux: Build and Deploy DevOps Pipelines Using Linux Commands, Terraform, Docker, Vagrant, and Kubernetes (English Edition) by Alisson Machado de Menezes, 24 March 2021

4. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) by Mitesh Soni, 1 January 2020

MOOCS:

1. udemy – AWS Developer Associate Training - https://www.udemy.com/course/aws-developer-associate-training/

2. LinkedIn – Prepare for AWS Certification for Developer Associate Exam - https://www.linkedin.com/learning/paths/prepare-for-the-aws-certified-developer-associate-exam?u=89447330

Weblinks:

1. Create an AWS account https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-1-account.html
2. Following IAM Best Practices https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-2-iam.html
3. Launch the Employee Directory Application on Amazon EC2 https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-3-compute.html
4. Resize Images on the Fly with Amazon S3, AWS Lambda, and Amazon API Gateway https://aws.amazon.com/blogs/compute/resize-images-on-the-fly-with-amazon-s3-aws-lambda-and-amazon-api-gateway/
5. Create your first S3 bucket https://docs.aws.amazon.com/AmazonS3/latest/userguide/creating-bucket.html
6. Creating a VPC and Relaunching the Employee Directory Application on Amazon EC2 https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-4-networking.html
7. Create an Amazon S3 Bucket https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-5-storage.html
8. Amazon DynamoDB https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-6-databases.html
9. Configure High Availability for your Application https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/DEV-AWS-MO-GCNv2/lab-7-elb.html
10. Source Control https://aws-tc-largeobjects.s3.us-west-2.amazonaws.com/DEV-AWS-MO-DevOps-C1/exercise-1.html

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3235R **Course Name: SOLUTIONS ARCHITECTING ON CLOUD**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Design Resilient Architectures	PSO1, PO3, PO5	3
CO2	Design High-Performing Architectures	PSO1, PO1, PO3, PO5	3
CO3	Design Secure Applications and Architectures	PSO1, PO3, PO5	3
CO4	Design Cost-Optimized Architectures	PO3, PO5, PSO1	3
CO5	Designing solutions to the architecture of Cloud	PSO1, PO3, PO5	3

Syllabus:

Design a multi-tier architecture solution: Design a multi-tier architecture solution, Design highly available and/or fault-tolerant architectures, Design decoupling mechanisms using AWS services, Choose appropriate resilient storage. Design High-Performing Architectures : Identify elastic and scalable compute solutions for a workload, Select high-performing and scalable storage solutions for a workload, Select high-performing networking solutions for a workload,Choose high-performing database solutions for a workload. Design Secure Applications and Architectures: Design secure access to AWS resources, Design secure application tiers, Select appropriate data security options. Design Cost-Optimized Architectures: Identify cost-effective storage solutions, Identify cost-effective compute and database services, Design cost-optimized network architectures.

Textbooks:

1. AWS Certified Solutions Architect Study Guide, Ben Piper, David Clinton, Sybex publishers, 2020.

2. AWS Certified Solutions Architect Associate: The ultimate guide for the SAA-C02 exam, Anderson, Jonathan, 2020

Reference books:

1. AWS Certified Solutions Architect - Associate Quick Reference Guide, Specialist, IP, 2020 AWS Certified Solutions Architect Associate All-in-One Exam Guide , Joyjeet Banerjee, McGraw-Hill Education,2021

MOOCS:

1. AWS Fundamentals : Migrating to the cloud-- https://www.coursera.org/learn/aws-fundamentals-cloud-migration

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2. Exam Prep: AWS Certified Solutions Architect - Associate: https://www.coursera.org/learn/aws-certified-solutions-architect-associate

3. Building Cloud Computing Solutions at Scale Specialization: https://www.coursera.org/specializations/building-cloud-computing-solutions-at-scale

4. Modern Application Development with Python on AWS Specialization: https://www.coursera.org/specializations/aws-python-serverless-development

Weblinks:

1. https://cloudacademy.com/learning-paths/aws-solutions-architect-associate-certification-preparation-for-aws-2021-1-2977/

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3254R **Course Name: VISUAL PROGRAMING**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: OOP**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understanding the basic concepts of .Net framework, C#.Net and Build console and desktop applications using C#.net framework	PO2,PO3,PO4	3
CO2	Build C#.net desktop applications using ADO.NET	PO2,PO3,PO4	3
CO3	Applying the concepts of ASP.NET Standard Server controls for visual programming application development	PO2,PO3,PO4	3
CO4	Build the Visual programming applications using MVC, Page and State management and master pages.	PO4,PO2,PO3	3
CO5	Develop the programs for desktop, web and enterprise application development using Visual Programming Techniques.	PSO1,PO2	3

Syllabus:

.Net framework Overview, .Net Architecture, Core C#-Variables, Data Types, Flow control, Objects and Types, Classes, Constructors and its types, Inheritance, polymorphism, sealed class and methods, interface, abstract class, exception handling, Generics – Arrays and Tuples, Operators and Casts, accessing data with ADO.NET, Data providers, Dataset, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration. Web application with web forms, Basics of HTML,CSS and Javascript,ASP.NET introduction, ASP.NET standard server controls- displaying information, accepting user-input, Displaying images, Page and State management techniques, Asp.Net validation controls, Designing websites with master pages.

Textbooks:

1. ASP.NET: The complete reference by Mathew Macdonald.

2. ADO.Net The complete reference by Michael Otey and Danielle Otey

3. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012

Reference books:

1. Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.

2. Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O"Reilly, 2010.

3. Programming ASP.Net core by Dino Esposito

Weblinks :

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1. https://www.linkedin.com/learning-login/share?forceAccount=false&redirect=https%3A%2F%2Fwww.linkedin.com%2Flearning%2Flearning-c-sharp-8581491%3Ftrk%3Dshare_ent_url%26shareId%3DM%252BdYADXBRZO%252BLTP0QGXdRg%253D%253D
2. https://www.linkedin.com/learning/paths/become-an-asp-dot-net-core-developer
3. https://www.youtube.com/watch?v=ccXz-olrFe0&list=PLWPirh4EWFpGdA3VPS9umbvP6YGT3hUU9
4. https://www.youtube.com/watch?v=RriFg1AFoT0&list=PLWPirh4EWFpFMkh4NFDzascBGWJ-E3zO8

MOOCS :

1. Coursera moocs: https://www.coursera.org/programs/cse-faculty-courses-an6zm/view-all-collections/curated?collectionId=&productId=y1aLxXVnEeuBTg7vUdMe9w&productType=course&showMiniModal=true
2. https://www.coursera.org/programs/cse-faculty-courses-an6zm/view-all-collections/curated?collectionId=&productId=Cj-q2zcuEeulxxlEigy4GQ&productType=course&showMiniModal=true
3. Linkedin courses: https://www.linkedin.com/learning/using-docker-and-dot-net-core/what-is-docker-why-use-it?autoAdvance=true&autoSkip=false&autoplay=true&resume=true
4. https://www.linkedin.com/learning/paths/become-an-asp-dot-net-developer
5. https://www.linkedin.com/learning/paths/become-an-asp-dot-net-core-developer
6. https://www.linkedin.com/learning/paths/become-a-c-sharp-developer

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3255R **Course Name: CROSS-PLATFORM DEVELOPMENT FRAMEWORKS**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: OOP**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Introduction to Kotlin, Layouts, and Navigations	PSO2, PO1	3
CO2	Connect to internet, Database Connectivity and Build APK	PO3, PSO2	3
CO3	Development of Flutter Application using DART	PO1, PO5	3
CO4	Build dynamic flutter application with Firebase and REST Operations	PSO2, PO1, PO5	3
CO5	Lab experiments on android application development	PO1, PO4	3

Syllabus:

CO1: Introduction to Kotlin- kotlin basics, OOPs concept in kotlin App life cycle, Android UI, and Material UI Components Layouts- Build two different apps and improve the UI of the app, material design guidelines, and UI development using widgets. Navigation- Enhance users' ability to navigate across and into and back out from various screens within the android app for a consistent and predictable user experience. CO2: Connect to the internet – routines for complex code and HTTP, REST API to get data from the internet and Coil library and Intro JETPACK suite. Database Connectivity: Database connectivity with SQLite3, MongoDB Deployment: Creating Dynamic Mobile Application and Deployment. CO3: DART Programming: basics of DART, Control flow, Null Safety, Functions, Data Processing, OOP Concept.Intro to Flutter: Introduction to development with Flutter – Material app using Android studio, widget tree, and pre-made Flutter widgets for UI design. Incorporate Image and text widgets to create simple user interfaces. Customize pre-built Flutter widgets. Add App icons for IOS and Android builds. Run Flutter apps on an IOS simulator, android emulator, and physical android and IOS devices. Creating effective UI with Flutter – Hot reload and Hot restart, Pubspec.yaml file to incorporate dependencies, custom assets, and fonts. Introduction to widget build() method. Incorporate layout widget material icons using the class of the icon. Building APP With Flutter: Building Apps with state- stateful and stateless widgets, call backs. The declarative style of UI programming. Flexible layouts using Flutter. setState(), state objects and stateful widgets. Using DART package manager – to incorporate Flutter compatible packages into projects. Functions in Dart and arrow syntax. Refactor widgets and understand Flutter's philosophy of UI as code. Structuring Flutter apps – Dart constructors to create customizable Flutter widgets. Apply common mobile design patterns to structure mobile apps. CO4: FIREBASE: Create, Update. Delete and Select Operations with Firebase with flutter APP REST API: How to create dynamic generate User interface material UI using flutter application using REST API Build, Deployment and publish app in Android and iOS

Textbooks:

1. Kotlin in action first edition by Dmitry Jemerov and Svetlana Isakova

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2. Flutter for beginners: An introductory guide to building cross platform mobile applications with Flutter and Dart by Alessandro Biessek.

Reference books:

1. Kotlin Programming : The big nerd ranch guide by big nerd ranch guides

2. Beginning Flutter : A hands on guide to app development paperback –illustrated 15 November 2019, By Marco L. Napoli

MOOCS:

1. https://www.coursera.org/programs/cse-faculty-courses-an6zm/browse?currentTab=CATALOG&productId=onanI5PsEeic_hJxqQLJmg&productType=course&query=kotlin&showMiniModal=true

2. https://www.linkedin.com/learning/learning-google-flutter-for-mobile-developers/android-setup?autoAdvance=true&autoSkip=false&autoplay=true&resume=true&u=89447330

Weblinks:

1. https://developer.android.com/kotlin

2.https://flutter.dev/?gclsrc=aw.ds&gclid=Cj0KCQiAubmPBhCyARIsAJWNpiP5KdgXa1aYPgdREb2ri3F0mb708Q9x3G89pip_BekuYshP0jTdPlQaAjBKEALw_wcB

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3258R **Course Name: SOFTWARE RELIABILITY**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: SE**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand Software Reliability and develop a software project from requirement gathering to implementation.	PO8, PO1, PO2, PO5	1
CO2	Analyze software system failures and develop convincing solutions	PO1, PO2, PO3, PO5, PO8	2
CO3	Estimate Software Reliability parameters using Markovian Modelling, Maximum Likelihood and Least Square Method	PO3, PO4, PSO1, PO1	3
CO4	Evaluate performance of Binomial-Type, Poison-Type and Markovian Models and Predict Software Reliability using SQA Intelligent Techniques	PSO1, PO2, PO5, PO8, PO11	4

Syllabus:

Software Reliability: Introduction to Software Reliability: The need for Software Reliability, Some Basic Concepts, Software Reliability and Hardware Reliability, Availability, Modelling and General Model Characteristics. Software Reliability Modeling: Halstead's Software Metric, McCabe's Cyclomatic Complexity Metric, Error Seeding Models, Failure Rate Models, Curve Fitting Models, Reliability Growth Models, Markov Structure Models, Defining failure for the product, common measure for all associated systems, setting system failure intensity objectives, determining develop software failure intensity objectives, software reliability strategies, failures, faults and errors, availability, system and component reliabilities & failure intensities, predicting basic failure intensity. Time Series Models, Non-homogeneous Poison Process Models. Markovian Models: General Concepts, General Poison-Type Models, Binomial -Type Models, Poison-Type Models, Comparison of Binomial-Type and Poison-Type Models, Fault Reduction Factor for Poison-Type Models. Descriptions of Specific Models: Finite Failure Category Models, Infinite Failure Category Models. Parameter Estimation: Maximum Likelihood Estimation, Least Squares Estimation, Bayesian Inference. Comparison of Software Reliability Models: Comparison Criteria, Comparison of Predictive Validity of Model Groups, Evaluation of other Criteria. Software Reliability Prediction: Problems associated with different Software Reliability Models, Software Reliability prediction parameters, Intelligent Techniques for Software Reliability Prediction. Software Quality Management: Software Quality Attributes, Quality Measurement & Metrics, Software Quality Assurance functions, Tool support for SQA.

Textbooks:

1. Michael R. Lyu, "Handbook of Software Reliability Engineering," IEEE Computer Society Press, McGraw-Hill Book Company, 2005.

2. John D. Musa, Anthony Iannino, Kazuhira Okumoto, Software Reliability Measurement, Prediction, Application. McGraw-Hill Book Company; 1987.

Reference books:

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1. Hoang Pham, System Software Reliability, Springer; 2005

2. David C. Kung, Object-Oriented Software Engineering: An Agile Unified Methodology, McGrawHill Education (India) Edition 2015.

MOOCS :

1. https://www.coursera.org/learn/site-reliability-engineering-slos

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3264R **Course Name: WEB SECURITY**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: CNS**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand and discuss about Web Security Concepts	PSO2,PO4	2
CO2	Identify different techniques involved in protecting privacy and principles of Web Security.	PO5,PSO2	3
CO3	Deploy SSL server Certificates , client side digital certificates and Microsoft's Authenticode	PSO2,PO6	3
CO4	Determine security for content providers through privacy policies and security legislations.	PSO2,PO6	3
CO5	Test the software /tools application completely and make it sure that it's performing well and as per the security specifications	PSO2,PO5	5

Syllabus:

Introduction Web Technology, Web Security Landscape, The Architecture of the World Wide Web, Cryptography Basics, Cryptography and the Web, Understanding SSL and TLS, Digital Identification I: Passwords, Biometrics, and Digital Signatures Digital Identification II: Digital Certificates, CAs, and PKI, The Web's War on Your Privacy, Privacy-Protecting Techniques, Web Server Security: Physical Security for Servers, Host Security for Servers, Securing Web Applications Deploying SSL Server Certificates, Securing Your Web Service, Computer Crime, Security for Content Providers: Controlling Access to Your Web Content, Client-Side Digital Certificates, Code Signing and Microsoft's Authenticode Security for Content Providers: Pornography, Filtering Software, and Censorship, Privacy Policies, Legislation, and P3P, Privacy Policies, Legislation, and P3P, Digital Payments, Intellectual Property and Actionable Content

Textbooks:

1. Simson Garfinkel, Gene Spafford, "Web Security, Privacy & Commerce, 2nd Edition, O'Reilly Media, Inc.
2. Web Security: A WhiteHat Perspective - 1st Edition - Routledge

Reference books:

1. Hanqing Wu, Liz Zhao, Web Security, A WhiteHat Perspective, 1st Edition.
2. Andrew Hoffman, Web Application Security, O'Reilly Media, Inc.

MOOCS :

1. Introduction to Structured Query Language (SQL) | Coursera

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3272R **Course Name: Computational Epidemiology**

L-T-P-S: 2-0-2-0 **Credits: 3**

Prerequisite: ARTIFICIAL INTELLIGENCE, DATA SCIENCE

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand the models of Epidemiology and applications of computational science in Epidemiology	PO2	2
CO2	Apply computational model on sparse disease incidence data to infer transmission probability, period of infectivity and reproduction number	PO3,PO4	3
CO3	Design a low-cost surveillance and infection control policy using an efficient computational model	PO6,PO7	4
CO4	Design a computational model for epidemic spread using Machine Learning concepts	PO5	4
CO5	Build and Inspect tools associated Epidemiology using R	PSO2,PO5	4

Syllabus:

Introduction, models, and Disease dynamics: Epidemiology and computational epidemiology, historical overview of epidemiology and computational epidemiology. The importance of understanding and controlling disease-spread. Mass action disease models. Networked computational epidemiology. Dynamics of disease-spread in mass action models and on contact network models. Inference, Prediction, and forecasting: Inferring disease model paraments-transmission probability, period of infectivity and reproduction number. inferring infection source and most likely cascades. Predicting future cases and forecasting epidemics. Infection Surveillance and Control: Designing low-cost disease surveillance and infection control policies. Surveillance includes placing data collection sites in clinics, performing extra testing on selected patients, swabbing selected surfaces in a hospital, etc. Infection control policies include vaccination, prescribing antibiotics and antivirals, quarantining, sequestering, etc. Machine Learning Application in Computational Epidemiology: Prediction in the Context of Observational Epidemiology, clinical decision support, disease surveillance, introduction to super learner

Textbooks:

1. Computational Epidemiology-From disease transmission modelling to vaccination decision making, Liu, Jiming, shang and Xia, Health Information Science, Springer-2020

MOOCS/Web Links:

1. https://cacm.cm.org/magazines/2013/7/165478-computational-epidemiology/fulltext.
2. http://www.bio.utexas.edu/research/meyers/_docs/publications/DimitrovINFORMS10.pdf.
3. https://www.annualreviews.org/doi/10.1146/annurev-publhealth-040119-094437
4. https://cran.r-project.org/manuals.html
5. Essential Epidemiologic tolls for Public Health Practice

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3274R **Course Name: SPEECH PROCESSING**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: ARTIFICIAL INTELLIGENCE**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand the speech production and perception mechanism, acoustic phonetics and phonology, speech prosody, and speech sound units.	PSO1, PO1	2
CO2	Understand the speech signal processing in time and frequency domain, discrete Fourier transform, short-time analysis of speech, linear prediction and cepstral analysis of speech.	PO1, PO3, PSO1	2
CO3	Apply machine learning models such as Dynamic time warping (DTW), Gaussian mixture models (GMM), Hidden Markov models (HMM), Support vector machines (SVM) and state of art Deep Neural Network (DNN) models, for speech processing.	PSO1, PO1, PO2	3
CO4	Apply machine learning approaches for various application of speech processing such as Speech and Speaker recognition, Speech synthesis and Speech enhancement, Language identification etc.	PSO2, PO1, PO5	3
CO5	Apply above speech processing approaches in laboratory experiments related to feature extraction, and development of machine learning models for speech processing.	PSO1, PSO2, PO1, PO2, PO3, PO5	3

Syllabus:

CO 1 (Speech Science) Overview of speech communication, Speech signal to symbol (sound unit) transformation, nature of speech signal, Speech Production and Perception, Phonetics and Phonology, Acoustics Phonetics, Speech Prosody, Different types of Speech Sound units. CO 2 (Speech signal processing (Analysis of speech)) Review of DSP techniques, Time and frequency domain analysis, z-transform, Discrete Fourier transform, short-time analysis of speech, spectrograms, Segmental analysis of speech, Cepstral analysis, Mel frequency cepstral coefficients (MFCC), linear prediction analysis, Linear prediction cepstral coefficients (LPCC). CO 3 (Machine learning models for speech processing) Traditional Approaches: Dynamic time warping (DTW), Gaussian mixture models (GMM), hidden Markov models (HMM), Neural network models, Support vector machines State of the Art Models: Deep Neural Networks, LSTM Recurrent neural networks, Convolutional neural networks, Reinforcement learning CO 4 (End-to-end speech-to-speech Translation) Speech recognition, Speaker recognition, Speech synthesis, Speech enhancement, Language identification, Emotion recognition, Prosody manipulation.

Textbooks:

1. L. R. Rabiner and B. H. Juang "Fundamental of Speech Recognition", Prentice- Hal International, Inc, 1993

2. L.R.Rabiner and R.W.Schafer, Digital processing of speech signals, Pearson LPE (1993).

3. Alan V. Oppenheim, R. W. Schafer, and J. R. Buck, "Discrete Time Signal Processing", Prentice Hall, Uper Saddle River, New Jersey 07458, 1999

4. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, The MIT Press, November 2016.

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5. Machine Learning, Tom M. Mitchell, Mg-Graw Hill, Indian Edition, 2019

6. Homayoon Beigi, Speaker Recognition: Advancements and Challenges, Recognition Technologies, Inc. 2021.

7. Paul Taylor, Text-to-Speech Synthesis, Cambridge University Press, 2011

8. Philipos C. Loizou, Speech Enhancement: Theory and Practice, CRC Press, Taylor and Francis, London, 2013.

9. Rajasekhar Nannapaneni, Human Emotion Recognition using Machine Learning, Dell Technologies Inc, 2019

MOOCS/Web Links:

1. http://web.stanford.edu/class/cs224s/
2. https://speech.zone/courses/speech-processing/
3. https://nptel.ac.in/courses/117/105/117105145/
4. https://www.youtube.com/watch?v=3MjIkWxXigM
5. Coursera Speech Recognition https://www.coursera.org/lecture/nlp-sequence-models/speech-recognition-sjiUm
6. Coursera Text-to-Speech https://www.coursera.org/lecture/google-machine-learning/text-to-speech-UNIgT

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3279R **Course Name: ADVANCED DATABASES**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: DBMS**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand the fundamentals of query optimization and database recovery protocols.	PSO2	2
CO2	Apply emerging database technologies and distributed databases.	PSO2	3
CO3	Analyze and Discriminate object oriented and relational database systems.	PSO2	4
CO4	Analyze multimedia databases.	PSO2	4
CO5	Build and Evaluate advanced database applications	PO1, PO2	5

Syllabus:

Query optimization, Heuristic in query optimization, selectivity and cost estimates in query optimization. Database tuning: An overview of databases Tuning in relational systems. Database Recovery Protocols: Recovery concepts, NO-UNDO/REDO Recovery Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, ARIES Recovery Algorithm. Advanced Database Models and Applications: Active Database Concepts, Temporal Database Concepts, Spatial Database Concepts, Deductive Databases. Emerging Database Technologies and Applications: Mobile Data Management, Geographical Information Systems (GIS), Genomic Databases. Distributed Databases: distributed database concepts, Types of Distributed database systems, Distributed database Architecture, Data Fragmentation, Allocation Techniques for Distributed Database Design, Query Processing and optimization in distributed database design, Overview of Transaction Management in distributed databases. Overview Of Concurrency Control and Recovery in Distributed Database Design. Object Oriented database systems: Object DBMSs, Weakness of RDBMSs, Object Oriented Concepts, Storing Objects in a Relational Database, Advantages and disadvantages of OODBMSs. Object Oriented DBMSs-Standards and Systems: Object Management Group, Object Data Standard ODMG 3.0, Object Store. Object Relational DBMSs:, Query Processing and Optimization, New Index Types, Object Oriented Extension in Oracle, Comparison of ORDBMS and OODBMS. Multimedia Databases: Multimedia databases, Multimedia Data, SQL and Multimedia-Manipulating Large objects, Querying Multimedia-Introduction, Manipulating Multimedia data. Multimedia modeling data, Multimedia Database Architecture, and performance. Dealing with Multimedia text, images, and video.

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Textbooks:

1. RamezElmasri, ShamkanthB.Navathe, "Fundamentals of Database Systems", 5th Edition Pearson, 2007.

2. Thomas Connolly, Carolyn Begg "Database Systems", 4th Edition, Pearson, 2012.

Reference books:

1. Dunckley Lynne, "Multimedia Databases: An Object Relational Approach", 1st Edition, Pearson Education, 2009.

2. Carlo Zaniolo, "Advanced database systems", Morgan Kaufmann, Elsevier, 1997.

3. Peter Rob and Corloscoronel,"Database Systems-Design, Implementation and Management ", 5th Edition, Thompson Learning, Course Technology, 2005

Web Links :

1. https://www.studyyaar.com/index.php/learning-program/7-advanced-database-management-system
2. https://dsinghpune.wordpress.com/advanced-database-management-system/
3. https://edutechlearners.com/advance-database-management-system-notes/
4. http://www.anirbanm.in/cse203

MOOCS :

1. Advanced Relational Database and SQL: https://www.coursera.org/learn/advanced-rdb-sql/home/welcome
2. Advanced Features with Relational Database Tables Using SQLiteStudio: https://www.coursera.org/learn/advanced-features-relational-database-table-sqlitestudio/home/welcome
3. Advanced SQL Retrieval Queries in SQLiteStudio: https://www.coursera.org/learn/advanced-sql-retrieval-queries-in-sqlitestudio/home/welcome
4. Advanced SQL for Query Tuning and Performance Optimization: https://www.linkedin.com/learning/advanced-sql-for-query-tuning-and-performance-optimization/reduce-query-reponse-time-with-query-tuning?autoAdvance=true&autoSkip=false&autoplay=true&resume=true&u=89447330
5. Advanced SQL: Logical Query Processing, Part 1: https://www.linkedin.com/learning/advanced-sql-logical-query-processing-part-1/course-introduction?autoAdvance=true&autoSkip=false&autoplay=true&resume=true&u=89447330

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3281S **Course Name: CLOUD & SERVERLESS COMPUTING**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand Cloud computing and analyse cloud service scheduling hierarchy.	PSO1, PO3	4
CO2	Understand Functions-as-a-service and Event-driven programming. Develop Scalable Models Using Serverless Architectures.	PO3, PSO1	3
CO3	Manage application functionalities using Serverless runtimes and Serverless databases.	PSO1, PO4	4
CO4	Apply Serverless Programming Practices and Patterns. Architect, Build, and Operate serverless applications.	PSO1, PO4	4
CO5	Build a real world and scalable full stack application using Serverless technologies.	PSO1, PO4	5
CO6	skill based -Build a real world and scalable full stack application using Serverless technologies.	PO4, PSO1	6

Syllabus:

Overview of cloud computing, Resource scheduling for cloud computing, Serverless AWS. Serverless Programming Practices and Patterns, building serverless applications using Java and AWS. Lambda. Building Serverless REST APIs with API Gateway. DynamoDB, Amazon Cognito, Web Hosting with S3, Route53, and CloudFront. Postman, Domain name services, Serverless Amazon Athena and the AWS Glue Data Catalog, Real-Time Data Insights Using Amazon Kinesis, Messaging and Notifications with SQS and SNS, Your first Serverless application on Azure, Google Cloud Platform, Example: Serverless Sensor Data Collector. Building Effective Serverless Applications with Kubernetes and OpenShift.

Textbooks:

1. Heartin Kanikathottu - Serverless Programming Cookbook - Practical solutions to building serverless applications using Java and AWS. (2020, Apress)

2. John Chapin_ Mike Roberts - Programming AWS Lambda_ Build and Deploy Serverless Applications with Java (2020, O'Reilly Media)

3. Nader Dabit - Full Stack Serverless_ Modern Application Development with React, AWS, and GraphQL (2020, O'Reilly Media, Inc.)

4. Praveen Kumar Sreeram - Azure Serverless Computing Cookbook_ Build and monitor Azure applications hosted on serverless architecture using Azure functions, 3rd Edition (2020, Packt Publishing)

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5. John Biggs_ Vicente Herrera Garcia - Building Intelligent Cloud Applications_ Develop Scalable Models Using Serverless Architectures with Azure (2019, O'Reilly Media)

Reference books:

1. Scott Patterson - Learn AWS Serverless Computing_ A beginner's guide to using AWS Lambda, Amazon API Gateway, and services from Amazon Web Services (2019, Packt Publishing)

2. Burr Sutter, Kamesh Sampath - Knative Cookbook_ Building Effective Serverless Applications with Kubernetes and OpenShift (2020, O'Reilly Media)

MOOCS:

1. Coursera Introduction to Amazon Web Services (AWS)
https://www.coursera.org/projects/introduction-to-amazon-web-services-aws

2. AWS Essential Training for Architects https://www.linkedin.com/learning/aws-essential-training-for-architects/amazon-web-services-essentials?u=89447330

3. Coursera AWS Fundamentals: Building Serverless Applications https://www.coursera.org/learn/aws-fundamentals-building-serverless-applications/home/welcome

4. Building Serverless Apps on AWS https://www.linkedin.com/learning/building-serverless-apps-on-aws-2018/code-your-get-lambda-function?u=89447330

5. AWS Lambda Foundations https://www.aws.training/Details/eLearning?id=27197

6. Build a RESTful Serverless API on AWS https://www.coursera.org/projects/restful-serverless-api-on-aws

7. Amazon DynamoDB for Serverless Architectures
https://www.aws.training/Details/eLearning?id=27196
8. Azure Serverless Computing https://www.linkedin.com/learning/azure-serverless-computing/welcome?u=89447330
9. Google Cloud Platform (GCP) Essential Training for Developers
https://www.linkedin.com/learning/google-cloud-platform-gcp-essential-training-for-developers/what-you-should-know?u=89447330

10. Kubernetes Essential Training: Application Development https://www.linkedin.com/learning/kubernetes-essential-training-application-development/getting-started-with-kubernetes?u=89447330

Weblinks:

1. https://aws.amazon.com/lambda/serverless

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3283R **Course Name: DATA ANALYTICS ON CLOUD**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: Data Science**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	To understand the Overview of cloud computing and its benefits for data analytics	PSO1,PO1	3
CO2	To analyse Cloud-based Data Warehousing and Big Data Analytics	PSO1,PO2	3
CO3	It Builds the knowledge about Cloud-based Data Integration and Governance	PSO1,PO3	3
CO4	It Identifies Cloud-based Analytics Case Studies and Trends	PSO1,PO3	4

Syllabus:

Introduction to Cloud Computing and Data Analytics : Overview of cloud computing and its benefits for data analytics, Understanding the differences between traditional on-premises and cloud-based data analytics, Introduction to cloud service providers (AWS, Azure, Google Cloud Platform) Data Analytics process and tools, Understanding cloud storage services and their benefits for data analytics, Introduction to cloud databases (relational, NoSQL). Introduction to cloud-based data warehousing, Big data processing and analytics on the cloud, Distributed computing in the cloud (MapReduce, Spark) , and Introduction to cloud-based machine learning tools and services. Introduction to cloud-based business intelligence s ,Creating and sharing dashboards and reports. Data visualization best practices for cloud-based analytics. Understanding data integration in the cloud, Dataa governance best practices for cloud-based analytics. Data security and privacy in the cloud, Compliance considerations in the cloud. Real-world case studies of cloud-based data analytics projects ,Emerging trends in cloud-based analytics (IoT analytics, serverless computing, etc.) , and Best practices for cloud-based analytics projects.

Textbooks:

1. Mastering Azure Analytics: Architecting in the Cloud with Azure Data Lake, HDInsight, and Spark, Zoiner Tejada, O'Reilly Media, 2017
2. Cloud Analytics with Google Cloud Platform: An end-to-end guide to processing and analyzing big data using Google Cloud Platform, Sanket Thodge, Packt Publishing, 2018
3. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, David Loshin, Morgan Kaufmann, 2013
4. Amazon Web Services in Action, Michael Wittig, Andreas Wittig, Manning Publications, 2015
5. Cloud Computing: Principles and Paradigms, Rajkumar Buyya , James Broberg, Andrzej Goscinski, WILEY , 2013

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3285R **Course Name: ARCHITECTING CLOUD SOLUTIONS**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: OPERATING SYSTEMS**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Design Resilient Architectures	PSO1,PO3,PO5	3
CO2	Design High-Performing Architectures	PSO1,PO1,PO3,PO5	3
CO3	Design Secure Applications and Architectures	PSO1,PO3,PO5	3
CO4	Design Cost-Optimized Architectures	PO3,PO5,PSO1	3
CO5	Designing solutions to the architecture of Cloud	PSO1,PO3,PO5	3

Syllabus:

Design a multi-tier architecture solution: Design a multi-tier architecture solution, Design highly available and/or fault-tolerant architectures, Design decoupling mechanisms using AWS services, Choose appropriate resilient storage. Design High-Performing Architectures: Identify elastic and scalable compute solutions for a workload, select high-performing and scalable storage solutions for a workload, select high-performing networking solutions for a workload, choose high-performing database solutions for a workload. Design Secure Applications and Architectures: Design secure access to AWS resources, Design secure application tiers, Select appropriate data security options. Design Cost-Optimized Architectures: Identify cost-effective storage solutions, Identify cost-effective compute and database services, Design cost-optimized network architectures.

Text Books:

1. AWS Certified Solutions Architect Study Guide, Ben Piper, David Clinton, Sybex publishers, 2020.
2. AWS Certified Solutions Architect Associate: The ultimate guide for the SAA-C02 exam, Anderson, Jonathan, 2020

Reference Books:

1. AWS Certified Solutions Architect - Associate Quick Reference Guide, Specialist, IP, 2020
2. AWS Certified Solutions Architect Associate All-in-One Exam Guide, Joyjeet Banerjee, McGraw-Hill Education,2021

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3286R **Course Name: CLOUD DEVOPS**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: SE**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Apply a test scenario that are appropriate for software development in many fields	PO1, PO2, PO4 & PSO1	3
CO2	Create a test plan dependent on document leveraging test automation tools	PO2, PO3,PO4 & PSO1	4
CO3	Create an automated testing tools and test plan based on documents	PO1, PO3, PO4, PSO1	4

Syllabus:

Networking Fundamentals: Network Fundamentals, Storage Fundamentals, Databases Fundamentals, Webservers (NGINX), LINUX Basic and Admin Importance of Linux in DevOps, Linux Basic Command Utilities, Shell Scripting Devops Fundamentals: Cloud Fundamentals, AWS fundamentals, SDLC, Devops Fundamentals: Git,Maven. Terraform: Overview, Terraform with AWS, Terraform -variables, conditions, iterator, provisioner, functions, modules, workspace, backends. Ansible: YAML, introduction, Architecture, Playbook Concepts, Ansible Inventory and Configuration, Ansible Modules, Roles. Docker & Kubernetes: How to get Docker Image? What is Docker Image, Docker Installation, working with Docker Container What is Container o Docker Engine, Crating Containers with an Image, Working with Images, Docker Command Line Interphase, Docker Compose, Docker Hub, Docker Trusted Registry, Docker swarm, Docker attach Docker File & Command, Kubernetes Architecture, Design and Install a Kubernetes Cluster. Jenkins: Introduction to Jenkins,Continuous Integration with Jenkins, Configure, Jenkins, Jenkins Management, Scheduling build Jobs, Maven Build Scripts, Support for the GIT version control System, Jenkins Build Pipeline Parent and Child Builds, Sequential Builds, Jenkins Master & Slave Node Configuration, Installing Jenkins Plugins, SCM plugin, Build and test. Build and Inspect the Tools associated to DevOps Life Cycle.

Textbooks:

1. Web Technologies: Concepts, Methodologies, Tools, and Applications, Arthur Tatnall, Information Science Reference, 2009

2. Beginning DevOps with Docker, Joseph Muli, PACKT Publishing, 2018

3. Introducing Maven: A Build Tool for Today's Java Developers, Richard Bullington-McGuire, Andrew K. Dennis, Michael Schwartz, Kindle Edition, 2021

4. Cloud computing, Shailendra singh, Oxford Higher education, 2021

5. Cloud computing, MN RAO, PHI Learning, 2021

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3282R **Course Name: MACHINE LEARNING ON CLOUD**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: Machine Learning**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand the concepts of Cloud Environments	PO1,PO2, PSO2	3
CO2	Demonstrate the working of Sample Preprocessing models	PO2,PO3,PO4, PSO 1, PSO2	4
CO3	Demonstrate the classification and clustering models in the cloud environment	PO1, PSO2,PO3, PSO2	4
CO4	Understand Amazon translate, azure Bot service and Google cloud autoML models on real time data	PPO2,O3,PO4, PSO2	5

Syllabus:

Introduction machine learning, introduction to cloud computing, Why Cloud Computing in Machine Learning, Advantages of Machine Learning with Cloud Computing, Types of Cloud-Based Machine Learning Services: Artificial Intelligence as a Service (AIaaS),GPU as a Service (GPUaaS),Cloud computing platforms for Machine Learning: AWS SageMaker, Azure Machine Learning, Google Cloud AutoML, IBMWatson. Amazon SageMaker: Identify and Understand Your Data Sources, Engineer the Features, engineer the features, Train and validate ML model, Introduction to Microsoft Azure Machine Learning studio, Microsoft Azure Databricks , hands-on examples on machine learning, An Overview of Google Cloud Platform Services, The Google Cloud SDK and Web CLI, Google Cloud Storage (GCS), Google Cloud AI Platform-develop sample. Amazon Forecast: train and deploy the mode, Azure: create classification models with Auto ML , Build an Azure ML pipeline that ingests data, trains a model, and deploys a web service. manage machine learning models like classification, regression and clustering in Google Cloud, Google Cloud Vision AI -develop machine learning applications to easily integrate vision detection features such as image labeling, text detection, face detection, tagging. Amazon Translate : Understand data source, Train and validate ML model with amazon translate, Microsoft Azure Bot Service – create intelligent bot services for machine learning applications. Google Cloud AutoML - train the machine learning model to generate automating machine learning models. ML pipeline automation.

Textbooks:

1. Pragmatic AI | An Introduction to Cloud-Based Machine Learning, Noah Gift, Pearson
2. Machine Learning in the AWS Cloud, Abhisek Mishra, Wiley
3. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge University Press
4. Cloud Computing for Machine Learning and Cognitive Applications, Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra, Morgan Kaufmann, Apress

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19CS3284R **Course Name: SECURITY SOLUTIONS IN CLOUD**

L-T-P-S: 2-0-2-0 **Credits: 3** **Prerequisite: CNS**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand the concepts of Cloud, and observing various Cloud Resources	PSO2	2
CO2	Analyze the ideas behind the working models of cloud networking system.	PSO2	3
CO3	Apply the techniques and procedure into project proto type.	PSO2	4
CO4	Relate various concepts of data security.	PSO2	4
CO5	To entertain the students into the Practice on various threads and securing the clouds.	PO1, PO2	5

Syllabus:

Basics of digital security, protecting personal computers and devices, protecting devices from Virus and Malware, Identity, Authentication and Authorization, need for strong credentials, keeping credentials secure, protecting servers using physical and logical security, World Wide Web (www), the Internet and the HTTP protocol, security of browser to web server interaction. Introduction to cyber-attacks, application security (design, development and testing), operations security, monitoring, identifying threats and remediating them, Principles of data security - Confidentiality, Integrity and Availability, Data Privacy, Data breaches, preventing attacks and breaches with security controls, Compliance standards, Computer Ethics. Gauging the threat – Security concepts – Set UID Programs. Strings - Common String Manipulation errors - Improperly Bounded String Copies - Off-by-One Errors – Null Termination Errors - String Truncation - String Errors without Functions - String vulnerabilities - Buffer Overflow - Process memory organization – Stack management - Stack smashing – Mitigation techniques – String handling functions – Runtime protection strategies. How to build private cloud using open-source tools Understanding various cloud plugins, setting up your own cloud environment Autoprovisioning Custom images Integrating tools like Nagios Integration of Public and Private Cloud. • 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 consideration. Trustworthy cloud infrastructures, Differential privacy, Secure computations, High-availability and integrity layer for cloud storage, Homomorphic encryption, Malware

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and cloud, Cloud forensics. Cloud-centric regulatory compliance issues and mechanisms. Case Study of sample cloud services. Project Work - Designing of sample cloud services.

Textbooks:

1. Sammons, John, and Michael Cross. The basics of cyber safety: computer and mobile device safety made easy. Elsevier, 2016.
2. Tim Mather, S. Kumaraswamy and S. Latif, "Cloud Security and Privacy: An EnterprisePerspective on Risks and Compliance", O'Reilly Media, 2009
3. Ronald L. Krutz Russell Dean Vines "Cloud Security: A Comprehensive Guide to SecureCloud Computing", Wiley ,2010

Reference Books:

1. Charles P. Pfleeger, Shari Lawrence, Pfleeger Jonathan Margulies; Security in Computing, Pearson Education Inc . 5th Edition, 2015
2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons, 2018
3. [Paper] Roy, Indrajit, et al. "Airavat: Security and Privacy for MapReduce." NSDI. Vol. 10. 2010.
4. [Paper] Bowers, Kevin D., Ari Juels, and AlinaOprea. "HAIL: a high-availability andintegrity layer for cloud storage" Proceedings of the 16th ACM conference on Computer andcommunications security. ACM, 2009.
5. [Paper] Dean, Jeffrey, and Sanjay Ghemawat. "MapReduce: simplified data processing onlarge clusters" Communications of the ACM 51.1 (2008): 107-113.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19EC1101 **Course Name: DIGITAL LOGIC & PROCESSORS**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Describe the concepts of number systems with codes and logic gates usage in digital circuit design and identify the logical expressions in different forms and their minimization techniques for logical circuit optimization. Code conversions and Digital IC's realization with respect to data sheets.	PO5	2
CO2	Employ Combinational logic circuits with minimization techniques and logical verification through hardware description language	PSO1,PO5	3
CO3	Substantiation of Sequential logic circuits and logical verification through hardware description language	PSO1,PO5	3
CO4	Implementation of digital circuits using PAL, PLA and FPGA. Discriminate the operations of ALU and execution of microinstructions.	PO5	4
CO5	Analyse the digital IC logic for combinational and sequential circuits implementation	PO6	4

Syllabus:

Basics of Logic Design: Number systems: Binary, Octal and Hexa decimal; Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Karnaugh map, Digital waveform characteristics; Codes: BCD, ASCII, Parity and Alphanumeric; Code Conversion, Logic Gates TTL and CMOS ICs, IC Data sheet parameters, Clock Buffer (7440) and level shifter (CD 4504) Combinational Logic design: Half Adder/Subtractor (7486, 7408 and 7404); Full adder using 7483, Full Subtractor using simple gates, Decoders (74HC238,74LS154), Encoders(CD4532,74184), Multiplexers/Demultiplexers (4051, 4052, 4053), Magnitude Comparators (4585 , 7485), Parity Generators and Checkers (74180), BCD to seven segment decoder (74LS47), Verilog HDL design for Combinational Logic Functions. Sequential Logic design: NAND/NOR Latches Gated Latches (4011/4001), JK (7476/4027) and D Flip-flops (7474/4013), Shift registers (SISO, SIPO, PISO,PIPO), Design of Synchronous counters (7476, 7490, 7493) and Asynchronous Counters (4013), Up-down counters (74193/CD4510),Ring and Johnson counters, Digital Clock design, Verilog HDL design for Sequential Logic Functions Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Logic implementation using Programmable Devices. Introduction Field Programmable Gate Arrays, Applications of FPGAs. Processors: Block diagram of generic processors, ALU, Instruction register, Instruction decoder, execution of micro instructions (Adding two HEXA Numbers).

Textbooks:

1. Stephen Brown and Zvonko Vrane "Fundamentals of Digital Logic with Verilog Design" Second Edition, McGraw-Hill.

2. M. Morris Mano, "Digital Logic and Computer Design", Pearson

3. Microprocessors and interfacing programming and hardware by Douglas V Hall

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Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009

2. J. Bhasker, "Verilog HDL Synthesis, A Practical Primer", Star Galaxy Publishing.

3. Digital Fundamentals by A Anand Kumar, PHI

4. Microprocessor Architecture, Programming and Applications with 8085 by Ramesh Gaonkar

MOOCS/Web Links:

1. https://onlinecourses.nptel.ac.in/

2. https://onlinecourses.nptel.ac.in/noc18_ee33/preview

3. https://drive.google.com/file/d/1lpksgYbRX2kD7LXLk62B-LSnd8tSXz2k/view

4. https://www.youtube.com/watch?v=qqeRUgAvmzQ

5. https://www.youtube.com/watch?v=o1-hj6GKaFY

6. https://www.youtube.com/watch?v=2gI3aC5blfA

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19EC1213 **Course Name: BASIC ELECTONIC CIRCUITS**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Understand the passive circuit elements and working.	PO1, PO5	2
CO2	Understand the basic circuit analysis techniques	PO5, PO1	3
CO3	Understand the active circuit elements and working.	PO1, PO5	2
CO4	Understand the applications of semiconductor devices	PO1, PO5	3

Syllabus:

Basic passive Circuits elements: Types of elements- Resistor, Inductor, Capacitor, energy sources and their properties, Ohm's Law. Circuit Analysis: Mesh and Node Analysis. Network Theorems:- Superposition, Reciprocity, Thevenin's, Norton's, Maximum power transfer, star/delta transformation and source transformation. - Simple numerical problems. Basic active Circuits elements: P & N-type semiconductors, P-N junction, forward bias and reverse bias, V-I characteristics, ideal and practical diodes, approximate model, diode data sheet, types of diodes and variants (Introductory level only), Types of transistors (PNP and NPN). Applications of active elements: Clippers, Clampers, Rectifiers - HWR, FWR with and without capacitive filters. Power supply with ripple reduction and regulation, Zener diode as a voltage regulator. Applications of Transistor: Transistor as an amplifier, switching transistors, power transistors (low, medium and large power), key parameter from data sheet. Analog & Digital ICs: 7805,7905, IC 741, IC 555, LM 339, LM723.

Textbooks:

1. John Bird . Electrical Circuit Theory and Technology, Routledge publishers, 6th edition, 2017.

2. Electronic Devices and Circuit Theory 12th Edition - Robert L. Boylestad

Reference books:

1. A Sudhakar, Shyam mohan S Palli , Circuits and Networks: Analysis and Synthesis, TMH, 5e 2. David A. Bell, Electronic Devices and Circuits, 5th Edition

MOOCS/Web Links:

1. https://www.youtube.com/watch?v=5d_TTQ2OJtM&t=126s
2. https://www.youtube.com/watch?v=ykgmK0VkyW0
3. https://www.youtube.com/watch?v=Pp5AAj2aIzc&t=94s

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4. https://www.youtube.com/watch?v=J0TjW_0xTJU&t=895s

5. https://www.youtube.com/watch?v=J0TjW_0xTJU&t=895s

6. https://www.youtube.com/watch?v=jfstUsnCmao

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19ME1103 **Course Name: DESIGN TOOLS WORKSHOP – I**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Practice design thinking by developing artistic skills	PO3	2
CO2	Visualize and complete his innovative design by final drafting using photogrammetric and model his design using prototyping technique	PSO2, PO4	3
CO3	Understand & apply the concept of AI , machine learning & Data analytics & finalize the requirements to design his idea	PSO2, PO5	3
CO4	Draft a report of his project from the initial stage & make a report which include scope, time and cost management of his project	PSO2, PO4	3

Syllabus:

Introduction to Design thinking: Design thinking, usage of visualization tool, Physics and preparation for Innovation, Idea generation and mind mapping, Strategic opportunities, Storytelling tool. Photogrammetry: Basic concepts of photogrammetry, types of photogrammetric techniques and measurements. Prototyping: Prototyping, including paper and tool-based prototyping, design principles and patterns, 3D Modeling, 360 Prototyping, 3D Printing. Engineering Project Management: Scope, Time and Cost Management. Data Analytics: Introduction to data analytics, Basic statistical mathematical operations using R language, Descriptive statistics mean, mode and median using R language. Artificial Intelligence: Introduction, water jug problem, Chat bot problem in python Machine Learning: Introduction to machine learning, Data preprocessing technique, Linear regression, using python.

Textbooks:

1. "Complete Design Thinking Guide for Successful Professionals" by Daniel Ling
2. "Project Management" by K. Nagarajan, 7th Edition, New Age International Publishers.
3. "Augmented Reality and Virtual reality" by Timothy Jung, M.Claudia Tom Dieck, Springer.
4. "Rapid Prototyping: Principles and Applications"by Chua C.K., Leong and Lim. C.S, 2nd Edition, World Scientific.
5. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, 3rd Edition, Prentice

MOOCS/Web Links:

1. https://www.coursera.org/learn/uva-darden-design-thinking-innovation?
2. https://www.coursera.org/learn/introduction-virtual-reality?specialization=virtual-reality
3. https://www.coursera.org/learn/scope-time-management-cost

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19MT2102 **Course Name: MATHEMATICS FOR ENGINEERS**

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

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Apply differential and integral calculus to find maxima & minima of functions, evaluate the integrals and solve the ordinary differential equations.	PO1	3
CO2	Demonstrate the Fourier series and Laplace transforms and solve the Partial differential equations.	PO1	3
CO3	Describe probability , Random Variables and Distributions	PO1	3
CO4	Explain complex variables, analytic functions and introduction to stochastic process and Algebraic structures.	PO1	3

Syllabus:

(A)Introduction to Advanced Matrix Algebra: Decomposition, Complex Matrices (B)Calculus (a) Differential and Integral Calculus: Taylor's series for function of two variables, Maxima and Minima for functions of two variables, Evaluation of double and triple integrals, change of order of Integration, Change of Variables, in polar, cylindrical and spherical coordinates. (b) Vector Calculus: Scalar and vector point functions, Gradient, Directional Derivative, Divergence and Curl, Evaluation of line integrals, Introduction to Greens and Stoke's theorems and their applications. (c) Ordinary Differential Equations: Solution of first order equations and their Applications, Newton law of cooling, Growth and Decay, Solution of Second and higher order Differential equations. (C) Laplace Transforms: Laplace and Inverse Laplace transforms and their properties. (D) Fourier Series: Definition, Dirchelt conditions, Fourier series for simple functions. (E) Partial Differential Equations: Formation of PDE, Solution of first order linear equations – Lagrange's method, Solution of second order PDE by separation of variables. Laplace's equation in two dimensions. (F) Probability and Random Variables: Probability, Addition, Multiplication and Baye's theorems. Random variables, Probability Distributions – Binomial, Poisson and Gaussian distributions, Introduction to Markov process. (G) Complex Variables: Complex functions- Exponential, Logarithmic and Trigonometric functions, Analytic function, Cauchy - Riemann equations, Introduction to Milne Thomson method. (H) Algebraic Structures: Introduction to Structure of Algebras, Semi groups, Monoids and Groups, Homomorphism's, Normal subgroups and congruence Relations, Rings.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Willey & Sons, 10th edition, 2010, New Delhi, India.

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Reference Books:

1. R.E.Walpole, R.H.Myers, S.L.Myes, Keying Ye, Probability and Statistics for Engineers and Scientists, , Pearson's Publications , 9th edition, 2012, USA.

2. Mott, J.L., Kandel, A. and Baker, T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India Private Ltd, 1986, India.

3. Tremblay J P and Manohar R, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill publishers, 1st edition, 2001, India.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19SC1209 **Course Name: DESIGN TOOLS WORKSHOP – II**

L-T-P-S: 0-0-4-0 **Credits: 2** **Prerequisite: DESIGN TOOLS WORKSHOP - I**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Practice the design ideology by 3D printing, 3D scanning techniques	PO3	2
CO2	Visualize the design ideology by incorporating VR technique and VR technology, Visualize and present his design idea by applying AR technique and Hologram	PSO2, PO5	3
CO3	Practice on PCB technology	PO4	2
CO4	Practice of Arduino based skill with different interfaces	PO4	2

Syllabus:

Design Thinking in 3D Printing technology, Photogrammetry. Introduction to 3D printing, Part Model 3D printing through FDM process, Assembly Model 3D printing through FDM process. Introduction to Photogrammetry, Photogrammetry by 3D scanning technology. Virtual Reality: Hardware and History, VR Applications, Psychology of VR: the three illusions, challenges in virtual reality, Future of Embodiment in VR, Realism, Graphics, Real-Time 3D Graphics in Games, Basic Concepts in 3D Computer Graphics, Realism Animation, Navigation, Nausea. Room Scale VR, Holography, Mirror Reality. Setting up room scale VR, Simulation of virtual environment, Stereoscopic Vision, Perspective, Interference and Diffraction, Laser Viewable Holograms, Real and Virtual Images, Introduction to mirror reality. Augmented Reality: Augmented Reality, characteristics of AR systems and main components of an AR architecture, Augmented Reality with Geolocation, Customizing an augmented reality game. Arduino: Interfacing with display, sensors and actuators. Interfacing of LED with Arduino, Interfacing of LED with push button with Arduino, Interfacing of temperature sensor with Arduino, Interfacing of LCD to display data with Arduino, Interfacing of DC motor.

Textbooks:

1. "Complete Design Thinking Guide for Successful Professionals" by Daniel Ling

2 "Project Management" by K. Nagarajan, 7th Edition, New Age International Publishers.

3 "Augmented Reality and Virtual reality" by Timothy Jung, M.Claudia Tom Dieck, Springer.

4 "Rapid Prototyping: Principles and Applications"by Chua C.K., Leong and Lim. C.S, 2nd Edition, World Scientific.

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5 "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall.

MOOCS/Web Links:

1. https://www.coursera.org/learn/uva-darden-design-thinking-innovation?
2. https://www.coursera.org/learn/uva-darden-design-thinking-innovation?
3. https://www.coursera.org/learn/augmented-reality
4. https://www.coursera.org/learn/prototyping-design

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 19TS3001 **Course Name: TECHNICAL SKILLS JAVA-PBL**

L-T-P-S: 0-0-0-10 **Credits: 2.5** **Prerequisite: NIL**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO5	Understanding the concepts of MEAN stack, JAVA and RPA and Applying the same in FULL Stack web development, window applications and bot creation.	PSO1, PSO2, PO2	3

Syllabus:

Mean Stack Syllabus: Angular: - Intro to MEAN and basics of typescript, Intro to Angular, Installing Angular CLI, Angular Architecture and Angular Components, Data Binding in Angular, Directives in Angular, Routing, Decorators, Angular Material, Angular Forms, Dependency Injection and Services in Angular. MongoDB: - Intro to NOSQL, Intro to MongoDB, setting up MongoDB, Basics of MongoDB, Creating Collection and Documents, Find and Pretty Functions, CRUD Operations, Filter Documents – writing criteria, limit, skip and sorting documents. NodeJs:- Intro to Node and Node Setup, REPL, Accessing the Process Object, Core Modules and Local Modules, NPM, Event Driven Architecture, Asynchronous vs Synchronous, User Inputs, Errors, File Systems, Readable and Writable streams, Creation of a HTTP Serv ExpressJs:- Intro to ExpressJs, Setting up Express, Configuring Routes, Mongoose, Serve Static Files, Middleware Functions,Processing request with Body Parsers, Server status and JSON responses, Introduction to ReactJS with typescript, TSX and Babel, Embedding Expressions, Template Literals, TSX Attributes & Styling React Elements. Java-PBL Syllabus: Introduction to Project Based Learning, different oops concepts, Modular programing, what is a project. Division of project modules. Collection Framework, Array List class, Linked List class, List Iterator interface, Hash Map class, Hash table class, Exception Handling and Logging: What and Why? try and catch block, Exception Propagation, Custom Exception. Jdbc: Introduction to jdbc, What Is the JDBC API, Driver Types, Connection Overview, Driver Manager Overview, Statement Overview, Result Set Overview, Prepared Statement Overview. Introduction to Design Patterns: Creational & Structural Patterns, Behavioural Design Patterns, Working with Design Patterns & Anti-patterns. Introduction to Git and GitHub, Install git and create a GitHub account, Create a local git repository, Create a new repository on GitHub, create a new branch and commit. JUnit Introduction, unit Environment Setup, Features of JUnit Test Frame work, Writing a Junit tests, Junit Assertions, JUnit - Plug with Eclipse. RPA Syllabus: Introduction to RPA, Scope and Techniques of Automation, Components of RPA, RPA Platforms and Comparison, Introduction to Automation Anywhere, Automation Anywhere Architecture, Task Recorder: Smart Recorder, Screen Recorder and Web Recorder, Introduction to Workbench, Inserting Mouse Click, Mouse Moves and Key Strokes, Variables and Variable Manager, Variable Operations, Reading User Input- Promt Command, If/Else Commands: Files/Folders, Windows, Applications, Task and Variable. File Operations & Reading Data Basic Files and Folder Commands, Read from Text/CSV, Usage of Filedata Column Variables, Introduction to Excel Automation, Usage of Excel Column Variables, Loops, String Operations, Introduction to Object Cloning, Usage of Excel Column/Filedata Column Variables with Object Cloning, PDF Integration, OCR. Error Handling & Email Automation Introduction to Error Handling, Error Handling options: Snapshot, Run Task, Log Data into File, Send e-mail and Variable Assignment, Send Mail Command, Read Mails, Delete Mails, Certificate Generation and Mailing. Control Room & AA Client Introduction to Control Room, Control Room Components: Dashboard, Repository Manager, Operations Room, User Management, Task Schedules, Security and Application Manager, AA Client: Properties, Schedule and Trigger.

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Textbooks:

1. Mean stack: The Full Stack Developer, Author: Chris Northwood

2. Java PBL: J2SE: The complete reference by James Keogh, publisher: McGraw-hill Osborne Media, 1st Edition, 2002.

3. Beginning Java EE 6 platform with Glass Fish 3 From Novice to Professional by Antonio Goncalves, 2009, Apress Publisher.

Reference books:

1. Mongo DB – The Definitive Guide by Krishna Chodorow, Publisher: Oreily, Second Edition

2. Mastering Mongo DB 4.x by Alex Giamas, Publisher: Packt, Second Edition.

3. ng-book , Publisher:Nate Murray, Felipe Coury, Ari Lerner, Carlos Taborda

4. Java - PBL: Java - The Complete Reference Herbert Schildt 11th Edition McGraw Hill Education

5.Head First Java Kathy Sierra & Bert Bates 2nd Edition Shroff/O'Reilly

Web Links:

1. Intro to TypeScript https://www.udemy.com/course/understanding-typescript/

2. https://www.coursera.org/learn/angular

3. https://www.coursera.org/learn/introduction-mongodb

4. https://www.udemy.com/course/typescript-asyncawait-in-node-js-with-testing/

5. https://www.udemy.com/course/react-with-typescript/

6. https://beginnersbook.com/java-tutorial-for-beginners-with-examples/

7. https://www.udemy.com/complete-jdbc-programming-part-1/

8. https://www.udemy.com/complete-jdbc-programming-part-2/

9. https://product.hubspot.com/blog/git-and-github-tutorial-for-beginners

10. https://guides.github.com/introduction/git-handbook/

11. https://www.guru99.com/junit-tutorial.html

12. https://www.tutorialspoint.com/junit/index.htm

13. https://university.automationanywhere.com/rpa-learningtrails/automation-anywhere-university-essential-level-prep-courses-engineering-students/

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14. https://university.automationanywhere.com/rpa-learning-trails/advanced-rpa-professional/

MOOCS:

1. Intro to TypeScript https://www.udemy.com/course/understanding-typescript/

2. Angular Using TypeScript https://www.coursera.org/learn/angular

3. Intro to MongoDB https://www.coursera.org/learn/introduction-mongodb

4. Node and Express Using TypeScript https://www.udemy.com/course/typescript-asyncawait-in-node-js-with-testing/

5. React Using TypeScript https://www.udemy.com/course/react-with-typescript/

6. Java - PBL: https://beginnersbook.com/java-tutorial-for-beginners-with-examples/

7. https://www.udemy.com/complete-jdbc-programming-part-1/

8. https://www.udemy.com/complete-jdbc-programming-part-2/

9. https://product.hubspot.com/blog/git-and-github-tutorial-for-beginners

10. https://guides.github.com/introduction/git-handbook/

11. https://www.guru99.com/junit-tutorial.html

12. https://www.tutorialspoint.com/junit/index.htm

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code: 18CY1005 **Course Name: CHEMISTRY FOR ENGINEERS**

L-T-P-S: 0-0-0-8 **Credits: 2** **Prerequisite: NIL**

CO#	Course Outcome (CO)	PO / PSO	BTL
CO1	Predict potential complications from combining various chemicals or metals in an engineering setting	PO1,PO3,PO7	2
CO2	Discuss fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena	PO1,PO3	2
CO3	Classify water quality and select appropriate purification technique for intended problem	PO1,PO7	2
CO4	Demonstrate the basic knowledge of instrumental methods and their applications in the structural analysis of materials	PO1,PO7	2

Syllabus:

Electro Chemistry: Single electrode potential and its measurement, Electrochemical cells, EMF series, Nernst equation, Cell emf measurement, Reversible and irreversible cells, Concentration cells, Reference electrodes-Determination of pH using glass electrode. Gas Sensors: Capacitance Manometer and Mass Spectrometer. Batteries: Chemistry, construction and engineering aspects of Primary (mercury battery) and secondary (lead-Acid cell, Ni-Metal hydride cell, Lithium cells) and fuel cells– Hydrogen–Oxygen fuel cell, advantages of fuel cell; Energy and Chemistry: Energy Use and the World Economy, Defining Energy, Energy Transformation and Conservation of Energy, Heat Capacity and Calorimetry. Enthalpy, Hess's Law and Heats of Reaction, Energy and Stoichiometry. CORROSION & ITS CONTROL: Causes and different types of corrosion and effects of corrosion. Theories of corrosion– Chemical, Electrochemical corrosion, Pitting corrosion, stress corrosion, Galvanic corrosion. Factors affecting corrosion– Nature of metal, galvanic series, over voltage, purity of metal, nature of oxide film, nature of corrosion product. Nature of environment- effect of temperature, effect of pH, Humidity, effect of oxidant. Cathodic protection, sacrificial anode, impressed current cathode, electroplating: WATER Technology: Introduction, Hardness: Causes, expression of hardness – units – types of hardness, estimation of temporary and permanent hardness of water, numerical problems. Alkalinity and estimation of alkalinity of water, numerical problems. Boiler troubles – Scale & sludge formation, caustic embrittlement, Boiler corrosion, priming & foaming. Softening of water: Internal and external treatments -Lime soda, Ion exchange process. Desalination-reverse osmosis and electro dialysis Instrumental Methods and Applications: Introduction to spectroscopy–types of energy present in molecules, types of spectra, UV-Vis spectroscopy – principle, types of electronic transitions, chromophore, auxochrome, Bathochromic shift, Hypsochromic shift, Instrumentation of UV-Vis spectrophotometer, applications; Infrared spectroscopy – principle, types of vibrational modes, group frequencies, Instrumentation of IR spectrophotometer, applications. principle and applications of physicochemical methods (SEM, TEM, X-ray diffraction).

Textbooks:

1. Engineering Chemistry, Jain & Jain, Dhanpat Rai Publishing Company. New Delhi.

2. Engineering Chemistry, O G Palanna, The Tata McGraw Hill, New Delhi.

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3. Instrumental methods of analysis by H.H Willard, Meritt Jr. and J.A Dean

4. Instrumental Method of Chemical Analysis by G.R.Chatwal and S.K.Anand

5. Electron Microscopy and Analysis by Peter J. Goodhew, John Humphreys, Richard Beanland

Reference books:

1. Chemistry in Engineering and Technology, Volume 2, J C Kuriacose & J Rajaram, Tata McGraw Hill, New Delhi.

2. Chemistry for Engineers Rajesh Agnihotri, Wiley, New Delhi.

3. Engineering Chemistry, B. Sivasankar, The Tata McGraw Hill, New Delhi.

4. A textbook of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co. New Delhi.

5. Engineering Chemistry, C Parameswara Murthy, C V Agarwal and Andra Naidu, B S Publications, Hyderabad.

6. Engineering Chemistry, Shikha Agarwal, Cambridge University Press.

7. Scanning Transmission Electron Microscopy Imaging and Analysis by Stephen J. Pennycook (auth.), Stephen J. Pennycook, Peter D. Nellist (eds.)

Weblinks:

1. http://www.chem1.com/acad/webtext/elchem/

2. https://nptel.ac.in/downloads/122101001/

3. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.ht

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Annexure-3(a)

B.Tech - Computer Science and Engineering 2019-20 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
19CS3277R	BIOINFORMATICS	PFE-4	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 Networks: Networks, Geographical Scope, Communication Models, Transmissions Technology, Protocols, Bandwidth, Topology , Hardware , Contents , Security, Ownership, Implementation, Management Data Visualization: Data Visualization, sequence	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 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	Added: CO2: Search Engines: The search process , Search Engine Technology , Searching and Information Theory, Computational methods , Search Engines and Knowledge Management. CO4: 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 ,	CO2, CO4	1. Develop the skills to design and implement effective search engines. 2. Apply the principles of searching and information theory to real-world problems. 3. Understand about the different systems biology tools and how they can be used to study biological systems	30%

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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
			visualization , structure visualization , user Interface , Animation Versus simulation , General Purpose Technologies. Statastics: 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 Data Mining: Clustering and Classification , Data Mining , Methods , Selection and Sampling, Preprocessing and Cleaning , Transformation and Reduction , Data Mining Methods , Evaluation , Visualization, Designing	and Knowledge Management Data Visualization: Data Visualization, sequence visualization , structure visualization , user Interface , Animation Versus simulation , General Purpose Technologies. Statastics: 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 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,	standards , Issues , Security, Intellectual property.			

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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
			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.	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. Modeling and Simulation : Drug Discovery , components , process , Perspectives , Numeric considerations , Algorithms , Hardware , Issues, Protein structure , AbInitio Methods , Heuristic methods, Systems Biology , Tools , Collaboration and				

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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
				Communications , standards , Issues , Security, Intellectual property.				
19CS3251R	ADVANCED COMPUTER ARCHITECTURE	PFE-4	FUNDAMENTALS OF COMPUTER DESIGN Review Of Fundamentals Of CPU, Memory And IO – Trends In Technology, Power, Energy And Cost, Dependability – Performance Evaluation INSTRUCTION LEVEL PARALLELISM ILP Concepts – Pipelining Overview – Compiler Techniques For Exposing ILP – Dynamic Branch Prediction – Dynamic Scheduling – Multiple Instruction Issue – Hardware Based Speculation – Static Scheduling – Multi-Threading – Limitations Of ILP – Case Studies. DATA-LEVEL PARALLELISM Vector Architecture – SIMD Extensions – Graphics	FUNDAMENTALS OF COMPUTER DESIGN Review Of Fundamentals Of CPU, Memory And IO – Trends In Technology, Power, Energy And Cost, Dependability – Performance Evaluation INSTRUCTION LEVEL PARALLELISM ILP Concepts – Pipelining Overview – Compiler Techniques For Exposing ILP – Dynamic Branch Prediction – Dynamic Scheduling – Multiple Instruction Issue – Hardware Based Speculation – Static Scheduling – Multi-Threading – Limitations Of ILP – Case Studies. DATA-LEVEL PARALLELISM Vector Architecture – SIMD Extensions – Graphics Processing Units – Loop Level Parallelism. THREAD LEVEL PARALLELISM Symmetric And Distributed	Added: CO3:Case Studies: Intel I7 Processor, SMT & CMP Processors MEMORY AND I/O Cache Performance – Reducing Cache Miss Penalty And Miss Rate – Reducing Hit Time CO4:Main Memory And Performance – Memory Technology. Types Of Storage Devices – Buses – RAID – Reliability, Availability And Dependability – I/O Performance Measures.	CO3, CO4	1. Gain knowledge on different types of storage devices and their capabilities. 2. Acquire knowledge about the different types of buses and how they are used	30%

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			Processing Units – Loop Level Parallelism. THREAD LEVEL PARALLELISM Symmetric And Distributed Shared Memory Architectures – Performance Issues – Synchronization – Models Of Memory Consistency	Shared Memory Architectures – Performance Issues –Synchronization – Models Of Memory Consistency – Case Studies: Intel I7 Processor, SMT & CMP Processors MEMORY AND I/O Cache Performance – Reducing Cache Miss Penalty And Miss Rate – Reducing Hit Time – Main Memory And Performance – Memory Technology. Types Of Storage Devices – Buses – RAID – Reliability, Availability And Dependability – I/O Performance Measures.				
19CS3267R	BUSINESS OF GAMES & ENTREPRENEURSHIP	PFE-4	Show the Money: The Business of Videogames, Funding Models, Where are Games Sold?, How do You Make Money, IP - Intellectual Property, Games are Made of People: Teamwork Fundamentals, It's About the People, Project Management Techniques,	Show the Money: The Business of Videogames, Funding Models, Where are Games Sold?, How do You Make Money, IP - Intellectual Property, IP – Copyright, IP- Patents and Trade Secrets and IP - Protecting Yourself Games are Made of People: Teamwork Fundamentals, It's About the People, Project	Added: CO1: IP – Copyright, IP- Patents and Trade Secrets and IP - Protecting Yourself CO2:SCRUM, Project Management Tools, Leadership, Leadership Qualities, Leadership Style and Leadership Tasks	CO1, CO2, CO3	1. Develop the skills to protect your own intellectual property. 2. Understand the different types of intellectual	30%

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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
			Complexity and Iteration, Pitching Your Game and Yourself: The Art of the Demo, Public Speaking - What Works, Effective Visuals, How to Demo Your Game, Getting a Job, Perfecting the Resume, Finding a Game Job, Interviewing, Interested People Are Interesting Entrepreneurship and Starting a Company: Your Friends Are Not A Company, Entrepreneurship	Management Techniques, Complexity and Iteration, SCRUM, Project Management Tools, Leadership, Leadership Qualities, Leadership Style and Leadership Tasks Pitching Your Game and Yourself: The Art of the Demo, Public Speaking - What Works, Effective Visuals, How to Demo Your Game, Getting a Job, Perfecting the Resume, Finding a Game Job, Interviewing, Interested People Are Interesting Entrepreneurship and Starting a Company: Your Friends Are Not A Company, Entrepreneurship, Launching a Business, Business Structures, Business Planning, Client Communication, Physical Communication	CO4:Launching a Business, Business Structures, Business Planning, Client Communication, Physical Communication		how they are protected 3. Understand the different agile frameworks and how they can be used to manage software development projects 4. Develop the skills to create a business plan.	
19CS3036R	CLOUD INFRASTRUCTURE & SERVICE	PFE-2	Introduction to Cloud Technologies: Introduction to the Cloud Computing, History of	Introduction to Cloud Technologies: Introduction to the Cloud Computing, History of cloud computing,	Added: CO1: CLOUD SERVICES:IaaS, PaaS, and SaaS. Data as a	CO1, CO2, CO4	1. emerging service of cloud IaaS, PaaS, and	30%

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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
			cloud computing, Cloudservice options, Cloud Deployment models, Business concerns in thecloud.Virtualization and Cloud Platforms: Exploring virtualization, Load balancing, Hypervisors, Machine imaging, Cloud marketplace overview, Comparison of Cloud providers. Introduction to AWS: AWS history, AWS Infrastructure, AWS services, AWS ecosystem.Programming, management console and storage on AWS: Basic Understanding APIs-AWS Programming Interface, web services, AWS URL naming, Matching interfaces and services, Elasticblock store - Simple storage service, Glacier - Content deliveryplatforms.AWS	Cloud Deployment models Cloud service options: IaaS, PaaS, and SaaS. Data as a Service, NoSQL as a Service, Identity as a Service, Desktop as a Service, Container as a Service (CaaS), cloud Architectures: NIST and ITU-T. Introduction to AWS: AWS history, AWS Infrastructure, AWS services, AWS ecosystem. Programming, management console and storage on AWS: Basic Understanding APIs-AWS Programming Interface, web services, AWS URL naming, matching interfaces and services, Elastic block store – Simple storage service, Glacier - Content delivery platforms. Elastic cloud computer-Introduction to servers, Imaging Computers, Auto scaling, Elastic load balancing, Cataloging the marketplace, AMIs, Selling on the marketplace's	Service, NoSQL as a Service, Identity as a Service, Desktop as a Service, Container as a Service (CaaS), NIST CLOUD COMPUTING REFERENCE ARCHITECTURE, ITU-T CLOUD COMPUTING REFERENCE ARCHITECTURE CO2: Matching interfaces and services, CO4: Understanding the need for a framework, exploring the core concepts of the Serverless Framework. Removed: CO1: Business concerns in the cloud, Exploring virtualization, Hypervisors and Load balancing, Machine imaging, Comparison		SaaS to be added so that student may get the knowledge on the different cloud services and its imporatance. 2. Implement the Desktop and Container services alos NIST clod computing reference and its archetecture will provide the path to the students in the industry sector. 3. To introduce ITU-T cloud computing reference	

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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
			identity services, security and compliance: Users, groups, and roles - Understanding credentials, Security policies,IAM abilities and limitations, AWS physical security - AWS compliance initiatives, Understanding public/private keys, Other AWS securitycapabilities. AWS computing and marketplace: Elastic cloud computer-Introduction to servers, Imaging Computers, Auto scaling, Elastic load balancing, Cataloging the marketplace, AMIs,Selling on the marketplace.AWS networking and databases: Virtual private clouds, Cloud models, Private DNS servers (Route 53),Relational database service –	networking and databases: Virtual private clouds, Cloud models, Private DNS servers (Route 53), Relational database service – DynamoDB, Elastic ache, Redshift. Introducing Amazon API Gateway, Securing an API. Other AWS services and management services: Analytics services, Application services, Cloud security, CloudWatch, Cloud Formation, Cloud Trail, and OpsWorks. AWS billing and Dealing with disaster: Managing costs, Utilization and tracking, Bottom line impact, Geographic and other concerns, Failure plans, Examining logs.	of Cloud providers CO2: AWS identity services: Users, groups, and Understanding credentials, Security policies, IAM abilities and limitations, AWS physical security - AWS compliance initiatives, Understanding public/private keys, Other AWS security capabilities.,		architecture will mange the cloud services by the student in the academic and insustry.	

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			DynamoDB, ElastiCache, Redshift. Other AWS services and management services: Analytics services, Application services, Cloud security, CloudWatch,CloudFormation, CloudTrail, OpsWorks. AWS billing and Dealing with disaster: Managing costs, Utilization and tracking, Bottom line impact,Geographic and other concerns, Failure plans, Examining logs					

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Annexure-3(b)

Report- Analysis of Feedback on curriculum – received from the stake holders prior to the commencement of the Academic Year 2019-20

Feedback from different stake holders has been collected in respect of the curriculum offered for the academic year 2019-20

S. No.	Type of Stake holder	Number of feedback
1	Students	721
2	Parents	37
3	Alumni	15
4	Faculty	128
5	Academic Peers	23
6	Industry Persons	14
Total		**938**

Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
Academic Peer	Prathusha Assistant Professor, VNR college Hyderabad, Academic peer recommended "Computational epidemiology" course as it employs data-driven techniques and mathematical models to analyze and predict disease patterns, offering vital insights for public health and outbreak control which helps students at the forefront of health research and crisis response.	It is resolved to approve new course "Computational Epidemiology" course for 2019-20 admitted batch students.
Academic Peer	Lova Kumari Assistant professor, suggested to include "Speech processing" course in curriculum because it involves the analysis, recognition, and synthesis of human speech, driving advancements in communication technology, voice assistants, and more.	It is resolved to approve to introduce new course "Speech Processing" for 2019-20 admitted batch students

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Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
Academic Peer	Dr.A Chandran Sekhar, Academic Peer suggested to introduce a course which focuses on Equipping students with HPC skills. It will empower students to tackle intricate computational challenges across various fields, ensuring their preparedness for cutting-edge research and industry demands. By providing hands-on experience with parallel computing, optimization techniques, and utilization of HPC clusters, this course will foster a deeper understanding of advanced computing paradigms, ultimately enhancing students' competitiveness and versatility in the technology landscape.	It is resolved to approve new course "High Performance Computing" for 2019-20 admitted batch students.
Academic Peer	Sonal Dipak Mali, Academic Peer recommend incorporating "Application Development on Cloud" in the curriculum to equip students with essential skills in leveraging cloud computing services for building scalable, cost-effective, and globally accessible applications.	It is resolved to approve new course "Application Development on Cloud" for 2019-20 admitted batch students.
Academic Peer	Mr.Konkimalla Venkata Ranga Rao, Academic peer suggested the course "Parallel & Distributed Computing" into the curriculum for preparing the students with the cutting-edge skills needed to harness the power of modern computing, enabling them to design and optimize high-performance systems for complex real-world challenges.	It is resolved to approve new course "Parallel & Distributed Computing" for 2019-20 admitted batch students.
Academic Peer	Mr.Digallinte Sreenivasulu, Academic Peer recommended to include a course where they can learn market demanding coding skills like PFSD for comp.Coding.	It is resolved to approve new course "Technical Skills(JAVA PBL)" for 2019-20 admitted batch students.

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Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
Academic Peer	Dr.Balakrishna, Academic Peer suggested to revise "Bioinformatics" to equip students with interdisciplinary skills in biology and data science. This course will enable them to analyze complex biological data, fostering innovations in fields such as genomics, drug discovery, and personalized medicine.	It is resolved to approve to revise "Bioinformatics" for 2019-20 admitted batch students.
Academic Peer	N Lakshmi Narayana, Academic Peer suggested to update the syllabus for Business of Games & Entrepreneurship to include contemporary industry trends and practical case studies.	It is resolved to approve the revision of syllabus "Business of Games & Entrepreneurship" course to 2019-20 admitted batch.
Academic Peer	Dr. Indranil sarkar, Academic peer suggested to introduce new course "Chemistry for Engineers" it helps to empower students with a profound understanding of chemical processes, enabling them to design safer, more efficient, and environmentally conscious technologies.	It is resolved to approve new course "Chemistry for Engineers" for 2019-20 admitted batch students and to 2018-19 admitted batch students with the course code 18CY1005.
Academic Peer	Dr. V. Ramalingam , The syllabus for Cloud Infrastructure & Services should be updated to incorporate recent advancements in cloud technologies, ensuring students receive the most relevant and practical knowledge.	It is resolved to approve the revision of syllabus "Cloud Infrastructure & Services" course to 2019-20 admitted batch.
Alumni	Suhas Achanta, Alumni suggested to introduce a comprehensive training program that must be designed to equip individuals with the essential skills and knowledge required to excel in Cloud DevOps practices.	It is resolved to approve new course "Cloud Devops" as a professional Elective Course for 2019-20 admitted batch students.
Alumni	Mr. Suhas Achanta, Alumni suggested the TS-SDP4 (CLOUD DEVOPS) course to bridges the gap between development and	It is resolved to approve new course "TS-SDP4 (CLOUD

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Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
	operations in the cloud, enabling streamlined software delivery and meeting the growing industry need for cloud-centric DevOps expertise.	DEVOPS)" for 2019-20 admitted batch students.
Alumni	Mr. Gopi Chigurupati, Alumni recommended "TS-SDP4 Cloud Based Solutions Architect" course to provide a well-rounded education in cloud architecture, meeting industry demand for professionals skilled in designing and optimizing cloud solutions.	It is resolved to approve new course "TS-SDP4 Cloud Based Solutions Architect" for 2019-20 admitted batch students.
Alumni	Mr. Hemanth Duriseti, Alumni suggested the course CLOUD BASED AI/ML SPECIALITY because the students should master in cloud-based AI/ML tools, frameworks, and deployment strategies, enabling them to develop intelligent applications and solutions on cloud platforms.	It is resolved to approve new course "TS-SDP4 Cloud Based AI/ML Speciality" for 2019-20 admitted batch students.
Alumni	Hanumanth Yaganti, Alumni suggested to revise Advanced Computer Architecture course to aligns the curriculum with industry demands, enhances students' competitiveness in the job market, and fosters a deeper understanding of complex architectural paradigms.	It is resolved to approve the revision of syllabus in "Advanced computer architecture" course to 2019-20 admitted batch.
Faculty	Dr. Vijaya Sri K, Faculty suggested to include a new course Mathematics for Computing to provide students with foundational mathematical skills vital for understanding complex computational concepts and algorithms.	It is resolved to approve to introduce a new course "Mathematics for Computing" to offer for 2019-20 admitted batch students, to bridge the gap between mathematics and computing and ensuring students grasp fundamental principles, enhancing their ability to excel in computational fields.

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Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
Faculty	Dr. A. Srinath, Dean-Skill Development recommended to offer Design Tools Workshop course that offers a foundational learning experience for aspiring designers, introducing essential design software and techniques to unleash creativity.	It is resolved and approve to offer two new courses "Design Tool Workshop-1" and "Design Tool Workshop-2" course for 2019-20 admitted batch students in their first year.
Faculty	Dr. Suman Maloji, Professor& HOD,ECE Dept suggested to introduce Digital Logic & Processors in place of Digital System Design as it delves into the fundamentals of electronic circuits and microprocessors, forming the backbone of modern computing systems and innovation.	It is resolved to approve a new course "Digital Logic & Processors" for 2019-20 admitted batch students.
Faculty	Dr.CH V Ramana Murthy, Professor, Faculty suggested to introduce a course that provides the essential analytical tools and problem-solving skills required for engineering professionals to excel in their field.	It is resolved to approve a new course "Mathematics for Engineers" for 2019-20 admitted batch students.
Faculty	Dr.A.S.C.S.Sastry, Professor, ECE Dept. Faculty suggested to introduce new course which helps as building blocks of modern electronics, enabling the creation of countless devices and innovations that shape our daily lives.	It is resolved to approve a new course "Basic Electronic Circuits" for 2019-20 admitted batch students.
Faculty	Ms.Pathuri Bindu, Assistant prof, Mathematics Dept. Faculty suggested to introduce 2 Mathematical Programming Courses one focusing on optimization techniques—linear, integer, and nonlinear programming—to equip students with problem-solving skills applicable across fields like economics, engineering, and computer science. Blend theory, software applications, and real-world projects to	It is resolved to approve new course "Mathematical Programming-I" and Mathematical Programming-II" for 2019-20 admitted batch students.

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Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
	foster analytical thinking" and second course to offer advanced problem-solving skills and optimization techniques essential for tackling real-world challenges across various disciplines. This course enriches their quantitative abilities and analytical thinking.	
Faculty	Dr.Kolla Bhanu Prakash, Faculty suggested to introduce a new course Digital Video Processing course to equip students with essential skills for today's digital world, fostering creativity and employability across various industries. This addition aligns our institution with the demands of the modern age and enhances our academic offerings.	It is resolved to approve a new course "Digital Video Processing" for 2019-20 admitted batch students.
Faculty	Mr.T.Vamsidhar, Faculty suggested to include "Functional & Concurrent Programming" as a Professional Elective for both Data Science and Cloud Specializations. This course offers students valuable skills in programming paradigms that are essential for navigating contemporary technological domains.	It is resolved to approve new course "Functional & Concurrent Programming" course for 2019-20 admitted batch students.
Faculty	Ms. M.V.B.T. Santhi, Faculty recommended a new course which explores advanced database concepts that are essential for students to get full potential of data bases in today's information-driven world, enabling innovation and informed decision-making.	It is resolved to approve a new course "Advanced Databases" as professional elective for 2019-20 admitted batch students.
Faculty	Ms.K.Srinidhi, Faculty suggested to introduce a course it helps students with essential knowledge and skills to identify, prevent, and mitigate security vulnerabilities in web applications and	It is resolved to approve new course "Web Security" for 2019-20 admitted batch students.

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Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
	online environments. Given the increasing reliance on digital platforms, this course is crucial for producing graduates well-equipped to safeguard sensitive information and uphold the integrity of web-based systems.	
Faculty	Dr.Y.Prasanth, Professor & Associate Dean strongly recommended the incorporation of a dedicated "Software Reliability" course in the curriculum. This course would provide students with a comprehensive understanding of techniques for designing, developing, and testing reliable software systems. By addressing the critical need for dependable software in various industries, this course equips students to excel as software engineers and contribute to the creation of resilient applications.	It is resolved to approve new course "Software Reliability" for 2019-20 admitted batch students.
Faculty	Dr. Shashi Melhothra, Faculty suggested to introduce a course that will empower students to master the art of creating applications that transcend platform constraints, utilizing frameworks such as React Native.	It is resolved to approve new course "Cross Platform Development Frameworks" for 2019-20 admitted batch students.
Faculty	Dr. K.V Raju Faculty suggested to incorporating Cloud & Serverless Computing into the curriculum to equip students with essential skills for modern technology landscapes.	It is resolved and approved new course" Cloud & Serverless Computing" for 2019-20 admitted batch students.
Industry Person	Sreeja Girija R, Industry person suggested to incorporate Artificial Neural Networks into the curriculum. It would offer students a cutting-edge perspective on machine learning.	It is resolved to approve new course "Artificial Neural Networks" for 2019-20 admitted batch students.

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Industry Person	Mr.Sagireddy Pulla Reddy, Industry person suggested to include a cloud and machine learning related course which empowers organizations to efficiently process and analyze vast datasets, enabling data-driven insights and innovation at scale.	It is resolved to approve new course "Machine Learning on Cloud" for 2019-20 admitted batch students.
Industry Person	Meenakshi Sharma, Assistant Director - PR & Media, Industry person suggested to include Architecting Cloud Solutions into curriculum as it will empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services, preparing them for in-demand roles in cloud architecture and technology.	It is resolved to approve a new course "Architecting Cloud Solutions" for 2019-20 admitted batch students.
Industry Person	Mr.Pallapothula Anvesh, Industry Person highly recommended the integration of a comprehensive "Data Analytics on Cloud" course, combining the power of advanced data analysis techniques with cloud computing.	It is resolved to approve new course "Data Analytics on Cloud" for 2019-20 admitted batch students.
Industry Person	Mr.Akhandam Venkat Aditya, Industry Person suggested to include Security solutions in the cloud offer robust protection against cyber threats, ensuring the integrity and confidentiality of data in cloud environments.	It is resolved to approve new course "Security Solutions in Cloud" for 2019-20 admitted batch students.
Industry Person	Mr. Vamsi Yelamarthi, Industry person suggested to introduce Visual Programming Course for 2019-20 admitted batch as this course would empower students to create applications using intuitive graphical interfaces,	It is resolved to approve new course "Visual Programming" for 2019-20 admitted batch students.

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	fostering creativity and accessibility in software development.	
Industry Person	Rajshekar Botcha, Industry person suggested to incorporate a course into curriculum that provides a detailed understanding of the programming languages used in embedded systems, such as C and C++, along with software design principles and real-time operating systems.	It is resolved to approve new course "Embedded Systems" for 2019-20 admitted batch students.
Industry Person	Vijay Krishna Pala, Industry Person suggested to introduce new course "Solutions Architecting on Cloud" that covering key cloud platforms, architectural design principles, security, scalability, and best practices for building resilient and efficient cloud solutions through skilling is recommended.	It is resolved to approve new course "Solutions Architecting on Cloud" for 2019-20 admitted batch students.
Industry Person	Bandaru Ravi Teja, Industry Personnel recommended integrating a comprehensive study of signal processing into the curriculum, emphasizing foundational concepts, mathematical rigor, practical implementations, and real-world applications.	It is resolved to approve new course "Signal Processing" for 2019-20 admitted batch students.
Industry Person	Mr. Vishnu Vardhan, Industry person suggested Technical Skilling (SDP-3) to enhance employability by imparting relevant, adaptable technical skills, making graduates competitive in today's job market and fostering interdisciplinary problem-solving. This addition aligns with evolving industry demands and attracts prospective students, positioning our institution as a forward-thinking educational leader.	It is resolved to approve new course "Technical Skilling (SDP-3)" for 2019-20 admitted batch students.

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Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
Industry Person	Mr. Madhu Bodapati, Industry Person recommended "TS-SDP4 Cloud Based Security Speciality" course because it equips individuals with specialized skills to fortify cloud environments, aligning with the increasing demand for cloud security expertise, ensuring data protection and compliance in the digital landscape.	It is resolved to approve new course "TS-SDP4 Cloud Based Security Speciality" for 2019-20 admitted batch students.
Industry Person	Mr. Sai Anil Muthyala, Industry Person suggested "TS-SDP4 Certified Game Developer" course to nurture expertise in game development, covering essential skills, tools, and industry insights for aspiring game creators is required.	It is resolved to approve new course "Certified Game Developer" for 2019-20 admitted batch students.
Industry Person	Kavitha Avula, Industry Person suggested that its appreciable if a specialized training program dedicated to fostering expertise in securing cloud environments is introduced. It is resolved to approve new course "TS-SDP4 Cloud Based Data Analytics Speciality" for 2019-20 admitted batch students.	It is resolved to approve new course "TS-SDP4 Cloud Based Data Analytics Speciality" for 2019-20 admitted batch students.
Industry Person	Abhinay Irala, Industry Person, suggested that there is a need for a specialized program dedicated for equipping individuals with the knowledge and skills needed to excel in developing Internet of Things (IoT) solutions on cloud platforms.	It is resolved to approve new course "TS-SDP4 Cloud Based IoT Developer" For 2019-20 Admitted Batch Students.
Industry Person	Industry Peers" Abhinay Irala- HR Manager, Sreeja Girija - RSoftware Engineer, Mr.Sagireddy Pulla Reddy - CSE "SP Software" Pvt Ltd, Meenakshi Sharma- Assistant Director -PR & Media, Mr.PALLAPOTHULA ANVESH -YSK INFOTECH PVT LTD MANAGING	It is resolved to approve the inclusion of open book exams for the courses Object Oriented Programming (Regular, Optional and Advanced), Operating Systems (Regular, Advanced) for II Btech and Distributed Computing

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Stakeholder Category	Stakeholder Feedback / Recommendation	Action Taken in BOS
	DIRECTOR have suggested to include open book exam to subjects	(Regular, Advanced), Enterprise Programming (Regular, Advanced) and Algorithm Design & Analysis (Regular, Advanced) for III Btech admitted Students

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Annexure-4(a)

B.Tech 2019-20 Admitted Batch Category Wise Course Structure

S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
1	19UC1101	BASIC ENGLISH	HSS	0	0	4	0	2	4	NIL	Retained	SKILL DEVELOPMENT	–	–
2	19UC1202	ENGLISH PROFICIENCY	HSS	0	0	4	0	2	4	NIL	Retained	SKILL DEVELOPMENT	–	–
3	19UC2103	PROFESSIONAL COMMUNICATION SKILLS	HSS	0	0	4	0	2	4	NIL	Retained	SKILL DEVELOPMENT	–	–
4	19UC2204	APTITUDE BUILDER - 1	HSS	0	0	4	0	2	4	NIL	Retained	EMPLOYABILITY	–	–
5	19UC3105	APTITUDE BUILDER-II	HSS	0	0	4	0	2	4	APTITUDE BUILDER - 1	Retained	SKILL DEVELOPMENT	–	–
							Total Credits	**10**						
6	19MT1101	MATHEMATICS FOR COMPUTING	BS	3	1	0	4	5	8	NIL	New	EMPLOYABILITY	Faculty	To enhance their ability to excel in computational fields.
7	19SC1101	PROBLEM SOLVING AND COMPUTER PROGRAMMING	BS	3	0	2	0	4	5	NIL	Retained	EMPLOYABILITY	–	–

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
8	19MT2102	MATHEMATICS FOR ENGINEERS	BS	3	0	0	0	3	3	NIL	New	SKILL DEVELOPMENT	Faculty	Provides the essential analytical tools and problem-solving skills required for engineering professionals to excel in their field.
9	19CS2104	MATHEMATICAL PROGRAMMING-1	BS	2	2	0	0	4	4	NIL	New	SKILL DEVELOPMENT	Faculty	To enrich their quantitative abilities and analytical thinking.
10		SCIENCE ELECTIVE - 1	BS	3	0	0	0	3	3	NIL	Retained	—	—	—
11	19CS2204	MATHEMATICAL PROGRAMMING -II	BS	2	2	0	0	4	4	MATHEMATICAL PROGRAMMING-1	New	SKILL DEVELOPMENT	Faculty	To enrich their quantitative abilities and analytical thinking.
12	18UC0009	ECOLOGY & ENVIRONMENT	BS	2	0	0	0	2	4	NIL	Retained	SKILL DEVELOPMENT	—	—
13		SCIENCE ELECTIVE - 2	BS	3	0	0	0	3	3	NIL	Retained	—	—	—

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
							Total Credits	28						
14	19ME1103	DESIGN TOOLS WORKSHOP - I	ES	0	0	4	0	2	4	NIL	New	SKILL DEVELOPMENT	Faculty	Foundational learning experience for aspiring designers, introducing essential design software and techniques to unleash creativity.
15	19EC1101	DIGITAL LOGIC & PROCESSORS	ES	3	0	2	0	4	5	NIL	New	EMPLOYABILITY	Faculty	Deals with fundamentals of electronic circuits and microprocessors, forming the backbone of modern computing systems and innovation.
16	19SC1106	TECHNICAL SKILLS-1 (CODING)	ES	0	0	0	6	1.5	6	PROBLEM SOLVING AND COMPUTER	Retained	SKILL DEVELOPMENT	—	—

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										PROGRAMMING				
17	19SC1202	DATA STRUCTURES	ES	3	0	2	3	4.75	8	PROBLEM SOLVING AND COMPUTER PROGRAMMING	Retained	EMPLOYABILITY	—	—
18	19SC1209	DESIGN TOOLS WORKSHOP - II	ES	0	0	4	0	2	4	DESIGN TOOLS WORKSHOP - I	New	SKILL DEVELOPMENT	Faculty	Foundational learning experience for aspiring designers, introducing essential design software and techniques to unleash creativity.
19	19CS1203	OBJECT ORIENTED PROGRAMMING	ES	3	0	2	3	4.75	8	PROBLEM SOLVING AND COMPUTER PROGRAMMING	Retained	EMPLOYABILITY	—	—
20	19EC1213	BASIC ELECTONIC CIRCUITS	ES	3	0	0	0	3	3	NIL	New	SKILL DEVELOPMENT	Faculty	Helps as building blocks of modern

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
														electronics, enabling the creation of countless devices and innovations that shape our daily lives.
21	20UC1102	DESIGN THINKING AND INNOVATION - 1	ES	1	0	0	4	2	5	NIL	Retained	ENTERPRENEURSHIP	—	—
22	20UC1203	DESIGN THINKING AND INNOVATION - II	ES	1	0	0	4	2	5	DESIGN THINKING AND INNOVATION -II	Retained	ENTERPRENEURSHIP	—	—
							Total Credits	**26**						
23	19EC1202	COMPUTER ORGANIZATION & ARCHITECTURE	PC	2	0	0	0	2	2	DIGITAL LOGIC & PROCESSORS	Retained	EMPLOYABILITY	—	—
24	19CS2106	OPERATING SYSTEMS DESIGN	PC	3	0	2	2	4.50	7	NIL	Retained	EMPLOYABILITY	Academic Peer	It focuses on the principles and techniques behind the development of

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
														operating systems, which are the backbone of modern computing.
25	19CS2211	SOFTWARE ENGINEERING	PC	2	2	0	0	4	4	NIL	Retained	EMPLOYABILITY	—	—
26	19CS2108S	DATABASE MANAGEMENT SYSTEMS	PC	2	1	2	2	4.5	7	NIL	Retained	EMPLOYABILITY	—	—
27	19CS2212	ARTIFICIAL INTELLIGENCE	PC	2	0	2	0	3	4	NIL	Retained	EMPLOYABILITY	—	—
28	19CS2107	ENTERPRISE PROGRAMMING	PC	3	0	2	4	5	9	OBJECT ORIENTED PROGRAMMING	Retained	EMPLOYABILITY	—	—
29	19CS2205	DATA SCIENCE	PC	2	0	2	2	3.5	6	NIL	Retained	EMPLOYABILITY	—	—
30	19CS2109	COMPUTER NETWORKS & SECURITY	PC	3	1	0	0	4	4	NIL	Retained	EMPLOYABILITY	—	—
31	19CS3113	ANALYSIS & DESIGN OF ALGORITHMS	PC	3	0	2	4	5	9	DATA STRUCTURES	Retained	SKILL DEVELOPMENT	—	—
							Total Credits	**35.5**						

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
		PE-1	PE	2	0	2	4	4	8	Course Specific	—	—	—	—
		PE-2	PE	2	0	2	0	3	4	Course Specific	—	—	—	—
		PE-3	PE	2	0	2	4	4	8	Course Specific	—	—	—	—
		PE-4	PE	2	0	2	0	3	4	Course Specific	—	—	—	—
		PE-5	PE	2	0	2	0	3	4	Course Specific	—	—	—	—
								Total Credits	**17**					
32	19IE2246	INDUSTRIAL TRAINING	PJ	0	0	4	0	2	4	NIL	Retained	SKILL DEVELOPMENT	—	—
33	19IE3247	TERM PAPER	PJ	0	0	4	0	2	4	NIL	Retained	SKILL DEVELOPMENT	—	—
34	19IE4048/ 19IE4050/ 19IE4051	PROJECT PART - 1/PRACTICE SCHOOL/INTERNSHIP	PJ	0	0	12	0	6	12	NIL	Retained	EMPLOYABILITY	—	—
37	19IE4049/ 19IE4050/ 19IE4052	PROJECT PART-2/PRACTICE SCHOOL/INTERNSHIP	PJ	0	0	12	0	6	12	NIL	Retained	EMPLOYABILITY	—	—
								Total Credits	**16**					

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
38		OE-1	OE	3	0	0	0	3	3	NIL	—	—	—	—
39		OE-2	OE	3	0	0	0	3	3	NIL	—	—	—	—
40		ME-1	OE	3	0	0	0	3	3	NIL	—	—	—	—
41		FOREIGN LANGUAGE	OE	2	0	0	0	2	2	NIL	—	—	—	—
42		OE-3	OE	3	0	0	0	3	3	NIL	—	—	—	—
							Total Credits	**14**						
43		FC-1	FC	3	0	2	0	4	5	Course Specific	—	—	—	—
44		FC-2	FC	3	0	2	0	4	5	Course Specific	—	—	—	—
							Total Credits	**8**						
		TECHNICAL SKILLS	SDC	0	0	0	10	2.50	10	NIL	—	SKILL DEVELOPMENT	—	—
	19TS2201	TECHNICAL SKILLING (PFSD + Comp.Coding)	SDC	0	0	0	8	2	8	PROBLEM SOLVING & COMPUTER PROGRAM MING	—	SKILL DEVELOPMENT	—	—
		TECHNICAL SKILLING (SDP-3)	SDC	0	0	0	8	2	8	PROBLEM SOLVING & COMPUTER	—	SKILL DEVELOPMENT	—	—

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
										PROGRAMMING				
		TECHNICAL SKILLING (SDP-4)	SDC	0	0	0	8	2	8	Course Specific	—	SKILL DEVELOPMENT	—	—
							Total Credits	**8.5**						
	19SP2117	SPORTS	SP	2	0	0	0	0	2		—	—	—	—
							Total Credits	**0**						
45	18UC0007	INDIAN HERITAGE & CULTURE	AUD	2	0	0	0	0	2	NIL	Retained	ENTREPRENEURSHIP	—	—
46	18UC0008	INDIAN CONSTITUTION	AUD	2	0	0	0	0	2	NIL	Retained	SKILL DEVELOPMENT	—	—
47	18UC0010	UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS	AUD	2	0	0	0	0	2	NIL	Retained	EMPLOYABILITY	—	—
							Total Credits	**163**						
ARTIFICIAL INTELLIGENCE & INTELLIGENT PROCESS AUTOMATION (AI & IPA)														
	19CS3021S	MACHINE LEARNING	PFE-1	2	0	2	4	4	8	ARTIFICIAL INTELLIGENCE	Retained	SKILL DEVELOPMENT	—	—

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48	19CS3022R	SOFT COMPUTING	PFE-2	2	0	2	0	3	4	ARTIFICAI L INTELLIG ENCE	Retained	EMPLOYABILITY	—	—
49	19CS3026R	ARTIFICIAL NEURAL NETWORKS	PFE-2	2	0	2	0	3	4	ARTIFICAI L INTELLIG ENCE	New	EMPLOYABILITY	Industry Person	To get grip on cross cutting-edge perspective on machine learning.
50	19CS3269S	DEEP LEARNING	PFE-3	2	0	2	4	4	8	MACHINE LEARNIN G	Retained	SKILL DEVELOPMENT	—	—
51	19CS3270R	COGNITIVE COMPUTING	PFE-4	2	0	2	0	3	4	ARTIFICIA L INTELLIG ENCE	Retained	EMPLOYABILITY	—	—
52	19CS3271R	PERCEPTION AND COMPUTER VISION	PFE-4	2	0	2	0	3	4	ARTIFICIA L INTELLIG ENCE	Retained	EMPLOYABILITY	—	—
53	19CS3278R	DIGITAL VIDEO PROCESSING	PFE-4	2	0	2	0	3	4	MATHEM ATICS FOR COMPUTI NG	New	EMPLOYABILITY	Faculty	To equip students with essential skills for today's digital world, fostering creativity and

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														employability across various industries.
54	19CS3232R	MACHINE LEARNING ON CLOUD	PFE-4	2	0	2	0	3	4	MACHINE LEARNING	New	SKILL DEVELOPMENT	Industry Person	Empowers organizations to efficiently process and analyze vast datasets, enabling data-driven insights and innovation at scale.
55	19CS3235R	ARCHITECTING CLOUD SOLUTIONS	PFE-4	2	0	2	0	3	4	OPERATING SYSTEMS	New	EMPLOYABILITY	Industry Person	Empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services
56	19CS3286R	CLOUD DEVOPS	PFE-4	2	0	2	0	3	4	SOFTWARE ENGINEERING	Retained	SKILL DEVELOPMENT	—	—

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57	19CS3272R	COMPUTATIONAL EPIDEMIOLOGY	PFE-5	2	0	2	0	3	4	ARTIFICIAL INTELLIGENCE, DATA SCIENCE	New	EMPLOYABILITY	Academic Peer	It employs data-driven techniques and mathematical models to analyze and predict disease patterns, offering vital insights for public health and outbreak control
58	19CS3273R	NATURAL LANGUAGE PROCESSING	PFE-5	2	0	2	0	3	4	ARTIFICIAL INTELLIGENCE	Retained	EMPLOYABILITY	—	—
59	19CS3274R	SPEECH PROCESSING	PFE-5	2	0	2	0	3	4	ARTIFICIAL INTELLIGENCE	New	EMPLOYABILITY	Academic Peer	It involves the analysis, recognition, and synthesis of human speech, driving advancements in communication technology, voice assistants.
DATA SCIENCE & BIG DATA ANALYTICS (DS&BDA)														

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60	19CS3051S	DATA VISUALISATION TECHNIQUES	PFE-1	2	0	2	4	4	8	DATABASE MANAGEMENT SYSTEMS	Retained	EMPLOYABILITY	Academic Peer	Acquire the skills to communicate insights effectively and make data-driven decisions across diverse fields
61	19CS3056S	FUNCTIONAL & CONCURRENT PROGRAMMING	PFE-1	2	0	2	4	4	8	OBJECT ORIENTED PRORAMMING	New	EMPLOYABILITY	Faculty	Offers students valuable skills in programming paradigms that are essential for navigating contemporary technological domains.
62	19CS3052R	DATA WAREHOUSING & MINING	PFE-2	2	0	2	0	3	4	DATABASE MANAGEMENT SYSTEMS	Retained	EMPLOYABILITY	—	—
63	19CS3275S	BIG DATA ANALYTICS	PFE-3	2	0	2	4	4	8	DATABASE MANAGEMENT SYSTEMS	Retained	EMPLOYABILITY	—	—

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64	19CS3276R	BIG DATA OPTIMIZATION	PFE-4	2	0	2	0	3	4	DESIGN AND ANALYSIS OF ALGORITHMS	Retained	EMPLOYABILITY	—	—
65	19CS3277R	BIOINFORMATICS	PFE-4	2	0	2	0	3	4	DATA SCIENCE	30%-Revised Considered as New Course	EMPLOYABILITY	Academic Peer	To analyze complex biological data, fostering innovations in fields such as genomics, drug discovery, and personalized medicine.
	19CS3278R	DIGITAL VIDEO PROCESSING	PFE-4	2	0	2	0	3	4	MATHEMATICS FOR COMPUTING	New	EMPLOYABILITY	Faculty	To equip students with essential skills for today's digital world, fostering creativity and employability across various industries.
66	19CS3233R	DATA ANALYTICS ON CLOUD	PFE-4	2	0	2	0	3	4	DATA SCIENCE	New	EMPLOYABILITY	Industry Peer	Combines the [illegible] of

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
														advanced data analysis techniques with cloud computing.
	19CS3285R	ARCHITECTING CLOUD SOLUTIONS	PFE-4	2	0	2	0	3	4	OPERATING SYSTEMS	New	EMPLOYABILITY	Industry Person	Empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services
	19CS3286R	CLOUD DEVOPS	PFE-4	2	0	2	0	3	4	SOFTWARE ENGINEERING	Retained	SKILL DEVELOPMENT	—	—
	19CS3272R	COMPUTATIONAL EPIDEMIOLOGY	PFE-5	2	0	2	0	3	4	ARTIFICIAL INTELLIGENCE, DATA SCIENCE	New	EMPLOYABILITY	Academic Peer	It employs data-driven techniques and mathematical models to analyze and predict disease patterns, offering vital insights for

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														public health and outbreak control
67	19CS3279R	ADVANCED DATABASES	PFE-5	2	0	2	0	3	4	DATABASE MANAGEMENT SYSTEMS	New	EMPLOYABILITY	Faculty	Explores advanced database concepts that are essential for students to get full potential of data bases
68	19CS3230R	GRAPH & WEB ANALYTICS	PFE-5	2	0	2	0	3	4	DATA SCIENCE	Retained	EMPLOYABILITY	—	—
CYBERSECURITY & BLOCKCHAIN TECHNOLOGY (CYS&BCT)														
69	19CS3041S	CRYPT ANALYSIS & CYBER DEFENSE	PFE-1	2	0	2	4	4	8	COMPUTER NETWORKS & SECURITY	Retained	SKILL DEVELOPMENT	—	—
70	19CS30[illegible]2R	NETWORK & INFRASTRUCTURE SECURITY	PFE-2	2	0	2	0	3	4	COMPUTER NETWORKS & SECURITY	Retained	SKILL DEVELOPMENT	Academic Peer	To ensure students are well-prepared for evolving cybersecurity challenges.
71	19CS30[illegible]5R	INTRODUCTION TO BLOCKCHAIN &	PFE-2	2	0	2	0	3	4	COMPUTER	Retained	SKILL DEVELOPMENT	Academic Peer	Gives more practical hands-

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
		CRYPTO CURRENCIES								NETWORKS & SECURITY				on exercises and real-world case studies to enhance student engagement and application of concepts
72	19CS3259S	DIGITAL FORENSICS	PFE-3	2	0	2	4	4	8	CRYPTANALYSIS & CYBER DEFENCE	Retained	EMPLOYABILITY	—	—
73	19CS3260R	DATABASE & SYSTEM SECURITY	PFE-4	2	0	2	0	3	4	DATABASE MANAGEMENT SYSTEMS	Retained	EMPLOYABILITY	—	—
74	19CS3261R	PROGRAMMING FOR SMART CONTRACTS	PFE-4	2	0	2	0	3	4	INTRODUCTION TO BLOCKCHAIN AND CRYPTO CURRENCIES	Retained	EMPLOYABILITY	—	—
75	19CS3234R	SECURITY SOLUTIONS IN CLOUD	PFE-4	2	0	2	0	3	4	COMPUTER NETWOR	New	SKILL DEVELOPMENT	Industry Person	Offer robust protection against cyber threats, ensuring

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										KS & SECURITY				the integrity and confidentiality of data in cloud environments.
	19CS3235R	ARCHITECTING CLOUD SOLUTIONS	PFE-4	2	0	2	0	3	4	OPERATING SYSTEMS	New	EMPLOYABILITY	Industry Person	Empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services
	19CS3236R	CLOUD DEVOPS	PFE-4	2	0	2	0	3	4	SOFTWARE ENGINEERING	Retained	SKILL DEVELOPMENT	—	—
76	19CS3252R	SECURE SOFTWARE ENGINEERING	PFE-5	2	0	2	0	3	4	SOFTWARE ENGINEERING	Retained	EMPLOYABILITY	—	—
77	19CS3254R	WEB SECURITY	PFE-5	2	0	2	0	3	4	COMPUTER NETWORKS & SECURITY	New	EMPLOYABILITY	Faculty	It helps students with essential knowledge and skills to identify, prevent, and

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
														mitigate security vulnerabilities in web applications and online environments.
78	19CS3265R	WIRELESS SENSOR NETWORKS	PFE-5	2	0	2	0	3	4	COMPUTER NETWORKS & SECURITY	Retained	EMPLOYABILITY	—	—
SOFTWARE MODELLING & DEVOPS (SM&DPS)														
79	19CS3062S	SOFTWARE VERIFICATION & VALIDATION	PFE-1	2	0	2	4	4	8	SOFTWARE ENGINEERING	Retained	—	—	—
80	19CS3064R	UX DESIGN	PFE-2	2	0	2	0	3	4	DESIGN THINKING FOR INNOVATION - 1	Retained	EMPLOYABILITY	Alumni	Equipped with the latest industry-relevant skills.
81	19CS3256S	CONTINUOUS DELIVERY & DEVOPS	PFE-3	2	0	2	4	4	8	SOFTWARE ENGINEERING	Retained	EMPLOYABILITY	—	—

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82	19CS3257R	SOFTWARE PROJECT MANAGEMENT	PFE-4	2	0	2	0	3	4	SOFTWARE ENGINEERING	Retained	EMPLOYABILITY	—	—
83	19CS3254R	VISUAL PROGRAMING	PFE-4	2	0	2	0	3	4	OBJECT ORIENTED PRORAMMING	New	EMPLOYABILITY	Industry Person	Will empower students to create applications using intuitive graphical interfaces, fostering creativity and accessibility in software development.
	19CS3235R	ARCHITECTING CLOUD SOLUTIONS	PFE-4	2	0	2	0	3	4	OPERATING SYSTEMS	New	EMPLOYABILITY	Industry Person	Empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services
	19CS3236R	CLOUD DEVOPS	PFE-4	2	0	2	0	3	4	SOFTWARE	Retained	SKILL DEVELOPMENT	—	—

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										ENGINEERING				
84	19CS3258R	SOFTWARE RELIABILITY	PFE-5	2	0	2	0	3	4	SOFTWARE ENGINEERING	New	EMPLOYABILITY	Faculty	Provide students with a comprehensive understanding of techniques for designing, developing, and testing reliable software systems.
85	19CS3255R	CROSS-PLATFORM DEVELOPMENT FRAMEWORKS	PFE-5	2	0	2	0	3	4	OBJECT ORIENTED PRORAMMING	New	EMPLOYABILITY	Faculty	To master the art of creating applications that transcend platform constraints, utilizing frameworks such as React Native.
CLOUD & EDGE COMPUTING (CEC)														
	19CS3056S	FUNCTIONAL & CONCURRENT PROGRAMMING	PFE-1	2	0	2	4	4	8	OBJECT ORIENTED PRORAMMING	New	EMPLOYABILITY	Faculty	Offers students valuable skills in programming paradigms that are essential for

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														navigating contemporary technological domains.
86	19CS3037R	CLOUD INFRASTRUCTURE & SERVICES	PFE-1	2	0	2	4	4	8	NIL	30%-Revised Considered as New Course		Academic Peer	To incorporate recent advancements in cloud technologies
87	19CS3032R	ADVANCED OPERATING SYSTEMS	PFE-2	2	0	2	0	3	4	OPERATING SYSTEMS DESIGN	Retained	EMPLOYABILITY	—	—
88	19CS3281S	CLOUD & SERVERLESS COMPUTING	PFE-3	2	0	2	4	4	8	NIL	New	EMPLOYABILITY	Faculty	To equip students with essential skills for modern technology landscapes.
89	19CS3251R	ADVANCED COMPUTER ARCHITECTURE	PFE-4	2	0	2	0	3	4	COMPUTER ORGANIZATION & ARCHITECTURE	30%-Revised Considered as New Course	EMPLOYABILITY	Alumni	To design and optimize high-performance computing
90	19CS3252R	PARALLEL ALGORITHMS	PFE-4	2	0	2	0	3	4	OPERATING SYSTEMS	Retained	EMPLOYABILITY	—	—

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										DESIGN, OOP				
	19CS3285R	ARCHITECTING CLOUD SOLUTIONS	PFE-4	2	0	2	0	3	4	OPERATING SYSTEMS	New	EMPLOYABILITY	Industry Person	Empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services
	19CS3286R	CLOUD DEVOPS	PFE-4	2	0	2	0	3	4	SOFTWARE ENGINEERING	New	SKILL DEVELOPMENT	Alumni	To introduce a comprehensive training program that must be designed to equip individuals with the essential skills and knowledge required to excel in Cloud DevOps practices.
91	19CS3253R	EDGE COMPUTING	PFE-5	2	0	2	0	3	4	OPERATING SYSTEMS DESIGN	Retained	EMPLOYABILITY	—	—

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92	19CS3038R	HIGH PERFORMANCE COMPUTING	PFE-5	2	0	2	0	3	4	OPERATING SYSTEMS DESIGN	New	EMPLOYABILITY	Academic Peer	Focuses on professionals looking to design and optimize high-performance computing systems
93	19CS3263R	SECURITY IN INTERNET OF THINGS	PFE-5	2	0	2	0	3	4	COMPUTER NETWORKS & SECURITY	Retained	EMPLOYABILITY	—	—
GAME DEVELOPMENT & UX DESIGN (GUX)														
94	19CS3071S	PROGRAMMING FOR GAME DEVELOPMENT	PFE-1	2	0	2	4	4	8	PROBLEM SOLVING AND COMPUTER PROGRAMMING	Retained	ENTREPRENEURSHIP	Industry Person	To include more modern programming languages and tools, reflecting industry trends
	19CS3064R	UX DESIGN	PFE-2	2	0	2	0	3	4	DESIGN THINKING FOR INNOVATION - 1	Retained	EMPLOYABILITY	Alumni	Equipped with the latest industry-relevant skills.

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95	19CS3266S	AR & VR APPLICATION DEVELOPMENT	PFE-3	2	0	2	4	4	8	PROBLEM SOLVING & COMPUTER PROGRAMMING	Retained	EMPLOYABILITY	—	—
96	19CS3267R	BUSINESS OF GAMES & ENTREPRENEURSHIP	PFE-4	2	0	2	0	3	4	NIL	30%-Revised Considered as New Course	ENTREPRENEURSHIP	Academic Peer	To include contemporary industry trends and practical case studies.
	19CS3285R	ARCHITECTING CLOUD SOLUTIONS	PFE-4	2	0	2	0	3	4	OPERATING SYSTEMS	New	EMPLOYABILITY	Industry Person	Empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services
	19CS3286R	CLOUD DEVOPS	PFE-4	2	0	2	0	3	4	SOFTWARE ENGINEERING	New	SKILL DEVELOPMENT	Alumni	To introduce a comprehensive training program that must be designed to equip individuals with the essential skills

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														and knowledge required to excel in Cloud DevOps practices.
97	19CS3268R	PRINCIPLES OF GAME DESIGN	PFE-5	2	0	2	0	3	4	NIL	Retained	EMPLOYABILITY	—	—
										INTERNET OF THINGS (IOT)				
98	19CS3117S	IOT SENSING AND ACTUATING DEVICES	PFE-1	2	0	2	4	4	8	OPERATING SYSTEMS DESIGN	Retained	EMPLOYABILITY	—	—
99	19CS3118R	INTERNET OF THINGS: ARCHITECTURES AND PROTOCOLS	PFE-2	2	0	2	0	3	4	OPERATING SYSTEMS DESIGN	Retained	EMPLOYABILITY	—	—
100	19CS3250S	CLOUD COMPUTING FOR IOT ENGINEERS	PFE-3	2	0	2	4	4	8	OPERATING SYSTEMS DESIGN	Retained	EMPLOYABILITY	—	—
	19CS3278R	DIGITAL VIDEO PROCESSING	PFE-4	2	0	2	0	3	4	MATHEMATICS FOR COMPUTING	New	EMPLOYABILITY	Faculty	To equip students with essential skills for today's digital world, fostering creativity and

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														employability across various industries.
	19CS3285R	ARCHITECTING CLOUD SOLUTIONS	PFE-4	2	0	2	0	3	4	OPERATING SYSTEMS	New	EMPLOYABILITY	Industry Person	Empower students with in-depth knowledge of designing scalable, cost-effective, and highly available cloud solutions using Amazon Web Services
	19CS3236R	CLOUD DEVOPS	PFE-4	2	0	2	0	3	4	SOFTWARE ENGINEERING	Retained	SKILL DEVELOPMENT	—	—
101	19CS3255R	WIRELESS SENSOR NETWORKS	PFE-5	2	0	2	0	3	4	COMPUTER NETWORKS & SECURITY	Retained	EMPLOYABILITY	—	—
	19CS3253R	EDGE COMPUTING	PFE-5	2	0	2	0	3	4	OPERATING SYSTEMS DESIGN	Retained	EMPLOYABILITY	—	—

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
FLEXI CORE COURSES														
	19CS3064R	UX DESIGN	FC	3	2	0	0	5	5	NIL	Retained	EMPLOYABILITY	—	—
102	19CS3060R	CONTINUOUS DELIVERY & DEVOPS	FC	3	0	2	0	4	5	NIL	Retained	EMPLOYABILITY	—	—
103	19CS3115R	EMBEDDED SYSTEMS	FC	3	0	2	0	4	5	NIL	New	EMPLOYABILITY	Industry Person	Provides a detailed understanding of the programming languages used in embedded systems, such as C and C++, along with software design principles and real-time operating systems.
104	19CS3234R	APPLICATION DEVELOPMENT ON CLOUD	FC	3	0	2	0	4	5	NIL	New	EMPLOYABILITY	Academic Peer	To equip students with essential skills in leveraging cloud computing services for building scalable,

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
														cost-effective, and globally accessible applications
105	19CS3235R	SOLUTIONS ARCHITECTING ON CLOUD	FC	3	0	2	0	4	5	NIL	New	EMPLOYABILITY	Industry Person	For building resilient and efficient cloud solutions through skilling
	19CS3232R	MACHINE LEARNING	FC	3	0	2	0	4	5	NIL	Retained	SKILL DEVELOPMENT	—	—
106	19CS3233R	DATA VISUALIZATION TECHNIQUES	FC	3	0	2	0	4	5	NIL	Retained	EMPLOYABILITY	—	—
107	19CS3036R	CLOUD INFRASTRUCTURE AND SERVICES	FC	3	0	2	0	4	5	NIL	30%-Revised Considered as New Course	SKILL DEVELOPMENT	—	—
108	19CS2210R	PARALLEL & DISTRIBUTED COMPUTING	FC	3	0	2	0	4	5	NIL	New	EMPLOYABILITY	Academic Peer	Enables to design and optimize high-performance systems for complex real-world challenges.

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	19CS3230R	CROSS-PLATFORM DEVELOPMENT FRAMEWORKS	FC	3	0	2	0	4	5	NIL	New	EMPLOYABILITY	Faculty	To master the art of creating applications that transcend platform constraints, utilizing frameworks such as React Native.
	19CS3231R	VISUAL PROGRAMING	FC	3	0	2	0	4	5	NIL	New	EMPLOYABILITY	Industry Person	Will empower students to create applications using intuitive graphical interfaces, fostering creativity and accessibility in software development.
109	19CS3214R	AUTOMATA THEORY AND COMPILER DESIGN	FC	3	2	0	0	5	5	NIL	Retained	EMPLOYABILITY	—	—
110	19CS3116R	SIGNAL PROCESSING	FC	3	2	0	0	5	5	NIL	New	EMPLOYABILITY	Industry Person	For emphasizing foundational concepts, mathematical

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														rigor, practical implementations , and real-world applications.
111	19CS3040R	CRYPT ANALYSIS AND CYBER DEFENCE	FC	3	0	2	0	4	5	NIL	Retained	SKILL DEVELOPMENT	—	—
TECHNICAL SKILLING COURSES														
112	19TS3001	TECHNICAL SKILLS(JAVA PBL)	SDC-CORE	0	0	0	10	2.5	10	NIL	New	SKILL DEVELOPMENT	Academic Peer	To learn market demanding coding skills like PFSD for comp.Coding
113	19TS2201S	TS - MEARN STACK + Adv. Java (SDP1)	TS-1 (SDP1)	0	0	0	8	2	8	OBJECT ORIENTED PROGRAMMING	Retained	SKILL DEVELOPMENT	—	—
114	19TS2201S	TS - PYTHON DJANGO FULL STACK + Competitive Coding (SDP2)	TS-1 (SDP2)	0	0	0	8	2	8	PROBLEM SOLVING & COMPUTER PROGRAMMING	Retained	SKILL DEVELOPMENT	—	—
115	19TS3101S	TECHNICAL SKILLING (SDP-3)	TS-1 (SDP3)	0	0	0	8	2	8	PROBLEM SOLVING & COMPUTER	New	SKILL DEVELOPMENT	Industry Person	To enhance employability by imparting relevant,

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
										PROGRAMMING				adaptable technical skills, making graduates competitive in today's job market
116	19TS3292S	TS-SDP4 (CLOUD DEVOPS)	TS-4 (SDP4)	0	0	0	8	2	8	SOFTWARE ENGINEERING, OOP	New	SKILL DEVELOPMENT	Alumni	To bridge the gap between development and operations in the cloud
117	19TS3291S	TS-SDP4 (CLOUD BASED SOLUTIONS ARCHITECT)	TS-4 (SDP4)	0	0	0	8	2	8	CLOUD INFRASTRUCTURE AND SERVICES	New	SKILL DEVELOPMENT	Alumni	To provide a well-rounded education in cloud architecture
118	19TS3293S	TS-SDP4 (CLOUD BASED SECURITY SPECIALITY)	TS-4 (SDP4)	0	0	0	8	2	8	COMPUTER NETWORKS & SECURITY	New	SKILL DEVELOPMENT	Industry Person	It equips individuals with specialized skills to fortify cloud environments, aligning with the increasing demand for cloud security expertise

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119	19TS3294S	TS-SDP4 (CERTIFIED GAME DEVELOPER)	TS-4 (SDP4)	0	0	0	8	2	8	PROGRAMMING FOR GAME DEVELOPMENT	New	SKILL DEVELOPMENT	Industry Person	To nurture expertise in game development, covering essential skills, tools, and industry insights
120	19TS3295S	TS SDP-4 (CLOUD BASED AI/ML SPECIALITY)	TS-4 (SDP4)	0	0	0	8	2	8	ARTIFICIAL INTELLIGENCE	New	SKILL DEVELOPMENT	Alumni	To master in cloud-based AI/ML tools, frameworks, and deployment strategies, enabling them to develop intelligent applications
121	19TS3296S	TS SDP-4 (CLOUD BASED DATA ANALYTICS SPECIALITY)	TS-4 (SDP4)	0	0	0	8	2	8	DATA SCIENCE	New	SKILL DEVELOPMENT	Industry Person	Enable to develop intelligent applications and solutions on cloud platforms.
122	19TS3290S	TS-SDP4 (CLOUD BASED IOT DEVELOPER)	TS-4 (SDP4)	0	0	0	8	2	8	NIL	New	SKILL DEVELOPMENT	Industry Person	To excel in developing Internet of Things (IoT)

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S. No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite	New/Revised /Retained	EES	Stake holders	Justification for Considering the feedback
														solutions on cloud platforms.
SCIENCE ELECTIVES, OPEN ELECTIVES														
	18PH4101	QUANTUM PHYSICS FOR ENGINEERS	BSE	3	0	0	0	3	3	NIL	Retained	SKILL DVELOPMENT	—	—
	18CY1005	CHEMISTRY FOR ENGINEERS	BSE	3	0	0	0	3	3	NIL	New	EMPLOYABILITY	—	—
	18CS40A7	FUNDAMENTALS OF SOFTWARE ENGINEERING	FSE	3	0	0	0	3	3	NIL	Retained	EMPLOYABILITY	—	—
	18CS40A6	FUNDAMENTALS OF DBMS	FDBMS	3	0	0	0	3	3	NIL	Retained	EMPLOYABILITY	—	—
	18CS40A8	FUNDAMENTALS OF INFORMATION TECHNOLOGY	FIT	3	0	0	0	3	3	NIL	Retained	EMPLOYABILITY	—	—

Percentage of Syllabus Revision = (Total No. of courses revised + new courses) * 100/Total Courses
= (40+4) * 100/122=36.065%

Percentage of Courses focusing on Employability= 70*100/122=57.37

Percentage of Courses focusing on Entrepreneurship= 3*100/122=2.459

Percentage of Courses focusing on Skill Development = 49*100/122=40.16

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-4(b)

M.Tech – COMPUTER SCIENCE AND ENGINEERING (CSE)

2019-20 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 COMPUTER SCIENCE	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 MANAGEMENT SYSTEMS	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

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S. No	Category	Course Code	Course Title	Periods			Credits	New/Revised/Retained	EES
				L	T	P			
			Elective-III	3	0	0	3		
			Elective-IV	3	0	0	3		
9	PRI	18IE5250	TERM PAPER	0	0	4	2	Retained	SKILL DEVELOPMENTEXP
10	PRI	18IE6050	DISSERTATION	0	0	72	36	Retained	EMPLOYABILITY
						Total Credits	**88**		
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	EMPLOYBILITY
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

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S. No	Category	Course Code	Course Title	Periods			Credits	New/Revised/Retained	EES
				L	T	P			
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
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(c)

M.Tech - MACHINE LEARNING & COMPUTING (MLC)

2019-20 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	Retained	EMPLOYBILITY
2	PCC	18CS5110	APPLIED STATISTICS	3	0	0	3	Retained	SKILL DEVELOPMENT
3	PCC	18CS5111	DATA MINING	3	0	2	4	Retained	EMPLOYABILITY
4	PCC	18CS5112	MATRIX COMPUTATION	3	0	2	4	Retained	SKILL DEVELOPMENT
			ELECTIVE-I	3	0	0	3		
			ELECTIVE-II	3	0	0	3		
	PRI	18IE 5149	SEMINAR	0	0	4	2	Retained	SKILL DEVELOPMENT
5	PCC	18CS5113	EVOLUTIONARY AND NATURAL COMPUTING	3	0	2	4	Retained	EMPLOYABILITY
6	PCC	18CS5114	DISCRETE MATHEMATICS	3	0	0	3	Retained	SKILL DEVELOPMENT
7	PCC	18CS5115	PATTERN RECOGNITION AND MACHINE LEARNING	3	0	2	4	Retained	EMPLOYABILITY
8	PCC	18CS5116	COMPUTER MODELING& SIMULATION	3	0	2	4	Retained	EMPLOYABILITY

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S. No	Category	Course Code	Course Title	Periods			Credits	New/Revised/Retained	EES
				L	T	P			
			ELECTIVE-III	3	0	0	3		
			ELECTIVE-IV	3	0	0	3		
9	PRI	18IE 5250	TERM PAPER	0	0	4	2	Retained	SKILL DEVELOPMENT
10	PRI	18IE 6050	DISSERTATION	0	0	72	36	Retained	EMPLOYABILITY
						Total Credits	**81**		
ELECTIVE-I									
11	PEC	18CS51E1	COMPUTER VISION AND IMAGE PROCESSING	3	0	0	3	Retained	SKILL DEVELOPMENT
12	PEC	18CS51E2	SERVICE ORIENTED ARCHITECTURE	3	0	0	3	Retained	SKILL DEVELOPMENT
13	PEC	18CS51E3	DATA ANALYSIS	3	0	0	3	Retained	EMPLOYABILITY
14	PEC	18CS51E4	CLOUD COMPUTING	3	0	0	3	Retained	EMPLOYABILITY
ELECTIVE-II									
15	PEC	18CS51F1	ARTIFICIAL NEURAL NETWORKS	3	0	0	3	Retained	EMPLOYABILITY
16	PEC	18CS51F2	APPLICATION DEVELOPMENT FRAMEWORKS	3	0	0	3	Retained	EMPLOYABILITY
17	PEC	18CS51F3	BIG DATA ANALYTICS	3	0	0	3	Retained	SKILL DEVELOPMENT

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S. No	Category	Course Code	Course Title	Periods			Credits	New/Revised/Retained	EES
				L	T	P			
18	PEC	18CS51F4	CLOUD SECURITY	3	0	0	3	Retained	EMPLOYABILITY
			Elective-III						
19	PEC	18CS52G1	CONTROL THEORY	3	0	0	3	Retained	SKILL DEVELOPMENT
20	PEC	18CS52G2	WEB SEMANTICS	3	0	0	3	Retained	EMPLOYABILITY
21	PEC	18CS52G3	MAP REDUCE DESIGN PATTERNS	3	0	0	3	Retained	EMPLOYABILITY
22	PEC	18CS52G4	DATA CENTRE VIRTUALIZATION	3	0	0	3	Retained	EMPLOYBILITY
			Elective-IV						
23	PEC	18CS52H1	REINFORCEMENT LEARNING	3	0	0	3	Retained	EMPLOYABILITY
24	PEC	18CS52H2	MULTI AGENT SYSTEMS	3	0	0	3	Retained	SKILL DEVELOPMENT
25	PEC	18CS52H3	NETWORK SECURITY	3	0	0	3	Retained	EMPLOYABILITY
26	PEC	18CS52H4	CLOUD APPLICATION ARCHITECTURES	3	0	0	3	Retained	SKILL DEVELOPMENT

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-4(d)

M.Tech - DIGITAL FORENSICS & CYBER SECURITY (DFCS)

2019-20 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	Retained	EMPLOYBILITY
2	PCC	18CS 5118	DIGITAL FORENSICS	3	0	2	4	Retained	EMPLOYBILITY
3	PCC	18CS 5119	ADVANCE NETWORK SECURITY & INVESTIGATIONS	3	0	2	4	Retained	EMPLOYBILITY
4	PCC	18CS 5120	SOFTWARE SECURITY	3	0	2	4	Retained	EMPLOYBILITY
			ELECTIVE-I	3	0	0	3		
			ELECTIVE-II	3	0	0	3		
5	PRI	18IE 5149	SEMINAR	0	0	4	2	Retained	SKILL DEVELOPMENT
6	PCC	18CS 5221	CRYPTOGRAPHY FOR CYBER DEFENSE	3	0	2	4	Retained	EMPLOYBILITY
7	PCC	18CS 5222	MALWARE ANALYSIS & REVERSE ENGINEERING	3	0	2	4	Retained	EMPLOYBILITY
8	PCC	18CS 5223	CYBER INCIDENT RESPONSE & RESILIENCE	3	0	2	4	Retained	EMPLOYBILITY
9	PCC	18CS 5224	CYBER LAW, GOVERNANCE & COMPLIANCE	3	0	2	4	Retained	EMPLOYBILITY

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

S. No	Category	Course Code	Course Title	Periods			Credits	New/Revised/ Retained	EES
				L	T	P			
			ELECTIVE-III	3	0	0	3		
			ELECTIVE-IV	3	0	0	3		
10	PRI	18IE 5250	TERM PAPER	0	0	4	2	Retained	SKILL DEVELOPMENT
11	PRI	18IE 6050	DISSERTATION	0	0	72	36	Retained	EMPLOYABILITY
						Total Credits	**84**		
ELECTIVE-I									
12	PEC	18CS 51I1	MOBILE DEVICE THREATS & INVESTIGATION	3	0	0	3	Retained	EMPLOYBILITY
13	PEC	18CS 51I2	FUNDAMENTALS OF E-DISCOVERY	3	0	0	3	Retained	SKILL DEVELOPMENT
14	PEC	18CS 51I3	FUZZY SETS AND FUZZY LOGIC	3	0	0	3	Retained	SKILL DEVELOPMENT
ELECTIVE-II									
15	PEC	18CS 51J1	INTRODUCTION TO BIG DATA ANALYTICS	3	0	0	3	Retained	EMPLOYABILITY
16	PEC	18CS 51J2	SOCIAL MEDIA FORENSICS	3	0	0	3	Retained	SKILL DEVELOPMENT
17	PEC	18CS 51J3	CRITICAL INFORMATION INFRASTRUCTURE SECURITY	3	0	0	3	Retained	EMPLOYBILITY
ELECTIVE-III									

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S. No	Category	Course Code	Course Title	Periods			Credits	New/Revised/ Retained	EES
				L	T	P			
18	PEC	18CS 52K1	INFRASTRUCTURE ATTACKS AND DEFENSE	3	0	0	3	Retained	EMPLOYBILITY
19	PEC	18CS 52K2	SOFTWARE VULNERABILITY ANALYSIS AND RESILIENCE	3	0	0	3	Retained	EMPLOYABILITY
20	PEC	18CS 52K3	PARALLEL & CLOUD COMPUTING	3	0	0	3	Retained	EMPLOYABILITY
ELECTIVE-IV									
21	PEC	18CS 52L1	APPLIED CRYPTOGRAPHY AND STEGANOGRAPHY	3	0	0	3	Retained	SKILL DEVELOPMENT
22	PEC	18CS 52L2	SOFTWARE MODELING	3	0	0	3	Retained	EMPLOYBILITY
23	PEC	18CS 52L3	DIGITAL IMAGE PROCESSING	3	0	0	3	Retained	SKILL DEVELOPMENT

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Annexure-4(e)

B.Tech - CSE

LIST OF COURSES OFFERED IN ADVANCE AND PEER MENTOR MODE

FOR 2019-20 ADMITTED BATCH

S. No	Course Code	Course Title	Category	Mode	L	T	P	S	Cr	H	Pre-requisite
1	19CS2104	MATHEMATICAL PROGRAMMING-1	BS	A/P	3	2	2	0	6	7	NIL
2	19CS2204	MATHEMATICAL PROGRAMMING -II	BS	A/P	3	2	2	0	6	7	MATHEMATICAl PROGRAMMING 1
3	19CS2106	OPERATING SYSTEMS DESIGN	PC	A/P	4	0	4	2	6.5	10	NIL
4	19CS2211	SOFTWARE ENGINEERING	PC	A/P	3	2	2	0	6	7	NIL
5	19CS2108S	DATABASE MANAGEMENT SYSTEMS	PC	A/P	3	1	4	2	6.5	10	NIL
6	19CS2212	ARTIFICIAL INTELLIGENCE	PC	A/P	3	0	4	0	5	7	NIL
7	19CS2107	ENTERPRISE PROGRAMMING	PC	A/P	4	0	4	4	7	12	OBJECT ORIENTED PROGRAMMING
8	19CS2205	DATA SCIENCE	PC	A/P	3	0	4	2	5.5	9	NIL
9	19CS2109	COMPUTER NETWORKS & SECURITY	PC	A/P	4	1	2	0	6	7	NIL
10	19CS3113	ANALYSIS & DESIGN OF ALGORITHMS	PC	A/P	4	0	4	4	7	12	DATA STRUCTURES
11	19IE4048/ 19IE4050/ 19IE4051	PROJECT PART - 1/PRACTICE SCHOOL/INTERNSHIP	PJ	A/P	0	0	16	0	8	16	NIL
12	19IE4049/ 19IE4050/ 19IE4052	PROJECT PART- 2/PRACTICE SCHOOL/INTERNSHIP	PJ	A	0	0	16	0	8	16	NIL
13	19CS3021S	MACHINE LEARNING	PFE-1	A/P	3	0	4	4	6	11	ARTIFICAIL INTELLIGENCE
14	19CS3022R	SOFT COMPUTING	PFE-2	P	3	0	4	0	5	7	ARTIFICAIL INTELLIGENCE
15	19CS3026R	ARTIFICIAL NEURAL NETWORKS	PFE-2	P	3	0	4	0	5	7	ARTIFICAIL INTELLIGENCE
16	19CS3269S	DEEP LEARNING	PFE-3	A/P	3	0	4	4	6	11	MACHINE LEARNING
17	19CS3270R	COGNITIVE COMPUTING	PFE-4	P	3	0	4	0	5	7	ARTIFICIAL INTELLIGENCE
18	19CS3271R	PERCEPTION AND COMPUTER VISION	PFE-4	P	3	0	4	0	5	7	ARTIFICIAL INTELLIGENCE

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S. No	Course Code	Course Title	Category	Mode	L	T	P	S	Cr	H	Pre-requisite
19	19CS3278R	DIGITAL VIDEO PROCESSING	PFE-4	P	3	0	4	0	5	7	MATHEMATICS FOR COMPUTING
20	19CS3272R	COMPUTATIONAL EPIDEMIOLOGY	PFE-5	P	3	0	4	0	5	7	ARTIFICIAL INTELLIGENCE, DATA SCIENCE
21	19CS3273R	NATURAL LANGUAGE PROCESSING	PFE-5	P	3	0	4	0	5	7	ARTIFICIAL INTELLIGENCE
22	19CS3274R	SPEECH PROCESSING	PFE-5	P	3	0	4	0	5	7	ARTIFICIAL INTELLIGENCE
23	19CS3051S	DATA VISUALISATION TECHNIQUES	PFE-1	A/P	3	0	4	4	6	11	DATABASE MANAGEMENT SYSTEMS
24	19CS3056S	FUNCTIONAL & CONCURRENT PROGRAMMING	PFE-1	A/P	3	0	4	4	6	11	OBJECT ORIENTED PRORAMMING
25	19CS3052R	DATA WAREHOUSING & MINING	PFE-2	P	2	0	2	0	3	4	DATABASE MANAGEMENT SYSTEMS
26	19CS3275S	BIG DATA ANALYTICS	PFE-3	A/P	3	0	4	4	6	11	DATABASE MANAGEMENT SYSTEMS
27	19CS3276R	BIG DATA OPTIMIZATION	PFE-4	P	3	0	4	0	5	7	DESIGN AND ANALYSIS OF ALGORITHMS
28	19CS3277R	BIOINFORMATICS	PFE-4	P	3	0	4	0	5	7	DATA SCIENCE
29	19CS3278R	DIGITAL VIDEO PROCESSING	PFE-4	P	3	0	4	0	5	7	MATHEMATICS FOR COMPUTING
30	19CS3272R	COMPUTATIONAL EPIDEMIOLOGY	PFE-5	P	3	0	4	0	5	7	ARTIFICIAL INTELLIGENCE, DATA SCIENCE
31	19CS3279R	ADVANCED DATABASES	PFE-5	P	3	0	4	0	5	7	DATABASE MANAGEMENT SYSTEMS
32	19CS3280R	GRAPH & WEB ANALYTICS	PFE-5	P	3	0	4	0	5	7	DATA SCIENCE
33	19CS3041S	CRYPT ANALYSIS & CYBER DEFENSE	PFE-1	A/P	3	0	4	4	6	11	COMPUTER NETWORKS & SECURITY
34	19CS3042R	NETWORK & INFRASTRUCTURE SECURITY	PFE-2	P	2	0	2	0	3	4	COMPUTER NETWORKS & SECURITY
35	19CS3045R	INTRODUCTION TO BLOCKCHAIN & CRYPTO CURRENCIES	PFE-2	P	2	0	2	0	3	4	COMPUTER NETWORKS & SECURITY
36	19CS3259S	DIGITAL FORENSICS	PFE-3	A/P	3	0	4	4	6	11	CRYPTANALYSIS & CYBER DEFENCE

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S. No	Course Code	Course Title	Category	Mode	L	T	P	S	Cr	H	Pre-requisite
37	19CS3260R	DATABASE & SYSTEM SECURITY	PFE-4	P	3	0	4	0	5	7	DATABASE MANAGEMENT SYSTEMS
38	19CS3261R	PROGRAMMING FOR SMART CONTRACTS	PFE-4	P	3	0	4	0	5	7	INTRODUCTION TO BLOCKCHAIN AND CRYPTO CURRENCIES
39	19CS3262R	SECURE SOFTWARE ENGINEERING	PFE-5	P	3	0	4	0	5	7	SOFTWARE ENGINEERING
40	19CS3264R	WEB SECURITY	PFE-5	P	3	0	4	0	5	7	COMPUTER NETWORKS & SECURITY
41	19CS3265R	WIRELESS SENSOR NETWORKS	PFE-5	P	3	0	4	0	5	7	COMPUTER NETWORKS & SECURITY
42	19CS3062S	SOFTWARE VERIFICATION & VALIDATION	PFE-1	A/P	3	0	4	4	6	11	SOFTWARE ENGINEERING
43	19CS3065S	DESIGN PATTERNS & CLEAN CODING TECHNIQUES	PFE-1	A/P	3	0	4	4	6	11	OBJECT ORIENTED PRORAMMING
44	19CS3064R	UX DESIGN	PFE-2	P	2	0	2	0	3	4	DESIGN THINKING FOR INNOVATION - 1
45	19CS3256S	CONTINUOUS DELIVERY & DEVOPS	PFE-3	A/P	3	0	4	4	6	11	SOFTWARE ENGINEERING
46	19CS3257R	SOFTWARE PROJECT MANAGEMENT	PFE-4	P	3	0	4	0	5	7	SOFTWARE ENGINEERING
47	19CS3254R	VISUAL PROGRAMING	PFE-4	P	3	0	4	0	5	7	OBJECT ORIENTED PRORAMMING
48	19CS3258R	SOFTWARE RELIABILITY	PFE-5	P	4	0	2	0	5	6	SOFTWARE ENGINEERING
49	19CS3255R	CROSS-PLATFORM DEVELOPMENT FRAMEWORKS	PFE-5	P	3	0	4	0	5	7	OBJECT ORIENTED PRORAMMING
50	19CS3056S	FUNCTIONAL & CONCURRENT PROGRAMMING	PFE-1	A/P	3	0	4	4	6	11	OBJECT ORIENTED PRORAMMING
51	19CS3036R	CLOUD INFRASTRUCTURE & SERVICES	PFE-1	A/P	3	0	4	4	6	11	NIL
52	19CS3032R	ADVANCED OPERATING SYSTEMS	PFE-2	P	3	0	4	0	5	7	OPERATING SYSTEMS DESIGN
53	19CS3281S	CLOUD & SERVERLESS COMPUTING	PFE-3	A/P	3	0	4	4	6	11	NIL
54	19CS3251R	ADVANCED COMPUTER ARCHITECTURE	PFE-4	P	3	0	4	0	5	7	COMPUTER ORGANIZATION

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S. No	Course Code	Course Title	Category	Mode	L	T	P	S	Cr	H	Pre-requisite
											& ARCHITECTURE
55	19CS3252R	PARALLEL ALGORITHMS	PFE-4	P	3	0	4	0	5	7	OPERATING SYSTEMS DESIGN, OOP
56	19CS3253R	EDGE COMPUTING	PFE-5	P	3	0	4	0	5	7	OPERATING SYSTEMS DESIGN
57	19CS3038R	HIGH PERFORMANCE COMPUTING	PFE-5	P	3	0	4	0	5	7	OPERATING SYSTEMS DESIGN
58	19CS3263R	SECURITY IN INTERNET OF THINGS	PFE-5	P	3	0	4	0	5	7	COMPUTER NETWORKS & SECURITY
59	19CS3071S	PROGRAMMING FOR GAME DEVELOPMENT	PFE-1	A/P	3	0	4	4	6	11	PROBLEM SOLVING AND COMPUTER PROGRAMMING
60	19CS3064R	UX DESIGN	PFE-2	P	2	0	2	0	3	4	DESIGN THINKING FOR INNOVATION - 1
61	19CS3266S	AR & VR APPLICATION DEVELOPMENT	PFE-3	A/P	3	0	4	4	6	11	PROBLEM SOLVING & COMPUTER PROGRAMMING
62	19CS3267R	BUSINESS OF GAMES & ENTREPRENEURSHIP	PFE-4	P	3	0	4	0	5	7	NIL
63	19CS3268R	PRINCIPLES OF GAME DESIGN	PFE-5	P	4	0	2	0	5	6	NIL
64	19CS3117S	IOT SENSING AND ACTUATING DEVICES	PFE-1	A/P	3	0	4	4	6	11	OPERATING SYSTEMS DESIGN
65	19CS3118R	INTERNET OF THINGS: ARCHITECTURES AND PROTOCOLS	PFE-2	P	2	0	2	0	3	4	OPERATING SYSTEMS DESIGN
66	19CS3250S	CLOUD COMPUTING FOR IOT ENGINEERS	PFE-3	A/P	3	0	4	4	6	11	OPERATING SYSTEMS DESIGN
67	19CS3278R	DIGITAL VIDEO PROCESSING	PFE-4	P	3	0	4	0	5	7	MATHEMATICS FOR COMPUTING
68	19CS3265R	WIRELESS SENSOR NETWORKS	PFE-5	P	3	0	4	0	5	7	COMPUTER NETWORKS & SECURITY
69	19CS3253R	EDGE COMPUTING	PFE-5	P	3	0	4	0	5	7	OPERATING SYSTEMS DESIGN
70	19CS3064R	UX DESIGN	FC	P	4	2	2	0	7	8	NIL

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S. No	Course Code	Course Title	Category	Mode	L	T	P	S	Cr	H	Pre-requisite
71	19CS3060R	CONTINUOUS DELIVERY & DEVOPS	FC	P	4	0	4	0	6	8	NIL
72	19CS3115R	EMBEDDED SYSTEMS	FC	P	4	0	4	0	6	8	NIL
73	19CS3232R	MACHINE LEARNING	FC	P	4	0	4	0	6	8	NIL
74	19CS3233R	DATA VISUALIZATION TECHNIQUES	FC	P	4	0	4	0	6	8	NIL
75	19CS3036R	CLOUD INFRASTRUCTURE AND SERVICES	FC	P	4	0	4	0	6	8	NIL
76	19CS2210R	PARALLEL & DISTRIBUTED COMPUTING	FC	P	4	0	4	0	6	8	NIL
77	19CS3230R	CROSS-PLATFORM DEVELOPMENT FRAMEWORKS	FC	P	4	0	4	0	6	8	NIL
78	19CS3231R	VISUAL PROGRAMING	FC	P	4	0	4	0	6	8	NIL
79	19CS3214R	AUTOMATA THEORY AND COMPILER DESIGN	FC	P	4	2	2	0	7	8	NIL
80	19CS3116R	SIGNAL PROCESSING	FC	P	4	2	2	0	7	8	NIL
81	19CS3040R	CRYPT ANALYSIS AND CYBER DEFENCE	FC	P	4	0	4	0	6	8	NIL
82	19TS3001	TECHNICAL SKILLS	SDC-CORE	P	0	0	0	18	4.5	18	NIL
83	19TS2201S	TS - MEARN STACK + Adv. Java (SDP1)	TS-1 (SDP1)	P	0	0	0	16	4	16	OBJECT ORIENTED PROGRAMMING
84	19TS2201S	TS - PYTHON DJANGO FULL STACK + Competitive Coding (SDP2)	TS-1 (SDP2)	P	0	0	0	16	4	16	PROBLEM SOLVING & COMPUTER PROGRAMMING
85	19TS3101S	TECHNICAL SKILLING (SDP-3)	TS-1 (SDP3)	P	0	0	0	16	4	16	PROBLEM SOLVING & COMPUTER PROGRAMMING
86	19TS3292S	TS-SDP4 (CLOUD DEVOPS)	TS-4 (SDP4)	P	0	0	0	16	4	16	SOFTWARE ENGINEERING, OOP
87	19TS3291S	TS-SDP4 (CLOUD BASED SOLUTIONS ARCHITECT)	TS-4 (SDP4)	P	0	0	0	16	4	16	CLOUD INFRASTRUCTURE AND SERVICES
88	19TS3293S	TS-SDP4 (CLOUD BASED SECURITY SPECIALITY)	TS-4 (SDP4)	P	0	0	0	16	4	16	COMPUTER NETWORKS & SECURITY

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S. No	Course Code	Course Title	Category	Mode	L	T	P	S	Cr	H	Pre-requisite
89	19TS3294S	TS-SDP4 (CERTIFIED GAME DEVELOPER)	TS-4 (SDP4)	P	0	0	0	16	4	16	PROGRAMMING FOR GAME DEVELOPMENT
90	19TS3295S	TS SDP-4 (CLOUD BASED AI/ML SPECIALITY)	TS-4 (SDP4)	P	0	0	0	16	4	16	ARTIFICIAL INTELLIGENCE
91	19TS3296S	TS SDP-4 (CLOUD BASED DATA ANALYTICS SPECIALITY)	TS-4 (SDP4)	P	0	0	0	16	4	16	DATA SCIENCE
92	19TS3290S	TS-SDP4 (CLOUD BASED IOT DEVELOPER)	TS-4 (SDP4)	P	0	0	0	16	4	16	NIL

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Annexure-6

B.Tech - CSE

2029-20 Admitted Batch MOOCS COURSES

S. No	Course Code	Course Title	Category	Mode	L	T	P	S	Cr	CH	Pre-requisite
1	18PH4002M	OPTICAL ENGINEERING	BSE	M	3	0	0	0	3	3	NIL
2	18PH4003M	SEMICONDUCTOR DEVICES	BSE	M	3	0	0	0	3	3	NIL
3	18FL3062M	LEARN SPANISH: BASIC SPANISH VOCABULARY	FL	M	4	0	0	0	4	4	NIL
4	18FL3060M	RUSSIAN FOR BEGINNERS	FL	M	4	0	0	0	4	4	NIL
5	18FL3063M	KOREAN LANGUAGE	FL	M	4	0	0	0	4	4	NIL
6	18FL3053M	LEARN CHINESE: HSK TEST PREPARATION	FL	M	4	0	0	0	4	4	NIL
7	18FL3064M	JAPANESE LANGUAGE	FL	M	4	0	0	0	4	4	NIL
8	18MB4058M	SIX SIGMA YELLOW BELT	ME	M	4	0	0	0	4	4	NIL
9	18MB4059M	SEARCH ENGINE OPTIMIZATION	ME	M	4	0	0	0	4	4	NIL
10	18MB4060M	FINTECH:FINANCE INDUSTRY TRANSFORMATION AND REGULATION	ME	M	4	0	0	0	4	4	NIL
11	18OE4001M	GRAPHIC DESIGN	OE-1	M	4	0	0	0	4	4	NIL
12	18OE4002M	PHOTOGRAPHY BASICS AND BEYOND FROM SMART PHONE TO DSLR	OE-1	M	4	0	0	0	4	4	NIL
13	18OE4003M	EXPLORING OUR RESPONSES TO CLIMATE CHANGE	OE-1	M	4	0	0	0	4	4	NIL
14	19OE4221M	CONSTRUCTION MANAGEMENT	OE-2	M	4	0	0	0	4	4	NIL
15	19OE4222M	ENERGY PRODUCTION, DISTRIBUTION & SAFETY	OE-2	M	4	0	0	0	4	4	NIL
16	19OE4223M	GEOGRAPHIC INFORMATION SYSTEMS	OE-2	M	4	0	0	0	4	4	NIL
17	19OE4224M	SELF DRIVING CARS	OE-2	M	4	0	0	0	4	4	NIL

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

S. No	Course Code	Course Title	Category	Mode	L	T	P	S	Cr	CH	Pre-requisite
18	19OE4231M	DIGITAL MARKETING	OE-2	M	4	0	0	0	4	4	NIL
19	19OE4233M	SOCIAL ENTREPRENEURSHIP	OE-3	M	4	0	0	0	4	4	NIL

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Annexure-7

B.Tech - CSE

2019-20 Admitted Batch VALUE ADDED COURSES

S. No	Course Code	Course Title	Category	MODE	L	T	P	S	Cr	CH
1	19CC3000	AWS CERTIFIED CLOUD PRACTITIONER (CLF-C01)	VAC	R	0	0	0	8	0	8
2	19CC3010	AWS CERTIFIED DEVELOPER - ASSOCIATE (AWS-DA)	VAC	R	0	0	0	8	0	8
3	19CC3011	AWS CERTIFIED SOLUTIONS ARCHITECT ASSOCIATE	VAC	R	0	0	0	8	0	8
4	19CC3012	MICROSOFT CERTIFIED: AZURE DEVELOPER ASSOCIATE (AZ-204)	VAC	R	0	0	0	8	0	8
5	19CC3013	GOOGLE CLOUD PRACTITIONER	VAC	R	0	0	0	8	0	8
6	19CC3014	MICROSOFT DEVOPS SOLUTIONS (AZ-400)	VAC	R	0	0	0	8	0	8
7	19CC3015	TENSORFLOW DEVELOPER CERTIFICATE	VAC	R	0	0	0	8	0	8
8	19CC3016	MONGODB ASSOCIATE DEVELOPER EXAM/ MANGODB DEVELOPER ASSOCIATE	VAC	R	0	0	0	8	0	8
9	19CC3058	Palo Alto Network Certified Cyber Security	VAC	R	0	0	0	8	0	8
10	19CC3061	JUNIPER NETWORKS CERTIFIED ASSOCIATE, JUNOS (JNCIA-JUNOS JN0-104)	VAC	R	0	0	0	8	0	8
11	19CC3062	WIPRO TALENTNEXT JAVA J2EE CERTIFICATE	VAC	R	0	0	0	8	0	8
12	19CC3063	WIPRO TALENTNEXT JAVA FULL STACK CERTIFICATE	VAC	R	0	0	0	8	0	8
13	19CC3223	PCAP™ – CERTIFIED ASSOCIATE IN PYTHON PROGRAMMING	VAC	R	0	0	0	8	0	8
14	19CC3224	C++ CERTIFIED ASSOCIATE PROGRAMMER (CPA)	VAC	R	0	0	0	8	0	8
15	19CC3225	C PROGRAMMING LANGUAGE CERTIFIED ASSOCIATE (CLA)	VAC	R	0	0	0	8	0	8
16	19CC3226	CODECHEF CERTIFIED DATA STRUCTURE & ALGORITHMS PROGRAMME	VAC	R	0	0	0	8	0	8
17	19CC3227	SERVICENOW CERTIFIED SYSTEM ADMINISTRATOR	VAC	R	0	0	0	8	0	8
18	19CC3228	SERVICENOW CERTIFIED DEVELOPER	VAC	R	0	0	0	8	0	8
19	19CC3229	SALESFORCE ADMINISTRATOR CERTIFICATION EXAM (CRT101)	VAC	R	0	0	0	8	0	8
20	19CC3230	SALESFORCE DEVELOPER CERTIFICATION EXAM	VAC	R	0	0	0	8	0	8

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S. No	Course Code	Course Title	Category	MODE	L	T	P	S	Cr	CH
21	19CC3231	PEGA CERTIFIED SYSTEM ARCHITECT	VAC	R	0	0	0	8	0	8
22	19CC3232	PEGA CERTIFIED SENIOR SYSTEM ARCHITECT	VAC	R	0	0	0	8	0	8
23	19CC3233	ORACLE CLOUD INFRASTRUCTURE CERTIFICATION	VAC	R	0	0	0	8	0	8
24	19CC3234	MULESOFT CERTIFIED DEVELOPER	VAC	R	0	0	0	8	0	8
25	19CC3235	MONGODB ASSOCIATE DBA EXAM	VAC	R	0	0	0	8	0	8
26	19CC3236	MICROSOFT CERTIFIED: DEVOPS ENGINEER EXPERT (AZ-400)	VAC	R	0	0	0	8	0	8
27	19CC3237	MICROSOFT CERTIFIED: AZURE SOLUTIONS ARCHITECT EXPERT	VAC	R	0	0	0	8	0	8
28	19CC3238	MICROSOFT CERTIFIED: AZURE AI ENGINEER ASSOCIATE	VAC	R	0	0	0	8	0	8
29	19CC3239	MICROSOFT CERTIFIED: AZURE NETWORK ENGINEER ASSOCIATE	VAC	R	0	0	0	8	0	8
30	19CC3240	MICROSOFT CERTIFIED: AZURE SECURITY ENGINEER ASSOCIATE	VAC	R	0	0	0	8	0	8
31	19CC3241	MICROSOFT CERTIFIED: AZURE DATA ENGINEER ASSOCIATE	VAC	R	0	0	0	8	0	8
32	19CC3242	GOOGLE CLOUD ASSOCIATE CLOUD ENGINEER (GCP-ACE)	VAC	R	0	0	0	8	0	8
33	19CC3243	CAMBRIDGE ASSESSMENT ENGLISH BEC-PRELIMINARY	VAC	R	0	0	0	8	0	8
34	19CC3244	AWS CERTIFIED SOLUTIONS ARCHITECT - ASSOCIATE (AWS-SAA)	VAC	R	0	0	0	8	0	8
35	19CC3245	AWS CERTIFIED MACHINE LEARNING SPECIALITY	VAC	R	0	0	0	8	0	8
36	19CC3246	AWS CERTIFIED DATABASE SPECIALITY	VAC	R	0	0	0	8	0	8
37	19CC3247	AWS CERTIFIED SECURITY SPECIALITY	VAC	R	0	0	0	8	0	8
38	19CC3248	AWS CERTIFIED DATA ANALYTICS SPECIALITY	VAC	R	0	0	0	8	0	8
39	19CC3249	AWS CERTIFIED ADVANCED NETWORKING SPECIALITY	VAC	R	0	0	0	8	0	8
40	19CC3250	AWS CERTIFIED DEVOPS ENGINEER PROFESSIONAL	VAC	R	0	0	0	8	0	8
41	19CC3251	AWS CERTIFIED SOLUTIONS ARCHITECT PROFESSIONAL	VAC	R	0	0	0	8	0	8
42	19CC3252	AVIATRIX CERTIFIED ENGINEER MULTI-CLOUD NETWORKING ASSOCIATE (ACE-MCNA)	VAC	R	0	0	0	8	0	8
43	19CC3253	CERTIFIED ETHICAL HACKER (CEH)	VAC	R	0	0	0	8	0	8
44	19CC3254	AUTOMATION ANYWHERE RPA CERTIFICATION	VAC	R	0	0	0	8	0	8

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45	19CC3255	PEN-200 | PENETRATION TESTING| OFFENSIVE SECURITY CERTIFICATION	VAC	R	0	0	0	8	0	8

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