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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

MINUTES OF 38TH BOARD OF STUDIES MEETING

31st July 2026

The 38th Board of Studies meeting for the Department of Computer Science and Engineering was held on 31st July 2026, online (Microsoft Teams) from 01:30PM to 04:00PM.

The following members were present:

1. DR.T.PAVAN KUMAR,CHAIRPERSON
2. MR.HARI KIRAN VEGE,FACULTY REPRESENTATIVE
3. DR. K. AMARENDRA,FACULTY REPRESENTATIVE
4. DR. A SENTHIL,FACULTY REPRESENTATIVE
5. DR. B. TIRAPATHI REDDY,FACULTY REPRESENTATIVE
6. DR. M. VENKATA NARESH,FACULTY REPRESENTATIVE
7. DR NARASIMHA RAJU,FACULTY REPRESENTATIVE
8. DR.ASWIN KUMER S V,FACULTY REPRESENTATIVE
9. DR. ANNE PRAVEEN KRISHNA,FACULTY REPRESENTATIVE
10. DR. P VENKATESHWARA RAO,FACULTY REPRESENTATIVE
11. DR.ARPITA GUPTA,FACULTY REPRESENTATIVE
12. DR. T K RAMA KRISHNA RAO,FACULTY REPRESENTATIVE
13. DR. V. KRISHNA REDDY ,FACULTY REPRESENTATIVE
14. DR.D.HARITHA,FACULTY REPRESENTATIVE
15. DR. S. KAVITHA,FACULTY REPRESENTATIVE
16. DR. YOGESH KUMAR SHARMA,FACULTY REPRESENTATIVE
17. MRS. P. RAMYA,FACULTY REPRESENTATIVE
18. DR. V V S SASANK,FACULTY REPRESENTATIVE
19. SANTHI MUNNANGI V. BALA TERESA,FACULTY REPRESENTATIVE
20. DR. P. PRAVEEN KUMAR,FACULTY REPRESENTATIVE
21. DR. S. VIJAY KRISHNA ,FACULTY REPRESENTATIVE
22. DR. M. KAVITHA,FACULTY REPRESENTATIVE

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23. DR.CH. RADHIKA RANI,FACULTY REPRESENTATIVE
24. DR.B.VIJAYA BABU,FACULTY REPRESENTATIVE
25. DR. K.V.DURGA KIRAN,FACULTY REPRESENTATIVE
26. SURYAKANTH V GANGASHETTY,FACULTY REPRESENTATIVE
27. DR.SHAIK SAGAR IMAMBI,FACULTY REPRESENTATIVE
28. DR. B. CHAITANYA KRISHNA,FACULTY REPRESENTATIVE
29. DR.ENIREDDY VAMSIDHAR,FACULTY REPRESENTATIVE
30. DR.G.PRADEEPINI,FACULTY REPRESENTATIVE
31. DR.P.MANIKYA PRASUNA,FACULTY REPRESENTATIVE
32. DR.N. SRINIVASU ,FACULTY REPRESENTATIVE
33. DR. G. SIVANAGESWARA RAO ,FACULTY REPRESENTATIVE
34. DR.RAJARAJESWARI POTHURAJU,FACULTY REPRESENTATIVE
35. DR. S. SRI HARSHA,FACULTY REPRESENTATIVE
36. DR. B. CHAITANYA KRISHNA,FACULTY REPRESENTATIVE
37. DR.TATA RAVI KUMAR,FACULTY REPRESENTATIVE
38. DR.B.VIJAYA BABU,FACULTY REPRESENTATIVE
39. DR.K.V.V.SATYANARAYANA,FACULTY REPRESENTATIVE
40. DR. P. VIDYULLATHA,FACULTY REPRESENTATIVE
41. DR.V.S.BHAGAVAN,FACULTY REPRESENTATIVE
42. DR.CHETTY MANNA SHEELA RANI,FACULTY REPRESENTATIVE
43. DR. ARPIT JAIN,FACULTY REPRESENTATIVE
44. DR. A. SUDHIR BABU,FACULTY REPRESENTATIVE
45. DR.POTHAMSETTY KASI VISWESWARA RAO,FACULTY REPRESENTATIVE
46. DR. P. NAGESH,FACULTY REPRESENTATIVE
47. DR. P. V. VENKATESWARA RAO ,FACULTY REPRESENTATIVE
48. DR. G. VEERRAJU,FACULTY REPRESENTATIVE
49. MS. P. SUPRIYA,FACULTY REPRESENTATIVE
50. DR. TIRANDASU RAVI KUMAR,FACULTY REPRESENTATIVE
51. MR. J. YATEESH,FACULTY REPRESENTATIVE

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53. MR. S. MAHESH NAIDU,FACULTY REPRESENTATIVE
54. MS. THOTA LAKSHMI DEEPIKA ROY,FACULTY REPRESENTATIVE
55. DR.PHANEENDRA KUMAR B.L.N,FACULTY REPRESENTATIVE
56. DR.M.LAKSHMANA PHANEENDRA,FACULTY REPRESENTATIVE
57. DR. K. ASHESH ,FACULTY REPRESENTATIVE
58. DR.SAJJA TULASI KRISHNA,FACULTY REPRESENTATIVE
59. DR. JAYAVARAPU KARTHIK,FACULTY REPRESENTATIVE
60. DR.V.CHANDRA PRAKASH,FACULTY REPRESENTATIVE
61. DR.V.SRIKANTH,FACULTY REPRESENTATIVE
62. DR.Y.PRASANTH,FACULTY REPRESENTATIVE
63. DR.S.SRINIVASA RAO,FACULTY REPRESENTATIVE
64. DR.B.SEKHAR BABU,FACULTY REPRESENTATIVE
65. DR.P.LAKSHMI PRASANNA,FACULTY REPRESENTATIVE
66. DR. K. RAVINDRANATH,FACULTY REPRESENTATIVE
67. DR. K. V. RAJU,FACULTY REPRESENTATIVE
68. DR. P.V.R.D. PRASADA RAO,FACULTY REPRESENTATIVE
69. DR.G. SWAIN,FACULTY REPRESENTATIVE
70. DR.RAJU ANITHA,FACULTY REPRESENTATIVE
71. DR. P. YELLAMMA,FACULTY REPRESENTATIVE
72. DR.K. BHANU PRAKASH,FACULTY REPRESENTATIVE
73. DR. A K VELMURUGAN ,FACULTY REPRESENTATIVE
74. DR.P.M.ASHOK KUMAR,FACULTY REPRESENTATIVE
75. DR.P.VIDYA SAGAR,FACULTY REPRESENTATIVE
76. DR.VITHYA GANESAN,FACULTY REPRESENTATIVE
77. DR. NM JYOTHI,FACULTY REPRESENTATIVE
78. DR.P. ITHAYA RANI,FACULTY REPRESENTATIVE
79. DR. R.D. SATHIYA,FACULTY REPRESENTATIVE
80. DR.G.KRISHNA MOHAN,FACULTY REPRESENTATIVE

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82. DR. G. RAJENDRA KUMAR,FACULTY REPRESENTATIVE
83. DR.DHARMAIAH DEVARAPALLI,FACULTY REPRESENTATIVE
84. DR.K.RAJASEKHARA RAO ,FACULTY REPRESENTATIVE
85. DR.S.SARAVANAN,FACULTY REPRESENTATIVE
86. DR.D. NAGA MALLESWARI,FACULTY REPRESENTATIVE
87. MRS.N.SRAVANTHI,FACULTY REPRESENTATIVE
88. MR. I. AJAYKUMAR,FACULTY REPRESENTATIVE
89. DR. RUTH RAMYA,FACULTY REPRESENTATIVE
90. DR. P.S.V.S.SRIDHAR,FACULTY REPRESENTATIVE
91. DR.G.DINESH KUMAR,FACULTY REPRESENTATIVE
92. DR. M S R PRASAD,FACULTY REPRESENTATIVE
93. DR. G SURESH KUMAR,FACULTY REPRESENTATIVE
94. DR.SHANKAR RAJENDRAN,FACULTY REPRESENTATIVE
95. DR.SIREESHA KONERU,FACULTY REPRESENTATIVE
96. DR.DIPLESH GAUTAM,FACULTY REPRESENTATIVE
97. DR. V S V PRABHAKAR,FACULTY REPRESENTATIVE
98. DR. V SIVA RAMA KRISHNA SARMA,FACULTY REPRESENTATIVE
99. DR. J SATISH BABU,FACULTY REPRESENTATIVE
100. DR. T SAJANA,FACULTY REPRESENTATIVE
101. DR. M PRAVEENA,FACULTY REPRESENTATIVE
102. MR. SAVARAM MYTHREYA,FACULTY REPRESENTATIVE
103. DR. B SREENIVASULU,FACULTY REPRESENTATIVE
104. DR. V RAMA KRISHNA,FACULTY REPRESENTATIVE
105. DR. PATNALA SRI RAMA CHANDRA MURTHY,FACULTY REPRESENTATIVE
106. DR. RAVURI DANIEL,FACULTY REPRESENTATIVE
107. MR. SATHULURI SAGAR,FACULTY REPRESENTATIVE
108. MR. CHANDRAJITH YADAV,FACULTY REPRESENTATIVE
109. DR. CHINARAO KURANGI,FACULTY REPRESENTATIVE

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111.DR. J SIRISHA DEVI,FACULTY REPRESENTATIVE

112.DR. G KALPANA,FACULTY REPRESENTATIVE

113.DR. K VIJAYA KUMAR,FACULTY REPRESENTATIVE

114.DR. M. PURUSHOTHAM REDDY,FACULTY REPRESENTATIVE

115.DR. J KAVITHA,FACULTY REPRESENTATIVE

116.DR. P SRILATHA,FACULTY REPRESENTATIVE

117.DR. V MUNIRAJU NAIDU,FACULTY REPRESENTATIVE

118.DR. N NIRMALA JYOTHI,FACULTY REPRESENTATIVE

119.DR. N SHIRISHA,FACULTY REPRESENTATIVE

120.DR. Y SUBBARAYUDU,FACULTY REPRESENTATIVE

121.DR. S SPANDANA,FACULTY REPRESENTATIVE

122.DR. V SRINIVAS,FACULTY REPRESENTATIVE

123.DR. S BALAJI,FACULTY REPRESENTATIVE

124.DR.MANCHIRAJU KAMESWARA RAO,FACULTY REPRESENTATIVE

125.DR.PORURI GOPI KRISHNA,FACULTY REPRESENTATIVE

126.MR.JONNALAGADDA SURYA KIRAN,FACULTY REPRESENTATIVE

127.DR.PADMANABAN K,FACULTY REPRESENTATIVE

128.DR.GANGA RAMA KOTESWARA RAO,FACULTY REPRESENTATIVE

129.DR.SUNEETHA BULLA,FACULTY REPRESENTATIVE

130.Ms.ANJANA DEVI AKURATHI,FACULTY REPRESENTATIVE

131.Dr.SURYA KIRAN CHEBROLU,FACULTY REPRESENTATIVE

132.Dr.GANTA JACOB VICTOR,FACULTY REPRESENTATIVE

133.Dr. KOMARAGIRI RAGHAVA RAO,FACULTY REPRESENTATIVE

134.Dr. Ch.M.H. SAI BABA,FACULTY REPRESENTATIVE

135.Dr. R. VENU BABU,FACULTY REPRESENTATIVE

136.Dr. S. ANJALI DEVI,FACULTY REPRESENTATIVE

137.Dr. K. SWARNA,FACULTY REPRESENTATIVE

138.Dr. MOHAMMED MOULANA ,FACULTY REPRESENTATIVE

10/7/2026

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139.Dr. B. VENKATESWARLU,FACULTY REPRESENTATIVE

140.Dr. MAGANTI SYAMALA,FACULTY REPRESENTATIVE

141.Ms. CHERUKUPALLI NAGA LAKSHMI SOWJANYA,FACULTY REPRESENTATIVE

142.Dr. B. SREEDHAR,FACULTY REPRESENTATIVE

143.Dr. ASESH KUMAR TRIPATHY,FACULTY REPRESENTATIVE

144.Dr. Ch. SMITHA CHOWDARY,FACULTY REPRESENTATIVE

145.Dr. V. VISWANATH SHENOI,FACULTY REPRESENTATIVE

146.Dr. BURRA LAKSHMI RAMANI,FACULTY REPRESENTATIVE

147.Dr. K. PRAKASH,FACULTY REPRESENTATIVE

148.PROF. MADHU MUTYAM,PROFESSOR, EXTERNAL SUBJECT EXPERT

149.DR. AMARALINGESWARA RAO KAKA ,EXTERNAL, INDUSTRY REPRESENTATIVE

150.MS PRANAVI MUVVA,ALUMNI REPRESENTATIVE

151.CH HARSHITHA,ALUMNI REPRESENTATIVE

152.K TEJA MAHESHWARA REDDY,ALUMNI REPRESENTATIVE

153.SANHITH CHINTALA,ALUMNI REPRESENTATIVE

154.GOURIVALI HENRY JOSEPH,ALUMNI REPRESENTATIVE

155.R V RAHUL KRISHNA,STUDENT REPRESENTATIVE

156.T MANAS CHAKRAVARTY,STUDENT REPRESENTATIVE

157.K. VAISHNAVI,STUDENT REPRESENTATIVE

158.DR. M. SUMAN,OTHER DEPARTMENT FACULTY

159.N ASHISH ,STUDENT REPRESENTATIVE

160.NEERAJ KARTHIKEYA,STUDENT REPRESENTATIVE

161.PINNAMARAJU MANOJ VARMA,STUDENT REPRESENTATIVE

162.SHAIK ALMAS,STUDENT REPRESENTATIVE

163.SUDHEER VENKATA SAI KALLAKURI,STUDENT REPRESENTATIVE

164.EPURI SWATHI,STUDENT REPRESENTATIVE

165.JOSHI JEEVAN SAI - 2320030046,STUDENT REPRESENTATIVE

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

166.BHUVANAGIRI INDIRA PRIYADARSHINI -2320030037, STUDENT REPRESENTATIVE

The following members were Absent:

1. DR.MERAJOTHU CHANDRA NAIK,FACULTY REPRESENTATIVE
2. DR. R. VIJAYA KUMAR REDDY,FACULTY REPRESENTATIVE
3. DR. THUMMALA PURNIMA,FACULTY REPRESENTATIVE
4. DR.DARA VIKRAM,FACULTY REPRESENTATIVE
5. DR.KALAKOTI GOWRISANKAR,FACULTY REPRESENTATIVE
6. DR. EKBAL RASHID,FACULTY REPRESENTATIVE
7. DR. CHANNABASAMMA,FACULTY REPRESENTATIVE
8. DR. R SATEESH KUMAR,FACULTY REPRESENTATIVE
9. Dr. G. SYAM PRASAD,FACULTY REPRESENTATIVE
10. MR SAI DEEP MUVVA,ALUMNI REPRESENTATIVE
11. VALLABHANENI HARSHINI,STUDENT REPRESENTATIVE
12. YELGODU MOHAMMED ARIEF,STUDENT REPRESENTATIVE
13. VENNAPUSA DHANUSH REDDY,STUDENT REPRESENTATIVE
14. VELLURI PENCHALA GANESH,STUDENT REPRESENTATIVE
15. PENUMATCHA VAMSHI KRISHNA RAJU,STUDENT REPRESENTATIVE
16. MOHAMMED EAZAZ,STUDENT REPRESENTATIVE

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

The BoS Chairman commenced the meeting by informing all members that proposed curriculum structure for the B.Tech-CSE students admitted in the academic year 2026-27, new and revised courses of the curriculum and the revised structure of B.Tech-CSE students admitted in the A.Y. 2025-26. The proposed course structure for the M.Tech-CSE students admitted in the academic year 2026-27, new and revised courses of the

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curriculum. Further discussed about the introduction of new course Lean and Six Sigma Green Belt Essentials course under the HAS category in Moocs mode with 2 credits to replace the Leadership and Management skills to fulfillment of the degree credits of the 2023-24 admitted batch. And also proposed the course titled 23AVI3405 – Intelligent Image Analysis in place of the existing course Visual Recognition and Scene Understanding as a PE-4 course under the AI Systems for Visual Intelligence specialization for the 2023-24 admitted batch.

31/07/2026

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

AGENDA and RESOLUTIONS

AGENDA ITEM-1

Consider and approve DAC meeting minutes held on 21st July 2026 in online mode	Resolution: Approved DAC minutes and recommended to Academic Council for approval.

- Chairman of the BOS informed all the members about the Department Academic Committee (DAC) meeting held on 21st July 2026 and highlighted the major resolutions of discussion.

  It is resolved to approve the recommendations made by DAC.

  Annexure-1 DAC minutes (Dt: 21-07-2026)

AGENDA ITEM-2

To consider and approve the proposed courses for 2026-27 admitted batch B. Tech CSE Students based on the feedback received from stakeholders.	Resolution: Approved for courses for B.Tech CSE 2026-27 admitted Batch and the same is recommended to Academic Council.

To consider and introduce course structure for 2026-27 admitted batch students based on the stake holder's feedback.

1. Mr. Konkimalla Venkata Ranga Rao, Academic Peer, recommended introducing "Mathematics for Computation" to strengthen students' analytical, computational, and mathematical problem-solving skills required for modern computing.

   It is resolved to introduce the "Mathematics for Computation" course for 2026–27 admitted batch students.

2. N. Lakshmi Narayana, Academic Peer, recommended introducing "Mathematics for AI" covering linear algebra, probability, statistics, optimization, and calculus essential for Artificial Intelligence.

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It is resolved to introduce the "Mathematics for AI" course for 2026–27 admitted batch students.

3. Hanumanth Yaganti, Alumni, strongly recommended revising "Digital Design & Computer Architecture" to include modern processor architecture, FPGA concepts, digital logic optimization, and computer organization.

   It is resolved to introduce the "Digital Design & Computer Architecture" course for 2026–27 admitted batch students.

4. Sreeja Girija R., Industry Person, recommended introducing "Full Stack Development – Front End Frameworks" focusing on React, Angular, responsive UI development, state management, and modern web technologies.

   It is resolved to introduce the "Full Stack Development – Front End Frameworks" course for 2026–27 admitted batch students.

5. Dr. P. Harini, Academic Peer, recommended introducing "Computational Foundations for AI" to strengthen students' understanding of algorithms, optimization, search techniques, and computational intelligence.

   It is resolved to introduce the "Computational Foundations for AI" course for 2026–27 admitted batch students.

6. Mr. T. Ravi Kumar, Faculty, recommended introducing "Data Structures & Algorithms – I" with emphasis on fundamental data structures, recursion, searching, sorting, and algorithm analysis.

   It is resolved to introduce the "Data Structures & Algorithms – I" course for 2026–27 admitted batch students.

7. Abhinay Irala, Industry Person, recommended introducing "Full Stack Development – Database Systems & Back End Engineering" covering SQL, NoSQL, REST APIs, Spring Boot, Node.js, authentication, and cloud databases.

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21/04/2026

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It is resolved to introduce the "Full Stack Development – Database Systems & Back End Engineering" course for 2026–27 admitted batch students.

8. Dr. Anveeksh Koneru, Alumni, strongly recommended strengthening "Machine Learning" by incorporating deep learning fundamentals, model evaluation, explainable AI, and practical projects using real-world datasets.

   It is resolved to introduce the "Machine Learning" course for 2026–27 admitted batch students.

9. Mr. T. Ravi Kumar, Faculty, recommended introducing "Data Structures & Algorithms – II" focusing on advanced trees, graphs, heaps, hashing, greedy algorithms, and dynamic programming.

   It is resolved to introduce the "Data Structures & Algorithms – II" course for 2026–27 admitted batch students.

10. Dr. Raju Anitha, Faculty, recommended introducing "Data Structures & Algorithms – III" covering advanced algorithmic paradigms, string algorithms, computational geometry, and graph optimization techniques.

    It is resolved to introduce the "Data Structures & Algorithms – III" course for 2026–27 admitted batch students.

11. Dr. T. S. Rajeshwari, Faculty, recommended revising "Operating Systems & Systems Programming" by incorporating process management, memory management, concurrency, Linux programming, and shell scripting.

    It is resolved to introduce the "Operating Systems & Systems Programming" course for 2026–27 admitted batch students.

12. Mr. Vaishnava Dhaatri Academic Peer, recommended introducing "System Design for Scalability & Reliability" covering distributed systems, microservices, cloud architecture, scalability, fault tolerance, and high availability.

    It is resolved to introduce the "System Design for Scalability & Reliability" course for 2026–27 admitted batch students.

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13. Sai Anil Muthyala, Industry Person, strongly recommended introducing "Embedded AI & Tiny ML" covering edge AI, TinyML frameworks, embedded machine learning, low-power AI devices, and intelligent embedded systems.

    It is resolved to introduce the "Embedded AI & Tiny ML" course for 2026–27 admitted batch students.

S.NO	COURSE CODE	COURSE TITLE	COURSE TYPE	CREDITS	REMARKS
1	26MT1101	MATHEMATICS FOR COMPUTATION	BSC	4	INTRODUCED AS A BASIC SCIENCE COURSE
2	26MT1202	MATHEMATICS FOR AI	BSC	4	INTRODUCED AS A BASIC SCIENCE COURSE
3	26EC1202	DIGITAL DESIGN & COMPUTER ARCHITECTURE	ESC	3	INTRODUCED AS A ENGINEERING SCIENCE COURSE
4	26SC1204	FULL STACK DEVELOPMENT – FRONT END FRAMEWORKS	ESC	4	INTRODUCED AS A ENGINEERING SCIENCE COURSE
5	26SC1306	COMPUTATIONAL FOUNDATIONS FOR AI	ESC	3	INTRODUCED AS A ENGINEERING SCIENCE COURSE
6	26SC1203	DATA STRUCTURES & ALGORITHMS – 1	ESC	3	INTRODUCED AS A ENGINEERING SCIENCE COURSE
7	26SC1307	FULL STACK DEVELOPMENT – DATABASE SYSTEMS & BACK END ENGINEERING	ESC	4	INTRODUCED AS A ENGINEERING SCIENCE COURSE
8	26SC2110	MACHINE LEARNING	ESC	4	INTRODUCED AS A ENGINEERING SCIENCE COURSE
9	26SC1305	DATA STRUCTURES & ALGORITHMS – 2	ESC	4	INTRODUCED AS A ENGINEERING SCIENCE COURSE

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S.NO	COURSE CODE	COURSE TITLE	COURSE TYPE	CREDITS	REMARKS
10	26SC2109	DATA STRUCTURES & ALGORITHMS – 3	ESC	4	INTRODUCED AS A ENGINEERING SCIENCE COURSE
11	26CS2101	OPERATING SYSTEMS & SYSTEMS PROGRAMMING	PCC	4	INTRODUCED AS A PROFESSIONAL CORE COURSE
12	26CS2305	SYSTEM DESIGN FOR SCALABILITY & RELIABILITY	PCC	4	INTRODUCED AS A PROFESSIONAL CORE COURSE
13	26EC3113	EMBEDDED AI & TINY ML	PCC	4	INTRODUCED AS A PROFESSIONAL CORE COURSE

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

AGENDA ITEM-3

To consider and approve revised syllabus for 2026-27 admitted batch B. Tech CSE Students based on the feedback received from stakeholders.	Resolution: Approved the revision of syllabus for B.Tech 2026-27 admitted batch and the same is recommended to Academic Council.

To consider and approve the revision of syllabus for 2026-27 admitted batch students based on the stake holders feedback.

1. Ms. Pathuri Bindu, Faculty, recommended to revise the "Indian Knowledge Systems" to provide awareness of India's scientific heritage, ethical values, traditional knowledge, and sustainable practices.
2. Karthik Parthiban, Industry Person, strongly recommended to revise the "Design Thinking for Innovation & Entrepreneurship" to foster creativity, innovation, user-centric design, and entrepreneurial thinking through real-world problem-solving activities.
3. Dr. Sanjit Ningthoujam, Academic Peer, recommended to revise the "Problem Solving Using Programming (Java)" a foundational course to improve logical thinking, algorithm design, and programming skills.

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4. Mr. Sagireddy Pulla Reddy, Industry Person, recommended to revise the "Fundamentals of IoT & Sensors" to provide students with practical knowledge of IoT architecture, sensors, embedded devices, and smart applications.
5. Mr. CH. Ramaiah, Faculty, recommended introducing "Embedded System Design & IoT" with practical laboratory sessions covering embedded controllers, IoT devices, and real-time applications.
6. Poothabalan Somasundaram, Industry Person" recommended to revise the "Computer Networks & Network Programming" with emphasis on networking protocols, socket programming, distributed computing, and cloud networking.
7. N. Lakshmi Narayana, Academic Peer, recommended to revise the "Embedded Software Development" focusing on firmware programming, RTOS, debugging techniques, and embedded software practices.
8. A. Aparna, Alumni, strongly recommended to revise the "Big Data Engineering & Data Pipelines" covering ETL pipelines, distributed computing, cloud data platforms, and scalable data processing.
9. Dr. P. Harini, Academic Peer, recommended to revise the "Advanced Object-Oriented Programming" with emphasis on software design principles, design patterns, reusable architecture, and enterprise application development.
10. Dr. P. Syam Sundar, Industry Person, strongly recommended to revise the "Generative AI & AI Platform Engineering" focusing on foundation models, prompt engineering, AI deployment, and enterprise AI platforms.
11. Madhu Bodapati, Industry Person, recommended to revise the "Natural Language Processing & LLM Engineering" covering transformer models, prompt engineering, fine-tuning, retrieval systems, and enterprise AI applications.

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12. Dr. Pragnyaban Mishra, Faculty, recommended to revise the "Adaptive Software Engineering" focusing on Agile methodologies, DevOps, software evolution, CI/CD, and resilient software architecture.
13. Mr. Uppala Gopala Rao, Alumni, strongly recommended to revise the "Agentic AI & Autonomous Enterprise Systems" focusing on AI agents, autonomous workflows, enterprise automation, and intelligent decision-making systems.

S.NO	COURSE CODE	COURSE TITLE	COURSE TYPE	PERCENTAGE OF REVISION	REMARKS
1	26UC0017	INDIAN KNOWLEDGE SYSTEMS	AUC	LTPS Change	BASED ON FACULTY FEEDBACK
2	26UC1137	DESIGN THINKING FOR INNOVATION & ENTREPRENEURSHIP	HSS	20%	BASED ON INDUSTRY FEEDBACK
3	26SC1101	PROBLEM SOLVING USING PROGRAMMING (JAVA)	ESC	20%	BASED ON ACADEMIC PEER FEEDBACK
4	26EC1101	FUNDAMENTALS OF IOT & SENSORS	ESC	20%	BASED ON INDUSTRY FEEDBACK
5	26EC2106	EMBEDDED SYSTEM DESIGN & IOT	ESC	LTPS Change	BASED ON FACULTY FEEDBACK
6	26CS2203	COMPUTER NETWORKS & NETWORK PROGRAMMING	PCC	20%	BASED ON INDUSTRY FEEDBACK
7	26EC2310	EMBEDDED SOFTWARE DEVELOPMENT	PCC	LTPS Change	BASED ON ACADEMIC PEER FEEDBACK
8	26AD2305	BIG DATA ENGINEERING & DATA PIPELINES	PCC	LTPS Change	BASED ON ALUMINI FEEDBACK

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S.NO	COURSE CODE	COURSE TITLE	COURSE TYPE	PERCENTAGE OF REVISION	REMARKS
9	26CS2202	ADVANCED OBJECT ORIENTED PROGRAMMING	PCC	15%	BASED ON ACADEMIC PEER FEEDBACK
10	26AD2202	GENERATIVE AI & AI PLATFORM ENGINEERING	PCC	20%	BASED ON INDUSTRY FEEDBACK
11	26AD3207	NATURAL LANGUAGE PROCESSING & LLM ENGINEERING	PCC	LTPS Change	BASED ON FACULTY FEEDBACK
12	26CS4107	ADAPTIVE SOFTWARE ENGINEERING	PCC	LTPS Change	BASED ON FACULTY FEEDBACK
13	26AD3308	AGENTIC AI & AUTONOMOUS ENTERPRISE SYSTEMS	PCC	LTPS Change	BASED ON ALUMINI FEEDBACK

The detailed syllabus for the list of revised courses is given in Annexure-3(a)

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

AGENDA ITEM-4

To discuss and approve the 2026-27 admitted batch academic structure of B.Tech-CSE offered by CSE department.	Resolution: Approved 2026-27 admitted batch academic structure of B.Tech program offered by CSE department and the same is recommended to Academic Council for approval.

The BoS Chairman initiated a detailed discussion on the proposed 2026-27 academic structure of the B.Tech-CSE program, highlighting its alignment with emerging industry trends. He emphasized the importance of updating the curriculum to enhance employability, skill development, and academic rigor, ensuring students are well-prepared for future technological advancements.

The detailed Course Structure proposed for 2026-27 admitting batch B.Tech -CSE program is given in Annexure-4.

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AGENDA ITEM-5

To discuss and approve the course structure revision proposal for the 2025–26 admitted batch of the B.Tech CSE program.	Resolution: Approved revised course structure of 2025–26 admitted batch of B.Tech program and the same is recommended to Academic Council for approval.

The BoS Chairman discussed the course structure revision proposal for the 2025–26 admitted B.Tech CSE batch. He highlighted its importance in ensuring continuity, standardization, and readiness for future academic and industry requirements.

The detailed revised Course Structure for 2025-26 admitting batch B.Tech -CSE program is given in Annexure-5.

AGENDA ITEM-6

To consider and approve the Program Development Documents (PDDs) of UG and PG programs offered by the CSE department.	Resolution: Approved PDDs and the same is recommended to Academic Council for approval

The BoS Chairman presented the Program Development Documents (PDDs) of both UG and PG programs offered by the CSE department and emphasized their role in streamlining curriculum design and outcome-based education. He highlighted the importance of approving the PDDs to ensure academic quality, compliance with regulatory standards, and alignment with industry expectations.

The Program Development Document (PDD) for B.Tech-Computer Science and Engineering is given in Annexure-6(a).

The Program Development Document (PDD) for M.Tech-Computer Science and Engineering is given in Annexure-6(b).

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AGENDA ITEM-7

To discuss and approve the 2026-27 admitted batch academic structure of M.Tech-CSE offered by CSE department.	Resolution: Approved 2026-27 admitted batch academic structure of M.Tech program offered by CSE department and the same is recommended to Academic Council for approval.

The BoS Chairman discussed the proposed academic structure for the 2026–27 admitted batch of the M.Tech CSE program, highlighting its alignment with advanced computing trends, research orientation, and industry demands. He emphasized that its approval is crucial for strengthening postgraduate education and enhancing employability and innovation.

The detailed Course Structure proposed for 2026-27 admitting batch M.Tech -CSE program is given in Annexure-7.

AGENDA ITEM-8

To consider and approve the proposed courses for 2026-27 admitted batch M. Tech CSE Students based on the feedback received from stakeholders.	Resolution: Approved for courses for M.Tech CSE 2026-27 admitted Batch and the same is recommended to Academic Council.

To consider and introduce course structure for 2026-27 admitted batch students based on the stake holder's feedback.

1. Dr. Pragnyaban Mishra, Faculty, recommended introducing the course "Communication Skills and Technical Writing" to strengthen students' professional communication, technical documentation, presentation skills, and workplace communication through practical writing activities and industry-oriented assignments.
2. Jack Ilamaran, Industry Person, recommended introducing "Placement Training and Professional Readiness" covering aptitude training, coding practice, interview preparation, communication skills, resume building, and industry recruitment processes.

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3. Karthik Parthiban, Industry Person, recommended introducing "Computational Thinking and Programming" by emphasizing logical reasoning, algorithmic thinking, structured programming, and hands-on programming practice using industry-relevant problem-solving approaches.
4. Dr. T. S. Rajeshwari, Faculty, recommended introducing "OS, Concurrency and Distributed Systems" covering operating system internals, process synchronization, concurrency models, distributed computing concepts, and practical implementation using modern tools.
5. Mr. Vaishnava Dhaatri, Academic Peer, recommended introducing "Datacentre Networks and Internet Protocols" by including modern data centre architectures, Internet protocols, software-defined networking, cloud networking, and practical networking laboratories.
6. Dr. Sonal Dipak Mali, Academic Peer, recommended introducing the course "AI and Machine Learning with Applied Mathematics" by integrating mathematical foundations, linear algebra, probability, optimization techniques, machine learning algorithms, and practical AI model implementation.
7. Meenakshi Sharma, Industry Person, recommended introducing "Full-Stack Web Engineering" with emphasis on modern front-end frameworks, backend technologies, REST APIs, cloud deployment, database integration, and project-based development.
8. Dr. Satyaprasad, Academic Peer, recommended introducing "Algorithm Engineering for Data Systems" covering advanced algorithm design, optimization techniques, scalable data processing, graph algorithms, and algorithm implementation for large-scale data systems.
9. Mr. Sagireddy Pulla Reddy, Industry Person, recommended introducing "Deep Learning and Natural Language Processing" by including neural network architectures, transformer models, language models, generative

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AI concepts, and practical NLP applications using industry-standard frameworks.

10. Dr. Raju Anitha, Faculty, recommended introducing "Research Methodology and Intellectual Property Rights" covering research design, scientific writing, publication ethics, patent filing procedures, intellectual property laws, and innovation management.
11. Dr. V. K. Gnanavel, Academic Peer, recommended introducing "Generative AI and LLM Application Engineering" by including foundation models, Large Language Models (LLMs), prompt engineering, Retrieval-Augmented Generation (RAG), AI agents, and real-world AI applications.
12. Mrs. Geetha S. Nazre, Industry Person, recommended introducing "Cloud Services and DevOps Engineering" covering cloud infrastructure, DevOps practices, CI/CD pipelines, Infrastructure as Code, containerization, and cloud deployment automation.
13. Rajshekar Botcha, Industry Person, recommended introducing "Data Science and Analytics Engineering at Scale" by integrating scalable data engineering, distributed analytics, big data processing frameworks, machine learning pipelines, and cloud-based analytics platforms.
14. Dr. P. Harini, Academic Peer, recommended introducing "Agentic AI, MCP and Multimodal Engineering" by including autonomous AI agents, Model Context Protocol (MCP), multimodal foundation models, AI orchestration frameworks, and practical application development.
15. Dr. CH V. Ramana Murthy, Faculty, recommended introducing "High-Performance Computing Systems" covering parallel architectures, distributed computing, cluster computing, GPU acceleration, and performance optimization techniques with laboratory implementation.
16. Dr. P. Syam Sundar, Faculty, recommended introducing the course "Parallel and Concurrent Programming Models (PC&S)" by incorporating parallel programming paradigms, concurrent execution models, synchronization

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mechanisms, multithreading, and practical implementation using modern programming frameworks.

17. Madhu Bodapati, Industry Person, recommended introducing the course "Kubernetes and Container Orchestration (CNE&D)" covering Kubernetes architecture, container orchestration, cluster management, workload deployment, service discovery, and cloud-native application management.
18. Kavitha Avula, Industry Person, recommended introducing "CUDA and GPU Programming (PC&S)" by including GPU architecture, CUDA programming, parallel algorithm development, memory optimization, and practical GPU computing applications.
19. Abhinay Irala, Industry Person, recommended introducing "Service Mesh and Microservices Architecture (CNE&D)" covering service mesh technologies, microservices architecture, API gateway implementation, traffic management, observability, and cloud-native deployment.
20. Dr. Ramesh G., Academic Peer, recommended introducing "ML Systems: Compilers, Training and Inference (PC&S)" by integrating machine learning compilers, distributed model training, inference optimization, model deployment, and AI system performance tuning.
21. Sreeja Girija R., Industry Person, recommended introducing "Site Reliability Engineering and Observability (CNE&D)" by including reliability engineering principles, observability frameworks, monitoring systems, incident response, automation, and cloud infrastructure management.
22. Dr. Kolla Bhanu Prakash, Faculty, recommended introducing "Processor Architecture and ISA Design (PC&S)" covering processor organization, instruction set architecture, pipelining, processor optimization, and hardware performance analysis through practical implementation.
23. Mr. E. Vamsidhar, Faculty, recommended introducing "Cloud Platform Engineering and Infrastructure as Code (IaC) (CNE&D)" covering

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Infrastructure as Code, cloud automation, cloud platform management, provisioning tools, and deployment pipelines.

24. Sai Anil Muthyala, Industry Person, recommended introducing "Capstone Research / Industry Project – Phase I" focusing on industry problem identification, literature survey, project planning, technology selection, research methodology, and prototype development.

25. Sai Anil Muthyala, Industry Person, recommended introducing "Capstone Research / Industry Project – Phase II" emphasizing solution implementation, testing, validation, deployment, technical documentation, and final project presentation aligned with industry requirements.

S.NO	COURSE CODE	COURSE TITLE	COURSE TYPE	CREDITS	REMARKS
1	26UC5101E	COMMUNICATION SKILLS AND TECHNICAL WRITING	AUC	0	Introduce as a Audit Course
2	26UC5302E	PLACEMENT TRAINING AND PROFESSIONAL READINESS	AUC	0	Introduce as a Audit Course
3	26CS5101E	COMPUTATIONAL THINKING AND PROGRAMMING	CORE	3.5	Introduce as a Core Course
4	26CS5102E	OS, CONCURRENCY AND DISTRIBUTED SYSTEMS	CORE	3.5	Introduce as a Core Course
5	26CS5103E	DATACENTRE NETWORKS AND INTERNET PROTOCOLS	CORE	3.5	Introduce as a Core Course
6	26CS5104E	AI AND MACHINE LEARNING WITH APPLIED MATHEMATICS	CORE	3.5	Introduce as a Core Course
7	26CS5205E	FULL-STACK WEB ENGINEERING	CORE	3.5	Introduce as a Core Course
8	26CS5206E	ALGORITHM ENGINEERING FOR DATA SYSTEMS	CORE	3.5	Introduce as a Core Course

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S.NO	COURSE CODE	COURSE TITLE	COURSE TYPE	CREDITS	REMARKS
9	26CS5207E	DEEP LEARNING AND NATURAL LANGUAGE PROCESSING	CORE	3.5	Introduce as a Core Course
10	26IE5201E	RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS	CORE	2	Introduce as a Core Course
11	26CS5308E	GENERATIVE AI AND LLM APPLICATION ENGINEERING	CORE	3.5	Introduce as a Core Course
12	26CS5309E	CLOUD SERVICES AND DEVOPS ENGINEERING	CORE	3.5	Introduce as a Core Course
13	26CS5310E	DATA SCIENCE AND ANALYTICS ENGINEERING AT SCALE	CORE	3.5	Introduce as a Core Course
14	26CS6111E	AGENTIC AI, MCP AND MULTIMODAL ENGINEERING	CORE	3.5	Introduce as a Core Course
15	26CS6112E	HIGH-PERFORMANCE COMPUTING SYSTEMS	CORE	3.5	Introduce as a Core Course
16	26CS52A1E	PARALLEL AND CONCURRENT PROGRAMMING MODELS(PC&S)	PE-1	3.5	Introduced as Professional Elective Course
17	26CS52B1E	KUBERNETES AND CONTAINER ORCHESTRATION(CNE&D)	PE-1	3.5	Introduced as Professional Elective Course
18	26CS53A2E	CUDA AND GPU PROGRAMMING (PC&S)	PE-2	3.5	Introduced as Professional Elective Course
19	26CS53B2E	SERVICE MESH AND MICROSERVICES ARCHITECTURE(CNE&D)	PE-2	3.5	Introduced as Professional

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S.NO	COURSE CODE	COURSE TITLE	COURSE TYPE	CREDITS	REMARKS
					Elective Course
20	26CS61A3E	ML SYSTEMS: COMPILERS, TRAINING AND INFERENCE(PC&S)	PE-3	3.5	Introduced as Professional Elective Course
21	26CS61B3E	SITE RELIABILITY ENGINEERING AND OBSERVABILITY(CNE&D)	PE-3	3.5	Introduced as Professional Elective Course
22	26CS61A4E	PROCESSOR ARCHITECTURE AND ISA DESIGN(PC&S)	PE-4	3.5	Introduced as Professional Elective Course
23	26CS61B4E	CLOUD PLATFORM ENGINEERING AND IAC (CNE&D)	PE-4	3.5	Introduced as Professional Elective Course
24	26IE6202E	CAPSTONE RESEARCH / INDUSTRY PROJECT – PHASE I	PRI	12	Introduced as a Project Research & Intership Course
25	26IE6303E	CAPSTONE RESEARCH / INDUSTRY PROJECT – PHASE II	PRI	12	Introduced as a Project Research & Intership Course

The detailed syllabus for the list of proposed courses is given in Annexure-8

AGENDA ITEM-9

To consider and approve the introduction of new course Lean and Six Sigma Green Belt Essentials course	Resolution: Approved the introduction of new course Lean and Six Sigma Green Belt Essentials course under the HAS category in

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under the HAS category in Moocs mode with 2 credits to replace the Leadership and Management skills to fulfillment of the degree credits of the 2023-24 admitted batch.	Moocs mode with 2 credits for Y23 regulation and the same is recommended to Academic Council for approval.

The BoS Chairman proposed the introduction of new course Lean and Six Sigma Green Belt Essentials course under the HAS category in Moocs mode with 2 credits for Y23 regulation.

AGENDA ITEM-10

To consider and approve the proposal of placing the course titled 23AVI3405 – Intelligent Image Analysis in place of the existing course Visual Recognition and Scene Understanding as a PE-4 course under the AI Systems for Visual Intelligence specialization for the 2023-24 admitted batch.	Resolution: Approved the proposal of placing the course titled 23AVI3405 – Intelligent Image Analysis in place of the existing course Visual Recognition and Scene Understanding as a PE-4 course under the AI Systems for Visual Intelligence specialization for the 2023-24 admitted batch and the same is recommended to Academic Council for approval.

The BoS Chairman initiated a discussion on proposal of placing the course titled 23AVI3405 – Intelligent Image Analysis in place of the existing course Visual Recognition and Scene Understanding as a PE-4 course under the AI Systems for Visual Intelligence specialization for the 2023-24 admitted batch.

31/07/2026

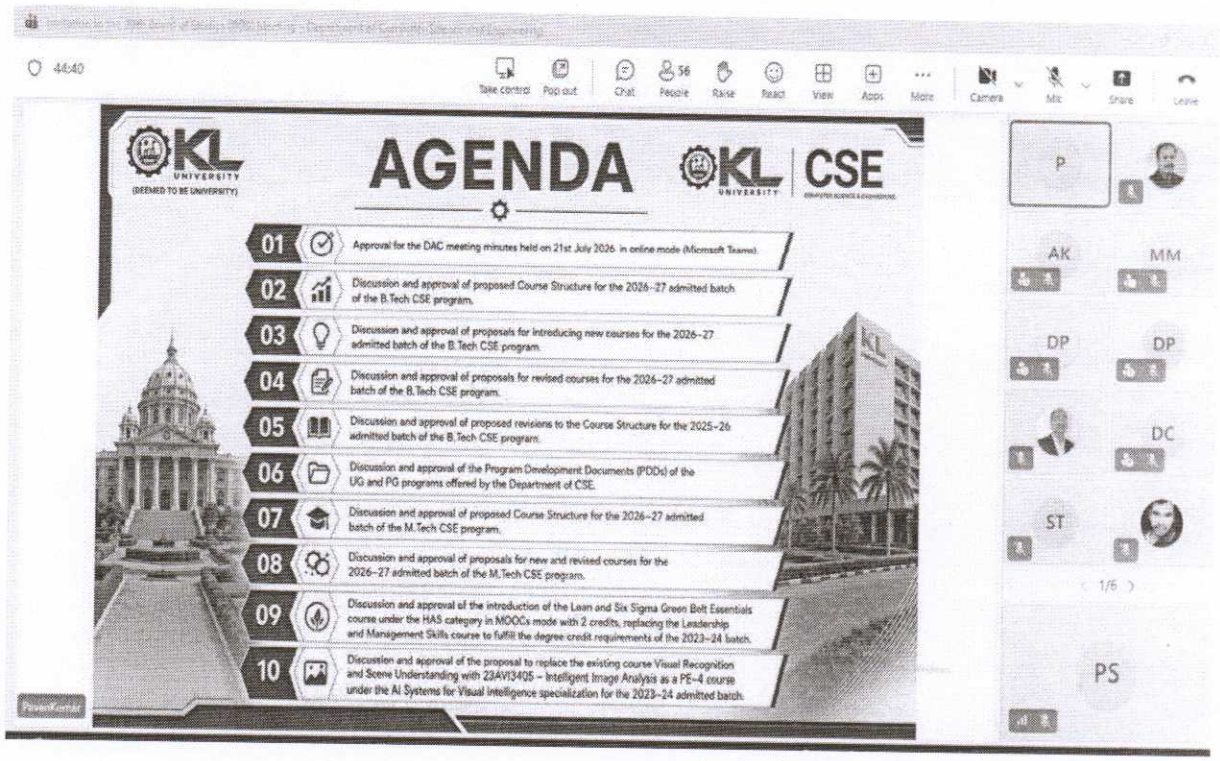
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BoS Meeting (Online) Screenshots:





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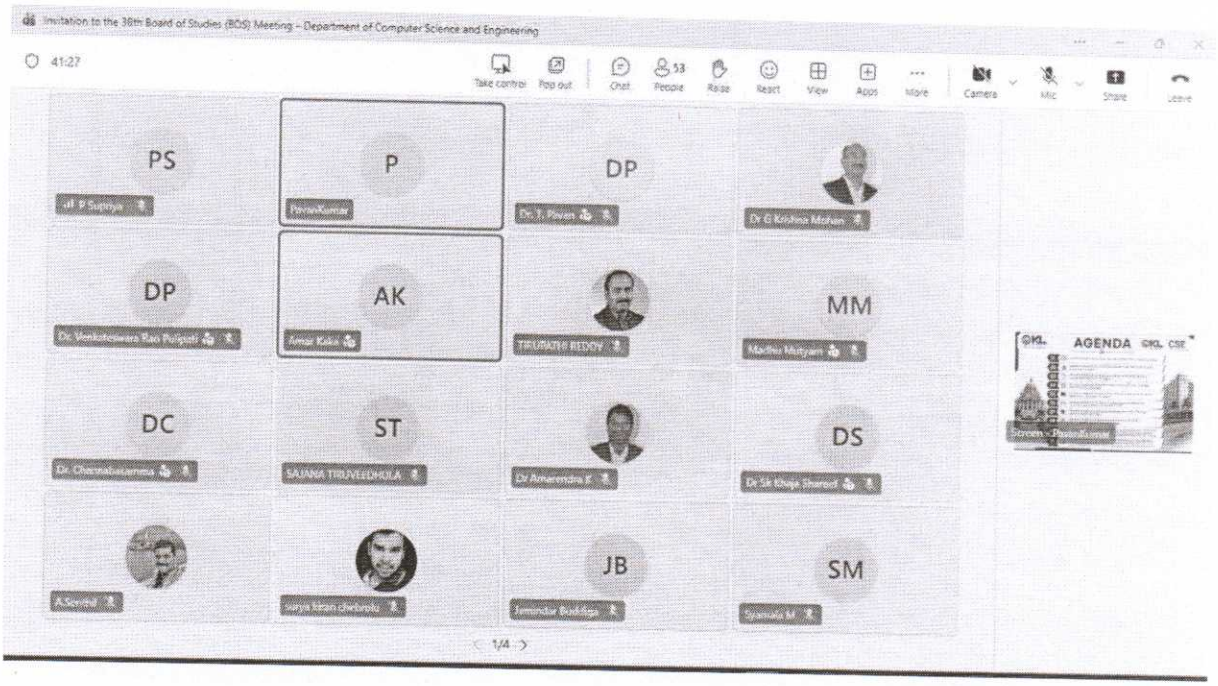
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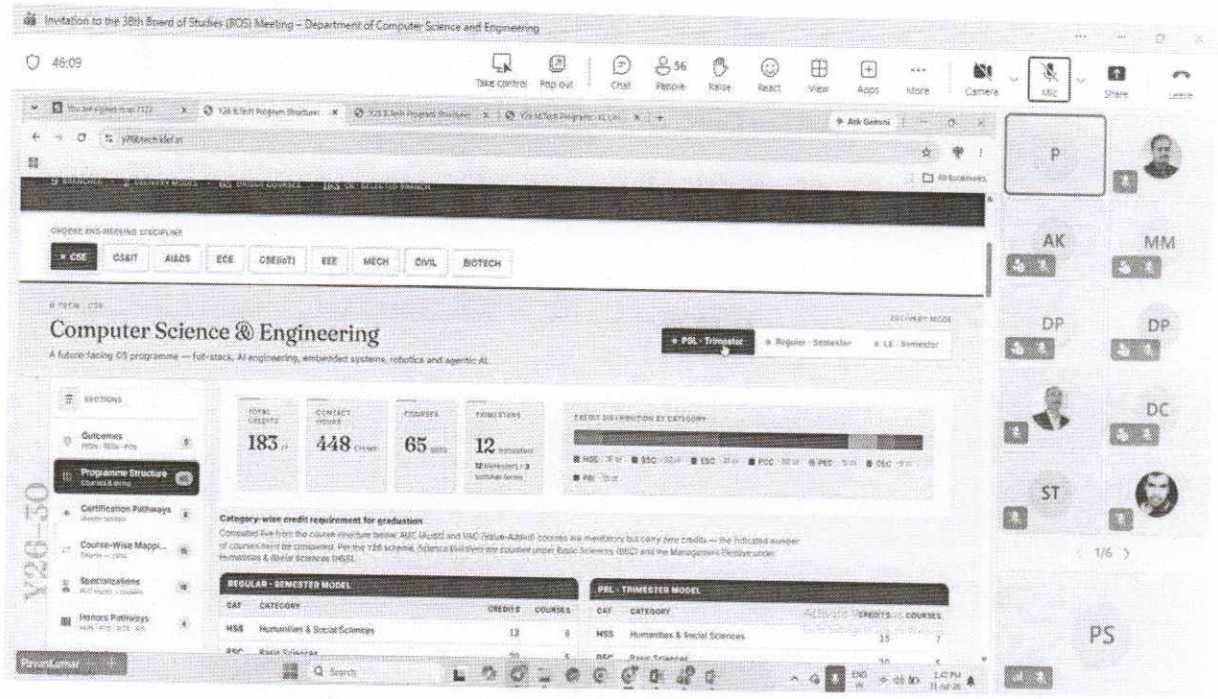
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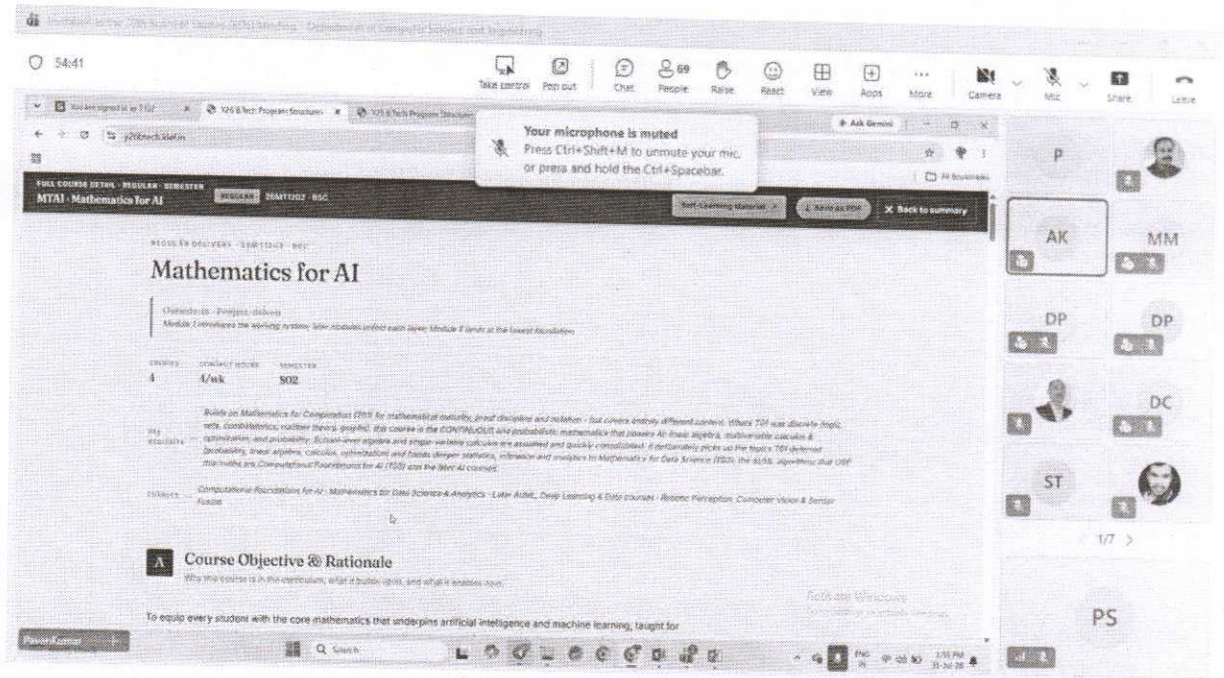


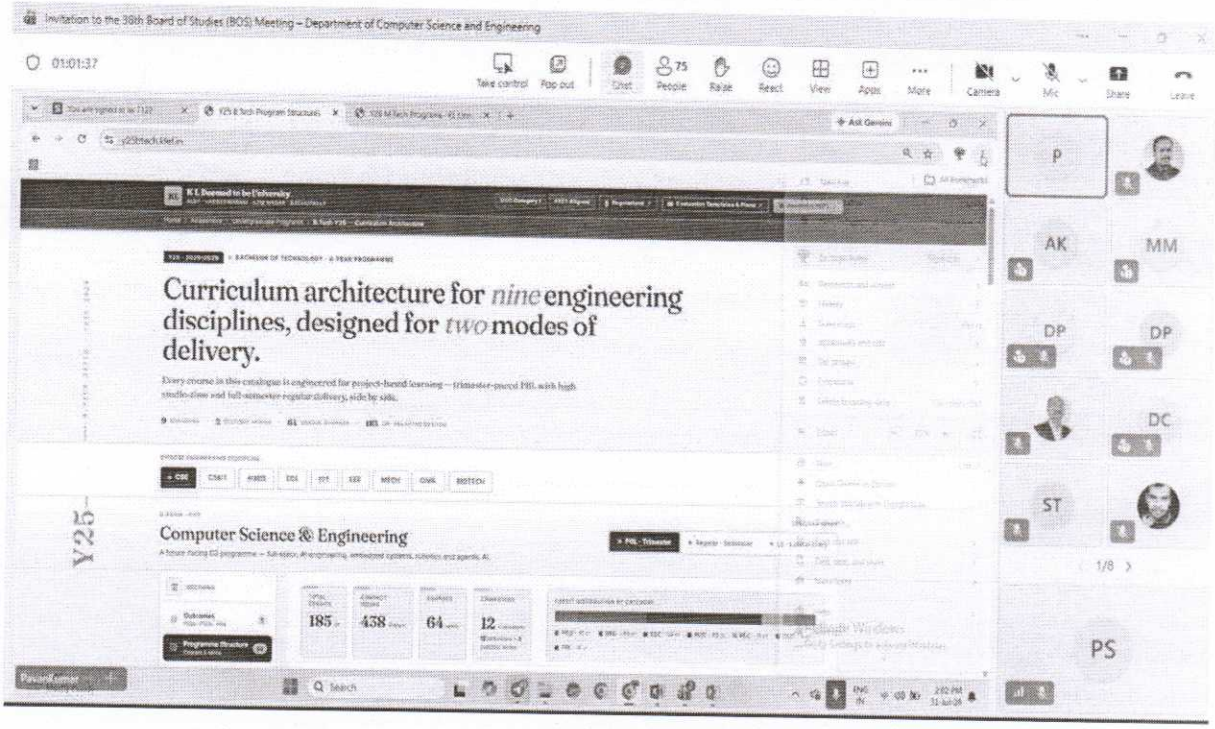


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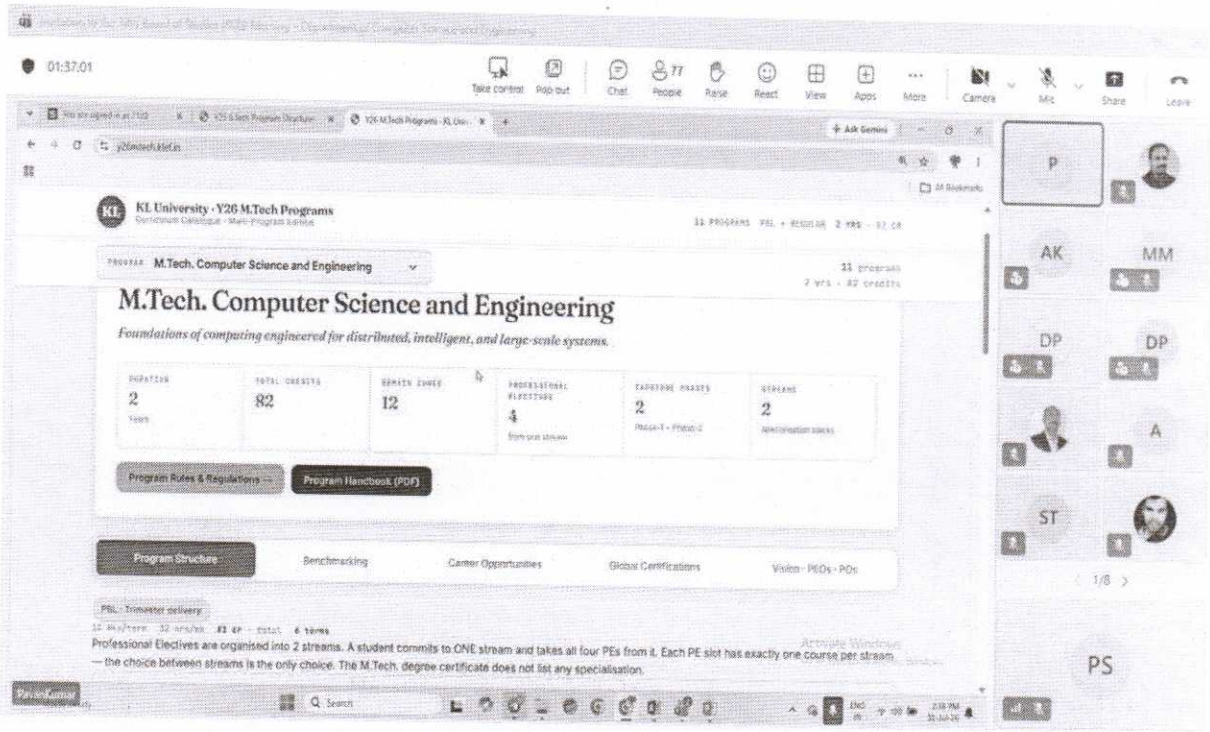
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31/07/2026

BoS - Chairman

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Annexure - 1

DEPARTMENT ACADEMIC COMMITTEE (DAC) MEETING MINUTES

The 41st DAC meeting minutes for the Department of Computer Science and Engineering were recorded during the online meeting held on Monday, 21st July 2026, between 01:30PM and 05:30 PM through Microsoft teams.

The Head of the Department welcomed the DAC members and commenced the meeting by highlighting the vision and mission statements of the University and the Department, as well as the Program Educational Objectives (PEOs) and Program Outcomes (POs) of the programs.

Agenda Items:

1. To Discuss on feedback obtained from various stake holders (Students, Parents, Academic Peers, Faculty, Alumni and Industry) on the existing curriculum.
2. To discuss on Course Structure proposed for 2026-27 admitting batch B.Tech-CSE and B.Tech-CSE (PBL) program.
3. To discuss on new Courses proposal for 2026-27 admitting batch B.Tech-CSE program.
4. To discuss on revised Courses proposal for 2026-27 admitting batch B.Tech-CSE program.
5. To discuss on revision of Course Structure and syllabus for 2025-26 admitted batch B.Tech-CSE program.
6. To discuss on Program Development Documents (PDD) of UG and PG programs offered by the CSE department.
7. To discuss on the introduction of new course Lean and Six Sigma Green Belt Essentials course under the HAS category in Moocs mode with 2 credits to replace the Leadership and Management skills to fulfillment of the degree credits of the 2023-24 admitted batch.

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8. To discuss the proposal of placing the course titled 23AVI3405 – Intelligent Image Analysis in place of the existing course for the 2023-24 admitted batch.
9. To discuss on result analysis of 2022-23 admitted B.Tech-CSE students.
10. To discuss on CO-PO attainments of 2022-23 admitted batch B.Tech-CSE students.
11. To discuss on Placement Statistics for 2022-23 and 2023-24 admitted batches.
12. To discuss on Course Structure proposed for 2026-27 admitting batch M.Tech-CSE program.

The following members were present:

1. DR.T. PAVAN KUMAR, CHAIRMAN
2. MR. V. HARI KIRAN, PROFESSOR
3. DR. AMARENDRA K, PROFESSOR
4. DR. B. TIRAPATHI REDDY, PROFESSOR
5. DR. A SENTHIL, PROFESSOR
6. DR NARASIMHA RAJU, PROFESSOR
7. DR. ASWIN KUMER S V, PROFESSOR
8. DR. ANNE PRAVEEN KRISHNA, PROFESSOR
9. DR. M. VENKATA NARESH, ASSOCIATE PROFESSOR
10. DR ARPITA GUPTA, PROFESSOR
11. DR RAMESH BABU, PROFESSOR
12. DR. KOMARAGIRI RAGHAVA RAO, PROFESSOR
13. DR. FAZAL NOORBASHA, PROFESSOR
14. DR. R. VENU BABU, PROFESSOR
15. DR. MOHAMMED MOULANA, PROFESSOR
16. DR.E. VAMSIDHAR, PROFESSOR
17. DR. T. SANTHI SRI, PROFESSOR
18. DR. JOGENDRA KUMAR MUNAGALA, PROFESSOR

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19. DR. YOGESH KUMAR SHARMA, PROFESSOR
20. DR. CH. SMITHA CHOWDARY, PROFESSOR
21. DR. K. PRAKASH, PROFESSOR
22. DR. G. SYAM PRASAD, PROFESSOR
23. DR. K.V. DURGA KIRAN, PROFESSOR
24. DR.G. PRADEEPINI, PROFESSOR
25. DR. T. PRAVEEN, PROFESSOR
26. DR. KUNDA VENKATA PRASAD, PROFESSOR
27. DR. VIJAY KUMAR BURUGARI, PROFESSOR
28. DR. N RAGHAVENDRA SAI, PROFESSOR
29. DR. G P SARADHI VARMA, PROFESSOR
30. DR. K SWATHI, PROFESSOR
31. DR. KANDEPU BALA VENKATA BRAHMARAO, PROFESSOR
32. DR. T K RAMA KRISHNA RAO, PROFESSOR
33. DR. B ANNAPURNA, PROFESSOR
34. DR. MALLADI RAVISANKAR, PROFESSOR
35. DR. P L KISHAN KUMAR REDDY, PROFESSOR
36. DR. P. PRAVEEN KUMAR, PROFESSOR
37. DR. V. KRISHNA REDDY, PROFESSOR
38. DR. G RAVIKANTH, PROFESSOR
39. DR.N. SRINIVASU, PROFESSOR
40. DR. G. SIVANAGESWARA RAO, PROFESSOR
41. DR. RAJARAJESWARI POTHURAJU, PROFESSOR
42. DR. B. CHAITANYA KRISHNA, PROFESSOR
43. DR.B. VIJAYA BABU, PROFESSOR
44. DR.K.V.V. SATYANARAYANA, PROFESSOR
45. DR. P. VIDYULLATHA, PROFESSOR

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46. DR.V.S. BHAGAVAN, PROFESSOR
47. DR. CHETTY MANNA SHEELA RANI, PROFESSOR
48. DR. ARPIT JAIN, PROFESSOR
49. DR. MERAJOTHU CHANDRA NAIK, PROFESSOR
50. DR. A. SUDHIR BABU, PROFESSOR
51. DR.V. CHANDRA PRAKASH, PROFESSOR
52. DR.V. SRIKANTH, PROFESSOR
53. DR.Y. PRASANTH, PROFESSOR
54. DR.S. SRINIVASA RAO, PROFESSOR
55. DR.B. SEKHAR BABU, PROFESSOR
56. DR.P. LAKSHMI PRASANNA, PROFESSOR
57. DR. K. RAVINDRANATH, PROFESSOR
58. DR. K. V. RAJU, PROFESSOR
59. DR. P.V.R.D. PRASADA RAO, PROFESSOR
60. DR.G. SWAIN, PROFESSOR
61. DR. RAJU ANITHA, PROFESSOR
62. DR. P. YELLAMMA, PROFESSOR
63. DR.K. BHANU PRAKASH, PROFESSOR
64. DR. A K VELMURUGAN, PROFESSOR
65. DR.P. M. ASHOK KUMAR, PROFESSOR
66. DR.P. VIDYA SAGAR, PROFESSOR
67. DR. VITHYA GANESAN, PROFESSOR
68. DR. NM JYOTHI, PROFESSOR
69. DR.P. ITHAYA RANI, PROFESSOR
70. DR. R.D. SATHIYA, PROFESSOR
71. DR. DARA VIKRAM, PROFESSOR
72. DR.G. KRISHNA MOHAN, PROFESSOR

31/01/2026

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73. DR. B. VEERAMALLU, PROFESSOR
74. DR. G. RAJENDRA KUMAR, PROFESSOR
75. DR. DHARMAIAH DEVARAPALLI, PROFESSOR
76. DR.K. RAJASEKHARA RAO, PROFESSOR
77. DR.S. SARAVANAN, PROFESSOR
78. DR. MANCHIRAJU KAMESWARA RAO, PROFESSOR
79. DR. PADMANABAN K, PROFESSOR
80. DR. GANGA RAMA KOTESWARA RAO, PROFESSOR
81. DR. CH. ANURADHA, PROFESSOR
82. DR. J SIRISHA DEVI, PROFESSOR
83. DR. G KALPANA, PROFESSOR
84. DR. K VIJAYA KUMAR, PROFESSOR
85. DR. M. PURUSHOTHAM REDDY, PROFESSOR
86. DR. EKBAL RASHID, PROFESSOR
87. DR. RADHIKA RANI CHINTALA, ASSOCIATE PROFESSOR
88. DR. M. KAVITHA, ASSOCIATE PROFESSOR
89. DR. B. VENKATESWARLU, ASSOCIATE PROFESSOR
90. DR. SATISH THATAVARTI, ASSOCIATE PROFESSOR
91. DR. ASESH KUMAR TRIPATHY, ASSOCIATE PROFESSOR
92. DR. ELANGOVAN GURUVA REDDY, ASSOCIATE PROFESSOR
93. DR. MANIKYA PRASUNA, ASSOCIATE PROFESSOR
94. DR. P. PRAVEEN KUMAR, ASSOCIATE PROFESSOR
95. DR. S. SRI HARSHA, ASSOCIATE PROFESSOR
96. DR. TATA RAVI KUMAR, ASSOCIATE PROFESSOR
97. DR. POTHAMSETTY KASI VISWESWARA RAO, ASSOCIATE PROFESSOR

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98. DR. P. V. VENKATESWARA RAO, ASSOCIATE PROFESSOR
99. DR. G. VEERRAJU, ASSOCIATE PROFESSOR
100. DR. R. VIJAYA KUMAR REDDY, ASSOCIATE PROFESSOR
101. DR. RUTH RAMYA, ASSOCIATE PROFESSOR
102. DR.D. NAGA MALLESWARI, ASSOCIATE PROFESSOR
103. DR. P.S.V.S. SRIDHAR, ASSOCIATE PROFESSOR
104. DR.M. LAKSHMANA PHANEENDRA, ASSOCIATE PROFESSOR
105. DR. K. ASHESH, ASSOCIATE PROFESSOR
106. DR.S. HRUSHIKESAVA RAJU, ASSOCIATE PROFESSOR
107. DR. B UMAMAHESWARA RAO, ASSOCIATE PROFESSOR
108. DR. JAYAVARAPU KARTHIK, ASSOCIATE PROFESSOR
109. DR. PHANEENDRA KUMAR B.L.N, ASSOCIATE PROFESSOR
110. DR. JUGUNTA SURESH BABU, ASSOCIATE PROFESSOR
111. DR. CH. RATHNA JYOTHI, ASSOCIATE PROFESSOR
112. DR. SADAM KAVITHA, ASSOCIATE PROFESSOR
113. DR. GANTA JACOB VICTOR, ASSOCIATE PROFESSOR
114. DR. P SRILATHA, ASSOCIATE PROFESSOR
115. DR. V MUNIRAJU NAIDU, ASSOCIATE PROFESSOR
116. DR. J KAVITHA, ASSOCIATE PROFESSOR
117. DR. P VENKATESHWARA RAO, ASSOCIATE PROFESSOR
118. DR. N NIRMALA JYOTHI, ASSOCIATE PROFESSOR
119. DR. M PURUSHOTHAM, ASSOCIATE PROFESSOR
120. DR. N SHIRISHA, ASSOCIATE PROFESSOR
121. DR. R SATEESH KUMAR, ASSOCIATE PROFESSOR

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122. MS. P. SUPRIYA, ASSISTANT PROFESSOR
123. DR. TIRANDASU RAVI KUMAR, ASSISTANT PROFESSOR
124.
125. DR. CH. KIRAN KUMAR, ASSISTANT PROFESSOR
126. MR. S. MAHESH NAIDU, ASSISTANT PROFESSOR
127. MS. THOTA LAKSHMI DEEPIKA ROY, ASSISTANT PROFESSOR
128. DR. THUMMALA PURNIMA, ASSISTANT PROFESSOR
129. DR.G. DINESH KUMAR, ASSISTANT PROFESSOR
130. DR. M S R PRASAD, ASSISTANT PROFESSOR
131. DR. SAJJA TULASI KRISHNA, ASSISTANT PROFESSOR
132. MRS.N. SRAVANTHI, ASSISTANT PROFESSOR
133. DR. KALAKOTI GOWRISANKAR, ASSISTANT PROFESSOR
134. MR. I. AJAYKUMAR, ASSISTANT PROFESSOR
135. DR. Y SUBBARAYUDU, ASSISTANT PROFESSOR
136. DR. CHANNABASAMMA, ASSISTANT PROFESSOR
137. DR. V SRINIVAS, ASSISTANT PROFESSOR
138. DR. P. LALITHA KUMARI, PROFESSOR
139. DR. K SRINIVAS, PROFESSOR
140. DR. S BALAJI, PROFESSOR
141. DR.A. SIVA KRISHNA REDDY, ASSOCIATE PROFESSOR
142. DR..SUMA LAKSHMI, ASSISTANT PROFESSOR
143. MR. CHANDA RAJ KUMAR, ASSISTANT PROFESSOR
144. DR. P. PAVAN KUMAR, ASSISTANT PROFESSOR
145. DR. D. ANANTHA REDDY, ASSISTANT PROFESSOR
146. DR. V.S.V. PRABHAKAR, PROFESSOR

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148. DR. T. SAJANA, ASSOCIATE PROFESSOR
149. DR. V RAMA KRISHNA, PROFESSOR
150. DR. AADAPA SRINIVASA RAO, PROFESSOR
151. DR. PATNALA SRI RAMA CHANDRA MURTHY, PROFESSOR
152. DR. RAVURI DANIEL, PROFESSOR
153. DR. M PRAVEENA, ASSISTANT PROFESSOR
154. DR M BHASKAR, ASSOCIATE PROFESSOR
155. DR S VIJAYA KRISHNA, ASSOCIATE PROFESSOR
156. DR. V SREENIVASA RAO, PROFESSOR
157. DR K RAMA KRISHNA, PROFESSOR
158. DR VVS SASANK, ASSISTANT PROFESSOR
159. MRS G KOMALI, ASSISTANT PROFESSOR
160. MR. KUCHIPUDI PRASANTH KUMAR, ASSISTANT PROFESSOR
161. DR. ATHMAKURI SATISH KUMAR, ASSISTANT PROFESSOR
162. MR N MURALI KRISHNA, ASSISTANT PROFESSOR
163. DR. RATNA KANTH NELAPATI, ASSOCIATE PROFESSOR
164. DR ASHISH, ASSOCIATE PROFESSOR
165. MR B SURENDRANATH BENARJI, ASSISTANT PROFESSOR
166. DR B KEERTHI SAMHITHA, ASSISTANT PROFESSOR
167. DR ANITA PRADHAN, ASSISTANT PROFESSOR
168. MR N RAJENDER, ASSISTANT PROFESSOR
169. DR N PRAVEENA, ASSISTANT PROFESSOR

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170. DR. G NAGA SOWJANYA, ASSISTANT PROFESSOR
171. DR Y TAYAR, ASSOCIATE PROFESSOR
172. DR N NEELIMA, ASSOCIATE PROFESSOR
173. MRS B SWATHI SRI, ASSISTANT PROFESSOR
174. DR G SATEESH, ASSISTANT PROFESSOR
175. DR SANJAY KUMAR, ASSISTANT PROFESSOR
176. DR G MUNI NAGAMANI, ASSISTANT PROFESSOR
177. DR.K. NIRMALA, ASSISTANT PROFESSOR
178. DR. NAGA SUNDARAM, ASSISTANT PROFESSOR
179. DR.P. MURTHUJA, ASSISTANT PROFESSOR
180. DR. SADAM KAVITHA, ASSOCIATE PROFESSOR
181. DR. RAMYA P, ASSOCIATE PROFESSOR
182. DR. G. RAMAKOTESWARA RAO, PROFESSOR
183. J. SURYA KIRAN, ASSISTANT PROFESSOR

The following members were Absent:

1. DR. J SIRISHA DEVI, PROFESSOR
2. MS CH LAVANYA SUSANNA, ASSISTANT PROFESSOR
3. MR R DILIP KUMAR, ASSISTANT PROFESSOR
4. DR. PHANI KUMAR SINDHE, ASSOCIATE PROFESSOR
5. MR. J. YATEESH, ASSISTANT PROFESSOR

The following points are discussed and resolved:

1. Stakeholders feedback on the existing curriculum to build Y26 academic structure for 2026-27 admitted batch. Based on stake holders feedback the following new courses are proposed for 2026-27 admitted batch B.Tech CSE students and same is recommended to BOS for approval.

    1. Mr. Konkimalla Venkata Ranga Rao, Academic Peer, recommended introducing "Mathematics for Computation" to strengthen students' analytical,

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computational, and mathematical problem-solving skills required for modern computing.

2. N. Lakshmi Narayana, Academic Peer, recommended introducing "Mathematics for AI" covering linear algebra, probability, statistics, optimization, and calculus essential for Artificial Intelligence.
3. Hanumanth Yaganti, Alumni, strongly recommended revising "Digital Design & Computer Architecture" to include modern processor architecture, FPGA concepts, digital logic optimization, and computer organization.
4. Sreeja Girija R., Industry Person, recommended introducing "Full Stack Development – Front End Frameworks" focusing on React, Angular, responsive UI development, state management, and modern web technologies.
5. Dr. P. Harini, Academic Peer, recommended introducing "Computational Foundations for AI" to strengthen students' understanding of algorithms, optimization, search techniques, and computational intelligence.
6. Mr. T. Ravi Kumar, Faculty, recommended introducing "Data Structures & Algorithms – I" with emphasis on fundamental data structures, recursion, searching, sorting, and algorithm analysis.
7. Abhinay Irala, Industry Person, recommended introducing "Full Stack Development – Database Systems & Back End Engineering" covering SQL, NoSQL, REST APIs, Spring Boot, Node.js, authentication, and cloud databases.
8. Dr. Anveeksh Koneru, Alumni, strongly recommended strengthening "Machine Learning" by incorporating deep learning fundamentals, model evaluation, explainable AI, and practical projects using real-world datasets.
9. Mr. T. Ravi Kumar, Faculty, recommended introducing "Data Structures & Algorithms – II" focusing on advanced trees, graphs, heaps, hashing, greedy algorithms, and dynamic programming.

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10. Dr. Raju Anitha, Faculty, recommended introducing "Data Structures & Algorithms – III" covering advanced algorithmic paradigms, string algorithms, computational geometry, and graph optimization techniques.
11. Dr. T. S. Rajeshwari, Faculty, recommended revising "Operating Systems & Systems Programming" by incorporating process management, memory management, concurrency, Linux programming, and shell scripting.
12. Mr. Vaishnava Dhaatri Academic Peer, recommended introducing "System Design for Scalability & Reliability" covering distributed systems, microservices, cloud architecture, scalability, fault tolerance, and high availability.
13. Sai Anil Muthyala, Industry Person, strongly recommended introducing "Embedded AI & Tiny ML" covering edge AI, TinyML frameworks, embedded machine learning, low-power AI devices, and intelligent embedded systems.

2. Stakeholders feedback on the existing curriculum to build Y26 academic structure for 2026-27 admitted batch. Based on stake holders feedback the following revised courses are proposed for 2026-27 admitted batch B.Tech CSE students and same is recommended to BOS for approval.
    1. Ms. Pathuri Bindu, Faculty, recommended to revise the "Indian Knowledge Systems" to provide awareness of India's scientific heritage, ethical values, traditional knowledge, and sustainable practices.
    2. Karthik Parthiban, Industry Person, strongly recommended to revise the "Design Thinking for Innovation & Entrepreneurship" to foster creativity, innovation, user-centric design, and entrepreneurial thinking through real-world problem-solving activities.

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3. Dr. Vijaya Sri K., Faculty, recommended to revise the "Ethics & Human Values for Responsible Technology" emphasizing AI ethics, responsible innovation, cybersecurity ethics, sustainability, privacy, and professional values.
4. Dr. Sanjit Ningthoujam, Academic Peer, recommended to revise the "Problem Solving Using Programming (Java)" a foundational course to improve logical thinking, algorithm design, and programming skills.
5. Mr. Sagireddy Pulla Reddy, Industry Person, recommended to revise the "Fundamentals of IoT & Sensors" to provide students with practical knowledge of IoT architecture, sensors, embedded devices, and smart applications.
6. Mr. CH. Ramaiah, Faculty, recommended introducing "Embedded System Design & IoT" with practical laboratory sessions covering embedded controllers, IoT devices, and real-time applications.
7. Poothabalan Somasundaram, Industry Person" recommended to revise the "Computer Networks & Network Programming" with emphasis on networking protocols, socket programming, distributed computing, and cloud networking.
8. N. Lakshmi Narayana, Academic Peer, recommended to revise the "Embedded Software Development" focusing on firmware programming, RTOS, debugging techniques, and embedded software practices.
9. A. Aparna, Alumni, strongly recommended to revise the "Big Data Engineering & Data Pipelines" covering ETL pipelines, distributed computing, cloud data platforms, and scalable data processing.
10. Dr. P. Harini, Academic Peer, recommended to revise the "Advanced Object-Oriented Programming" with emphasis on software design

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principles, design patterns, reusable architecture, and enterprise application development.

11. Dr. P. Syam Sundar, Industry Person, strongly recommended to revise the "Generative AI & AI Platform Engineering" focusing on foundation models, prompt engineering, AI deployment, and enterprise AI platforms.
12. Madhu Bodapati, Industry Person, recommended to revise the "Natural Language Processing & LLM Engineering" covering transformer models, prompt engineering, fine-tuning, retrieval systems, and enterprise AI applications.
13. Dr. Pragnyaban Mishra, Faculty, recommended to revise the "Adaptive Software Engineering" focusing on Agile methodologies, DevOps, software evolution, CI/CD, and resilient software architecture.
14. Mr. Uppala Gopala Rao, Alumni, strongly recommended to revise the "Agentic AI & Autonomous Enterprise Systems" focusing on AI agents, autonomous workflows, enterprise automation, and intelligent decision-making systems.

3. Stakeholders feedback on the existing curriculum to build Y25 academic structure for 2025-26 admitted batch. Based on stake holders feedback the following new and revised courses are proposed for 2025-26 admitted batch B.Tech CSE students and same is recommended to BOS for approval.

1. Prathusha, Industry Person, strongly recommended introducing a "Mathematics for Data Science and Analytics" course to build a strong mathematical foundation for data-driven problem solving. They emphasized covering topics such as linear algebra, probability, statistics, optimization, and calculus, along with practical applications in data science, analytics, and machine learning using real-world datasets and industry-relevant tools.

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2. Dr. Vivek S Deshpande, Faculty, strongly recommend the addition of the 'PROBLEM SOLVING THROUGH C' course to our curriculum, as it addresses the foundational course in programming that focuses on logical reasoning and structured problem-solving using the C language. It was suggested to make this course mandatory for first-year students.
3. Vishnu Teja, Alumni, highly recommend the subject "DIGITAL SYSTEM DESIGN" recommended introducing a course focused on digital logic and system architecture to strengthen students' understanding of hardware components, circuit design, and digital operations relevant to embedded and computer systems.
4. Poothabalan Somasundaram, Industry Person, highly recommend the subject"PYTHON PROGRAMMING" for th highlighted the growing demand for Python skills due to its applications in data science, automation, AI, and web development. They suggested integrating Python into the curriculum to enhance students' employability and real-world problem-solving skills.
5. Vishnu Teja, Alumni, Strong foundational knowledge"COMPUTER ORGANIZATION AND ARCHITECTURE" in computer hardware, memory architecture, and instruction-level operations is essential for success in technical interviews and competitive exams. They recommended including this course early in the curriculum.
6. Dr. R Venkata Ratnam, Academic Peer, recommended to introduce the Embedded System Design and IoT course in the curriculum to address the increasing demand for professionals with expertise in embedded systems, connected devices, and IoT technologies.
7. Dr. V. Ramalingam, Alumni, recommended introducing a to "DEEP LEARNING WITH ACCELERATED COMPUTING "concepts and accelerated computing technologies that are widely used in Artificial Intelligence applications. They

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noted that the curriculum provides a good foundation in neural networks, GPU-enabled computing, and deep learning frameworks.

8. Prathusha, Academic Peer, strongly recommended the introduction of a course on " Embedded Software Development", highlighting its relevance in preparing students for emerging technologies such as Embedded Systems, Internet of Things (IoT), Automotive Electronics, Robotics, and Edge Computing. He observed that the proposed course establishes a strong foundation in embedded programming and hardware–software integration.
9. Dr. Rajya Lakshmi, Faculty strongly recommended introducing Advanced Data Structures and Algorithms to provide students with comprehensive knowledge of advanced tree structures, graph algorithms, dynamic programming, greedy techniques, string algorithms, hashing, algorithm optimization, and computational complexity. She also recommended incorporating coding-intensive laboratory sessions, competitive programming exercises, and real-world problem-solving using industry-standard coding platforms.
10. Dr. Surendra Singh Jadav, Alumni, observed the course Big Data Engineering and Data Pipelines, stating that it is highly relevant to the growing demand for data engineers in cloud computing, artificial intelligence, and analytics industries. He observed that the course provides a strong foundation in distributed data processing, big data ecosystems, and data pipeline development.
11. Balakrishna, Academic Peer, strongly recommended,new course Generative AI and AI Platform Engineering, stating that it addresses the rapidly growing demand for expertise in Generative AI, Large Language Models (LLMs), and AI platform development. He observed that the proposed course establishes a strong foundation in AI model development and deployment.
12. Dr. B. Suneetha, Faculty strongly recommended introducing CI/CD and Cloud DevOps to equip students with modern software development and deployment

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practices. She suggested covering Continuous Integration (CI), Continuous Delivery/Deployment (CD), Git-based version control, Docker, Kubernetes, Infrastructure as Code (IaC), Jenkins, GitHub Actions, cloud platforms (AWS/Azure/GCP), monitoring, logging, and DevSecOps practices. She also emphasized hands-on laboratory sessions and industry-oriented DevOps projects."

13. Abhinay Irala, Industry Person, strongly recommended introducing Natural Language Processing & LLM Engineering to provide students with expertise in NLP fundamentals, transformer architectures, Large Language Models (LLMs), prompt engineering, fine-tuning, vector databases, and conversational AI applications. He recommended incorporating real-world case studies and project-based learning.
14. Hemanth Duriseti, Alumni, suggested "Agentic AI and Autonomous Enterprise System"incorporating AI governance, responsible AI, security, ethics, and human-AI collaboration to ensure students develop solutions that are scalable, secure, and aligned with industry best practices
15. Gopi Chigurupati, Alumni, recommended introducing a Term Paper course to strengthen students' research aptitude, technical writing, literature review, and analytical thinking skills,hould encourage students to explore emerging technologies, conduct independent research, and present findings through structured technical reports and seminar presentations.
16. Vaishnava Dhaatr, Academic Peer, strongly recommended introducing "Actuarial Sciences" to equip students with mathematical, statistical, and risk assessment techniques used in finance, insurance, and data analytics.
17. Dr. Sonal Dipak Mali, Academic Peer, strongly recommended introducing "Computational Biology" to provide students with interdisciplinary knowledge

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combining biology, computer science, and data analytics for solving biological problems.

18. Madhu Bodapati, Industry Person, strongly recommended introducing "Computational Neuroscience" to familiarize students with computational models of the brain, neural systems, artificial intelligence, and cognitive computing.
19. Rajshekar Botcha, Industry Person, strongly recommended introducing "Information Theory & Coding" to strengthen students' understanding of data communication, coding techniques, information compression, and error correction.
20. Dr. Shashi Mehrotra, Faculty, strongly recommended introducing "Organic & Physical Chemistry for Life Sciences" to strengthen students' understanding of chemical principles applied to biological systems and healthcare applications.
21. Dr. Satyaprasad, Academic Peer, strongly recommended introducing "Quantum Information Science" to provide students with knowledge of quantum computing, quantum algorithms, cryptography, and quantum communication.
22. K. Srinidhi, Faculty, I strongly recommended introducing "Semiconductor Physics" to provide students with fundamental knowledge of semiconductor materials, electronic devices, and modern microelectronics.
23. Dr. K. Raghava Rao, Academic Peer, highly recommended introducing the course "Agentic AI Systems: Architectures & Reasoning Frameworks" with greater emphasis on hands-on learning through practical case studies, autonomous AI agent development, reasoning frameworks, and mini-projects using modern Agentic AI platforms.
24. Dr. Ohm Prakash, Academic Peer, recommended strengthening the course "Autonomous Perception & Multi-Modal Sensor Fusion" by incorporating

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practical exposure to cameras, LiDAR, radar, ultrasonic sensors, sensor fusion algorithms, real-time datasets, and simulation-based experiments.

25. Dr. Uma, Academic Peer, recommended strengthening the course "Motion Planning, Control Systems & Autonomous Simulation" by including advanced motion planning algorithms, autonomous navigation techniques, modern control systems, and project-based simulation using industry-standard platforms.
26. R. M. Balaji, Academic Peer, recommended expanding the course "V2X Communications & Connected Mobility Intelligence" by covering Vehicle-to-Everything (V2X) communication standards, connected mobility technologies, intelligent transportation systems, smart city applications, and recent industry developments.
27. Prathusha, Industry Person, strongly recommended strengthening the course "Agentic AI Deployment, Safety Engineering & Field Integration" by incorporating AI deployment methodologies, safety engineering principles, ethical AI practices, validation techniques, deployment pipelines, and real-world field integration.
28. Dr. Lova Kumari, Academic Peer, recommended strengthening the course "Distributed Ledger & Blockchain Protocol Engineering" by including advanced distributed ledger architectures, consensus mechanisms, blockchain scalability, enterprise blockchain applications, and protocol-level implementation. She also suggested incorporating practical case studies to enhance students' conceptual understanding.
29. Mr. M. Trinsath Basu, Faculty, recommended introducing "Smart Contract Engineering & Web3 Application Development" with practical training in Solidity programming, decentralized application (DApp) development, Web3 frameworks, and project-based learning to strengthen programming and application development skills.

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30. Mr. M. Trinsath Basu, Faculty, recommended strengthening the course "Smart Contract Security, Auditing & Formal Verification" by incorporating secure coding practices, smart contract auditing techniques, vulnerability assessment, formal verification methods, and blockchain security tools through practical exercises.
31. Dr. B. Vijaya Babu, Industry Person, recommended introducing "DeFi Protocol Engineering, Tokenomics & Cross-Chain Systems" by incorporating decentralized finance (DeFi) protocols, tokenomics models, cross-chain interoperability, blockchain ecosystem architectures, and real-world fintech case studies. He also suggested emphasizing practical applications used in the financial technology sector.
32. Mr. B. Srikanth, Industry Person, recommended introducing "Zero-Knowledge Proofs, Layer-2 Scaling & AI-Native Blockchain Systems" by including Zero-Knowledge Proofs, Layer-2 scaling technologies, privacy-preserving blockchain solutions, AI-native blockchain applications, and recent industry developments through practical demonstrations and case studies.
33. N. Lakshmi Narayana, Academic Peer, recommended strengthening the course "Offensive Security & Ethical Hacking" by including advanced ethical hacking methodologies, penetration testing tools, exploit development, and real-world cybersecurity case studies. He also suggested increasing practical laboratory sessions aligned with industry standards.
34. Mr. SK. Mohammed Gouse, Faculty, recommended introducing "Vulnerability Assessment & Advanced Penetration Testing" by incorporating advanced vulnerability assessment techniques, penetration testing frameworks, automated security assessment tools, and hands-on laboratory exercises to strengthen practical learning.

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35. Mr. Jonnalagadda Surya Kiran, Faculty, recommended strengthening the course "Digital Forensics & Cyber Incident Response" by including digital evidence collection, forensic investigation tools, malware analysis, cyber incident response methodologies, and practical laboratory sessions.
36. Dr. G. Swain, Faculty, recommended strengthening the course "SOC Engineering & Cyber Threat Intelligence" by incorporating Security Operations Center (SOC) workflows, SIEM tools, cyber threat intelligence platforms, incident monitoring, and real-time security analytics.
37. Dr. P. V. R. D. Prasada Rao, Faculty, recommended strengthening the course "AI-Driven Security Operations & Zero Trust Architecture" by including AI-based threat detection, Security Orchestration, Automation and Response (SOAR), Zero Trust Architecture, and modern cloud security practices with practical demonstrations.
38. Vishnu Vardhan, Industry Person, recommended introducing the course "Kubernetes Orchestration & Cloud-Native Architecture" covering Kubernetes cluster management, container orchestration, cloud-native application deployment, microservices architecture, and DevOps practices through practical implementation.
39. A.Aparna, Alumni, recommended introducing the course "Zero Trust Security & Cloud-Native Network Engineering" to understand modern security models, identity-based access control, cloud-native networking, and Zero Trust Architecture.
40. P.siva bala vindho, Alumni, recommended introducing the course "Platform Engineering & Internal Developer Platforms" to understand platform engineering concepts, developer self-service platforms, automation, and internal development workflows through practical implementation.

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41. Mr. R. S. V. Badrinath, Industry Person, recommended introducing the course "Distributed Systems Design & Cloud-Native Data Engineering" covering distributed system fundamentals, cloud-native architectures, scalable data pipelines, and fault-tolerant systems with practical implementation.
42. Mr. Akhandam Venkat Aditya, Industry Person, recommended introducing the course "Hyperscale Cloud Architecture & Site Reliability Engineering" covering hyperscale cloud infrastructure, reliability engineering principles, observability, automation, and incident management through practical case studies.
43. Mr. Saroj Kumar Dhakal, Industry Person, recommended introducing the course "Game Engine Architecture & Real-Time Rendering Systems" covering modern game engine architecture, rendering pipelines, graphics APIs, shader programming, and real-time rendering techniques through hands-on projects.
44. Ms. Kajal Tiwari, Industry Person, recommended introducing "Gameplay Systems Engineering & Networked Multiplayer Architecture" with emphasis on gameplay mechanics, multiplayer networking, synchronization techniques, latency optimization, and scalable game server architectures.
45. Mr. R. S. V. Badrinath, Industry Person, recommended introducing "AI-Driven Game Systems: Procedural Generation & Generative Content" covering procedural content generation, generative AI techniques, intelligent game design, and AI-driven content creation through practical projects.
46. Mr. Prassad Suravadanula, Industry Person, recommended introducing "Extended Reality (XR) Engineering: VR, AR & Mixed Reality" with practical exposure to Virtual Reality, Augmented Reality, Mixed Reality development, spatial computing, immersive application design, and XR frameworks.
47. Mr. Murali Mohan Setty, Industry Person, recommended introducing "Cloud-Native Game Platform Engineering & Live Operations" covering cloud-native

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backend infrastructure, game deployment, live operations, matchmaking services, scalability, and DevOps practices for gaming platforms.

48. Dr. V. K. Gnanavel, Academic Peer, recommended introducing "RF & Wireless Communications Engineering" covering RF circuit fundamentals, antenna theory, wireless communication principles, RF measurements, and practical laboratory experiments.
49. Dr. D. William Albert, Academic Peer, recommended introducing "OFDM & Multicarrier Wireless Systems" covering OFDM principles, multicarrier modulation techniques, wireless channel modeling, and simulation-based practical exercises.
50. Dr. T. Cithraleka, Academic Peer, recommended introducing "5G NR Systems Architecture & Engineering" covering 5G New Radio architecture, protocol stack, radio access networks, network slicing, and practical simulation-based learning.
51. Mr. G. S. Raghavendra, Academic Peer, recommended introducing "6G Systems Architecture & Intelligent Radio Access Networks" with emphasis on next-generation wireless technologies, intelligent radio access networks, AI-enabled communication systems, and research-oriented learning.
52. Dr. Sujatha, Academic Peer, recommended introducing "AI-Native Wireless Networks & Cognitive Radio Engineering" by integrating AI-driven wireless networking, cognitive radio systems, adaptive spectrum management, intelligent network optimization, and practical implementation using simulation tools.
53. Dr. Ch. Ramesh Kumar, Academic Peer, recommended strengthening the course "GPU Architecture & CUDA Programming" by including comprehensive coverage of GPU hardware architecture, CUDA programming, parallel computing concepts, and practical laboratory sessions using modern GPU platforms.
54. Dr. Vivek S. Deshpande, Industry Person, recommended strengthening the course "Advanced GPU Systems & Performance Optimization" by incorporating

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advanced performance profiling, GPU memory optimization, benchmarking techniques, and practical optimization exercises.

55. Dr. Sanjit Ningthoujam, Academic Peer, recommended strengthening the course "Parallel & Heterogeneous Computing Systems" by including advanced parallel programming models, heterogeneous computing architectures, synchronization techniques, and practical implementation using multicore and GPU systems.
56. Dr. P. Harini, Academic Peer, recommended strengthening the course "High-Performance Computing & Distributed GPU Clusters" by incorporating distributed GPU cluster management, scheduling algorithms, distributed AI training, scalability techniques, and fault-tolerant computing concepts.
57. Mr. B. Srikanth, Industry Person, recommended strengthening the course "Accelerated AI Inference & GPU Platform Engineering" by incorporating inference optimization techniques, GPU deployment strategies, platform engineering principles, and practical implementation using AI acceleration frameworks.
58. Mr. Uppala Gopala Rao, Alumni, recommended introducing "Advanced Data Modeling, Warehousing & Lakehouse Architecture" covering modern data modeling techniques, enterprise data warehousing, and lake house architecture design.
59. Mr. Jonnalagadda Surya Kiran, Faculty, recommended introducing "Streaming Data Engineering & Real-Time Event Processing" covering event-driven architectures, stream processing frameworks, and real-time data pipelines with practical implementation.
60. Dr. P. V. Vara Prasad, Faculty, recommended introducing "Data Pipeline Orchestration, DataOps & Observability" covering workflow orchestration, DataOps methodologies, pipeline monitoring, and observability practices.

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61. Dr. K. Nagarjuna, Faculty, recommended introducing "Real-Time Analytics Engineering & Analytical Query Systems" covering analytical query engines, streaming analytics, dashboard development, and real-time decision-support systems.
62. Dr. Ruth Ramya, Faculty, recommended introducing "AI-Augmented Data Engineering & Intelligent Data Platforms" covering AI-assisted data engineering, intelligent data platforms, automated pipeline optimization, and machine learning integration.
63. Mrs. Divya Vadlamudi, Alumni, recommended introducing "Quantum Computing Foundations: Circuits, Hardware & Qubits" covering quantum circuits, quantum hardware, qubits, and simulation-based learning.
64. Dr. T. Sajana, Faculty, recommended introducing "Quantum Algorithms & Computational Complexity" covering quantum algorithms, computational complexity analysis, and implementation using quantum simulators.
65. Pathan Furqaan Akram Khan, Alumni, recommended introducing "Quantum Error Correction & Fault-Tolerant Computing" to understand quantum error correction, noise mitigation, and reliable quantum computation.
66. G. V. R. Nishchal Reddy, Alumni, recommended introducing "Quantum Cryptography, Secure Communications & Quantum Networks" covering quantum key distribution, secure communication protocols, and quantum networking technologies.
67. Mr. Murali Mohan Setty, Industry Person, recommended introducing "Quantum Machine Learning & Industrial Quantum Applications" covering quantum machine learning algorithms, industrial use cases, and practical implementation using quantum software frameworks.
68. Mr. R. S. V. Badrinath, Industry Person, recommended introducing the course "Real-Time Embedded Systems and RTOS" covering real-time operating systems,

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task scheduling, interrupt handling, embedded software design, and hands-on development using RTOS platforms.

69. Mr. Prassad Suravadanula, Industry Person, recommended introducing the course "Advanced Networked Embedded Systems and Industrial Protocols" covering embedded networking, CAN, LIN, Modbus, MQTT, OPC-UA, industrial communication protocols, and real-time industrial applications.
70. Mr. Murali Mohan Setty, Industry Person, recommended introducing the course "Secure and Reliable Edge AI Systems" covering Edge AI security, trusted AI deployment, secure embedded intelligence, reliability engineering, and AI-enabled edge device management.
71. Dr. V. K. Gnanavel, Academic Peer, recommended introducing the course "Edge AI Systems – NPU Architecture, Deployment and Optimization" covering Neural Processing Unit (NPU) architecture, AI model optimization, hardware acceleration, model deployment, and performance tuning on edge devices.
72. Dr. D. William Albert, Academic Peer, recommended introducing the course "Agentic Embedded Systems and Intelligent Edge Orchestration" covering autonomous embedded systems, intelligent edge orchestration, AI-driven embedded agents, distributed edge intelligence, and real-world autonomous applications.

1. Mr. B. Srikanth, Industry Person, revision for the DESIGN THINKING & INNOVATION course is highly recommended to the course effectively introduced design thinking concepts, it lacked sufficient hands-on projects and real-world problem scenarios for students to practice innovative solution development..
2. Dr.A.S.C.S.SASTRY, Faculty, observed that the revised Basic Electrical and Electronic Circuits course should further strengthen its content by including modern electronic components, practical troubleshooting techniques, simulation

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tools, and application-oriented laboratory experiments in addition to theoretical circuit analysis.

3. Karthik Parthiban, Industry Person, strongly recommended revising the Fundamentals of IoT & Sensors course to include emerging IoT architectures, smart sensors, edge computing, IoT security, cloud integration, and real-time industrial applications. He also suggested incorporating hands-on laboratory exercises using popular IoT platforms and development boards to improve practical skills.
4. Lova Kumari, Academic Peer, highly recommended revising the Object Oriented Programming course to strengthen students' programming fundamentals by emphasizing core OOP concepts such as classes, objects, inheritance, polymorphism, encapsulation, and abstraction using industry-standard programming languages like Java or Python, along with practical coding assignments.
5. Dr. SK. Mohammed Gouse, Faculty, strongly recommended revising the Front End Development Frameworks for Web Applications course by incorporating modern JavaScript frameworks such as React.js, component-based architecture, state management, responsive web design, REST API integration, client-side routing, UI libraries, performance optimization, and testing frameworks. He also recommended including project-based learning using industry-standard development tools and deployment practices.
6. Dr. B. Vijaya Babu, Faculty, strongly recommended revising the Database Management Systems course by incorporating advanced SQL, NoSQL databases, cloud database services, distributed database concepts, database security, query optimization, transaction management, and hands-on projects using industry-standard database platforms.

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7. Dr. T. Ravi Kumar, Faculty, strongly recommended revising the Design and Analysis of Algorithms course by incorporating advanced algorithm design techniques, graph algorithms, greedy methods, dynamic programming, divide-and-conquer strategies, approximation algorithms, randomized algorithms, and algorithm optimization. He also recommended increasing coding-based problem-solving sessions and competitive programming exercises.
8. Dr.B.VIJAYA BABU, Industry Person, strongly recommended revising the Computer Networks and Security course by incorporating advanced networking concepts, network security protocols, ethical hacking fundamentals, secure network architecture, wireless networking, cloud networking, intrusion detection, and practical network configuration and troubleshooting exercises aligned with current industry requirements.
9. Mr. B. Srikant, Industry Person, strongly recommended revising the Cloud Infrastructure and Services course by incorporating virtualization technologies, cloud deployment models, cloud security, containerization, Kubernetes, DevOps integration, Infrastructure as Code (IaC), and hands-on experience using AWS, Microsoft Azure, and Google Cloud Platform.
10. Ms.K Devi, Alumni, appreciated the revised Back End Engineering for Full Stack Web Applications course and recommended strengthening it by incorporating scalable backend architectures, RESTful and GraphQL APIs, microservices, cloud-native development, authentication and authorization, database optimization, DevOps practices, and deployment using modern backend frameworks and cloud platforms.
11. Dr. Shashi Mehrotra, Faculty, strongly recommended revising the Adaptive Software Engineering course by incorporating Agile software development methodologies, DevOps practices, software architecture patterns, microservices, CI/CD, software quality assurance, automated testing, software evolution, and

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AI-assisted software engineering. He also recommended integrating industry-based case studies, collaborative projects, and modern software development tools to enhance practical learning.

12. Suhas Achanta, Alumni, strongly recommended revising the Capstone Project–I course by strengthening its focus on problem identification, literature survey, project planning, innovation, research methodology, and industry-oriented project selection. They also suggested encouraging interdisciplinary and industry-sponsored projects to improve practical exposure and problem-solving skills.

13. Suhas Achanta, Alumni, strongly recommended revising the Capstone Project–II course by emphasizing complete project implementation, testing, validation, deployment, documentation, and presentation of innovative engineering solutions. They also recommended increasing industry mentorship, real-world project execution, and outcome-based assessment to enhance students' professional readiness.

4. Stakeholders feedback on the existing curriculum to build Y26 academic structure for 2026-27 admitted batch. Based on stake holders feedback the following new and revised courses are proposed for 2026-27 admitted batch M.Tech CSE students and same is recommended to BOS for approval.

1. Dr. Pragnyaban Mishra, Faculty, recommended introducing the course "Communication Skills and Technical Writing" to strengthen students' professional communication, technical documentation, presentation skills, and workplace communication through practical writing activities and industry-oriented assignments.
2. Jack Ilamaran, Industry Person, recommended introducing "Placement Training and Professional Readiness" covering aptitude training, coding

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practice, interview preparation, communication skills, resume building, and industry recruitment processes.

3. Karthik Parthiban, Industry Person, recommended introducing "Computational Thinking and Programming" by emphasizing logical reasoning, algorithmic thinking, structured programming, and hands-on programming practice using industry-relevant problem-solving approaches.
4. Dr. T. S. Rajeshwari, Faculty, recommended introducing "OS, Concurrency and Distributed Systems" covering operating system internals, process synchronization, concurrency models, distributed computing concepts, and practical implementation using modern tools.
5. Mr. Vaishnava Dhaatri, Academic Peer, recommended introducing "Datacentre Networks and Internet Protocols" by including modern data centre architectures, Internet protocols, software-defined networking, cloud networking, and practical networking laboratories.
6. Dr. Sonal Dipak Mali, Academic Peer, recommended introducing the course "AI and Machine Learning with Applied Mathematics" by integrating mathematical foundations, linear algebra, probability, optimization techniques, machine learning algorithms, and practical AI model implementation.
7. Meenakshi Sharma, Industry Person, recommended introducing "Full-Stack Web Engineering" with emphasis on modern front-end frameworks, backend technologies, REST APIs, cloud deployment, database integration, and project-based development.
8. Dr. Satyaprasad, Academic Peer, recommended introducing "Algorithm Engineering for Data Systems" covering advanced algorithm design, optimization techniques, scalable data processing, graph algorithms, and algorithm implementation for large-scale data systems.

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9. Mr. Sagireddy Pulla Reddy, Industry Person, recommended introducing "Deep Learning and Natural Language Processing" by including neural network architectures, transformer models, language models, generative AI concepts, and practical NLP applications using industry-standard frameworks.
10. Dr. Raju Anitha, Faculty, recommended introducing "Research Methodology and Intellectual Property Rights" covering research design, scientific writing, publication ethics, patent filing procedures, intellectual property laws, and innovation management.
11. Dr. V. K. Gnanavel, Academic Peer, recommended introducing "Generative AI and LLM Application Engineering" by including foundation models, Large Language Models (LLMs), prompt engineering, Retrieval-Augmented Generation (RAG), AI agents, and real-world AI applications.
12. Mrs. Geetha S. Nazre, Industry Person, recommended introducing "Cloud Services and DevOps Engineering" covering cloud infrastructure, DevOps practices, CI/CD pipelines, Infrastructure as Code, containerization, and cloud deployment automation.
13. Rajshekar Botcha, Industry Person, recommended introducing "Data Science and Analytics Engineering at Scale" by integrating scalable data engineering, distributed analytics, big data processing frameworks, machine learning pipelines, and cloud-based analytics platforms.
14. Dr. P. Harini, Academic Peer, recommended introducing "Agentic AI, MCP and Multimodal Engineering" by including autonomous AI agents, Model Context Protocol (MCP), multimodal foundation models, AI orchestration frameworks, and practical application development.
15. Dr. CH V. Ramana Murthy, Faculty, recommended introducing "High-Performance Computing Systems" covering parallel architectures, distributed

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computing, cluster computing, GPU acceleration, and performance optimization techniques with laboratory implementation.

16. Dr. P. Syam Sundar, Faculty, recommended introducing the course "Parallel and Concurrent Programming Models (PC&S)" by incorporating parallel programming paradigms, concurrent execution models, synchronization mechanisms, multithreading, and practical implementation using modern programming frameworks.
17. Madhu Bodapati, Industry Person, recommended introducing the course "Kubernetes and Container Orchestration (CNE&D)" covering Kubernetes architecture, container orchestration, cluster management, workload deployment, service discovery, and cloud-native application management.
18. Kavitha Avula, Industry Person, recommended introducing "CUDA and GPU Programming (PC&S)" by including GPU architecture, CUDA programming, parallel algorithm development, memory optimization, and practical GPU computing applications.
19. Abhinay Irala, Industry Person, recommended introducing "Service Mesh and Microservices Architecture (CNE&D)" covering service mesh technologies, microservices architecture, API gateway implementation, traffic management, observability, and cloud-native deployment.
20. Dr. Ramesh G., Academic Peer, recommended introducing "ML Systems: Compilers, Training and Inference (PC&S)" by integrating machine learning compilers, distributed model training, inference optimization, model deployment, and AI system performance tuning.
21. Sreeja Girija R., Industry Person, recommended introducing "Site Reliability Engineering and Observability (CNE&D)" by including reliability engineering principles, observability frameworks, monitoring systems, incident response, automation, and cloud infrastructure management.

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22. Dr. Kolla Bhanu Prakash, Faculty, recommended introducing "Processor Architecture and ISA Design (PC&S)" covering processor organization, instruction set architecture, pipelining, processor optimization, and hardware performance analysis through practical implementation.
23. Mr. E. Vamsidhar, Faculty, recommended introducing "Cloud Platform Engineering and Infrastructure as Code (IaC) (CNE&D)" covering Infrastructure as Code, cloud automation, cloud platform management, provisioning tools, and deployment pipelines.
24. Sai Anil Muthyala, Industry Person, recommended introducing "Capstone Research / Industry Project – Phase I" focusing on industry problem identification, literature survey, project planning, technology selection, research methodology, and prototype development.
25. Sai Anil Muthyala, Industry Person, recommended introducing "Capstone Research / Industry Project – Phase II" emphasizing solution implementation, testing, validation, deployment, technical documentation, and final project presentation aligned with industry requirements.

5. Chairman, DAC discussed about course structures proposed for 2026-27 admitted batch of B.Tech -CSE, B. Tech-CSE (PBL) and M.Tech – CSE programs.

a. As per the stakeholders feedback DAC members approved the inclusion of new and revision courses for 2026-27 admitted batch 2025-26 admitted batch B.Tech – CSE and B.Tech-CSE (PBL) Course Structure.

b. Discussed courses and their syllabus in all the categories of the proposed curriculum for Y26 and Y25 regulations of B.Tech-CSE and M.Tech-CSE.

6. DAC – Chairman, presented Program Development Documents (PDDs) of UG and PG programs offered by the department of CSE. DAC members approved and the same is forwarded to BoS for approval.

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7. Chairman – DAC, discussed on the introduction of new course Psychology for Engineers/ Media & Digital Literacy course under the HAS category to replace the Leadership and Management skills to fulfillment of the degree credits of Y23 regulation B.Tech-CSE. DAC members approved and the same is forwarded to BoS for approval.
8. Chairman – DAC, discussed about the proposal of placing the course titled 23AVI3405 – Intelligent Image Analysis in place of the existing course for the 2023-24 admitted batch of Professional elective course. DAC members approved and the same is forwarded to BoS for approval.
9. Chairman – DAC, discussed on result analysis of 2022-23 admitted batch B.Tech-CSE students.
10. Chairman – DAC, discussed on CO-PO attainments of 2022-23 admitted batch B.Tech-CSE students.

Category	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Direct PO attainment	2.72	2.68	2.72	2.79	2.86	2.92	2.85	2.92	2.89	2.97	2.89	3.00	2.66	2.77
Indirect PO attainment	2.27	2.24	2.42	2.29	2.19	2.23	2.17	2.29	2.31	2.32	2.39	2.30	2.38	2.44
Overall PO attainment for Y22 Regulation	2.63	2.59	2.66	2.69	2.72	2.78	2.71	2.79	2.78	2.84	2.79	2.86	2.61	2.70

11. Chairman - DAC discussed about progression of Placements, higher education & entrepreneurship statistics.

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CSE DEPARTMENT PLACEMENT STATISTICS for Y22 Regulation

- Highest CTC: ₹52.00 LPA
- Average CTC: ₹9.75 LPA
- Median CTC: ₹6.63 LPA
- Total students in department: 3310
- Students registered for placements: 2668
- Students with single offer: 1683
- Students with multiple offers: 640
- Note: Remaining students opted for higher studies (M.S, M.Tech, etc.)

Offer type

Offers		Count of offers
Single offers	1	1683
2 offers	2	503
3 offers	3	116
4 offers	4	21
Grand Total		2323

Company-wise Placement

Major recruiters: TCS, Altruist Technologies, LTIMindtree, Capgemini, CTS, Infosys, Skill High, etc...

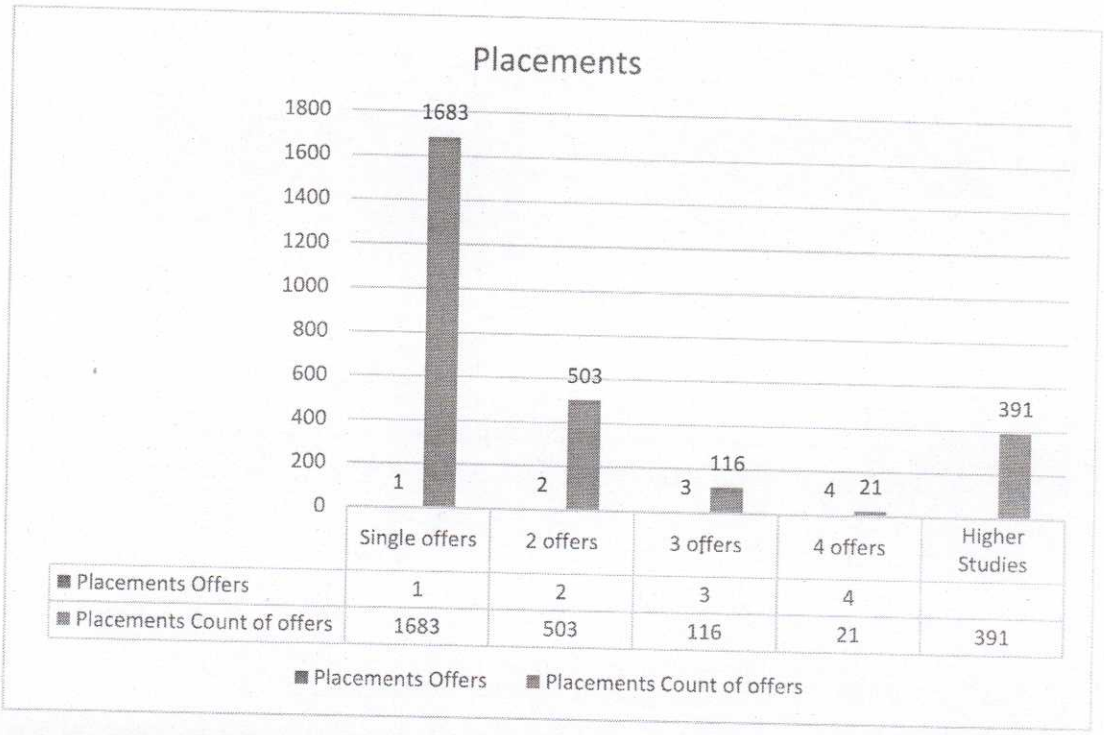
Sectors: IT Product, IT Services, Core Companies

High number of selections in product-based roles

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	Single offers	2 offers	3 offers	4 offers	Higher Studies
Placements Offers	1	2	3	4	
Placements Count of offers	1683	503	116	21	391

DAC Meeting Pictures:

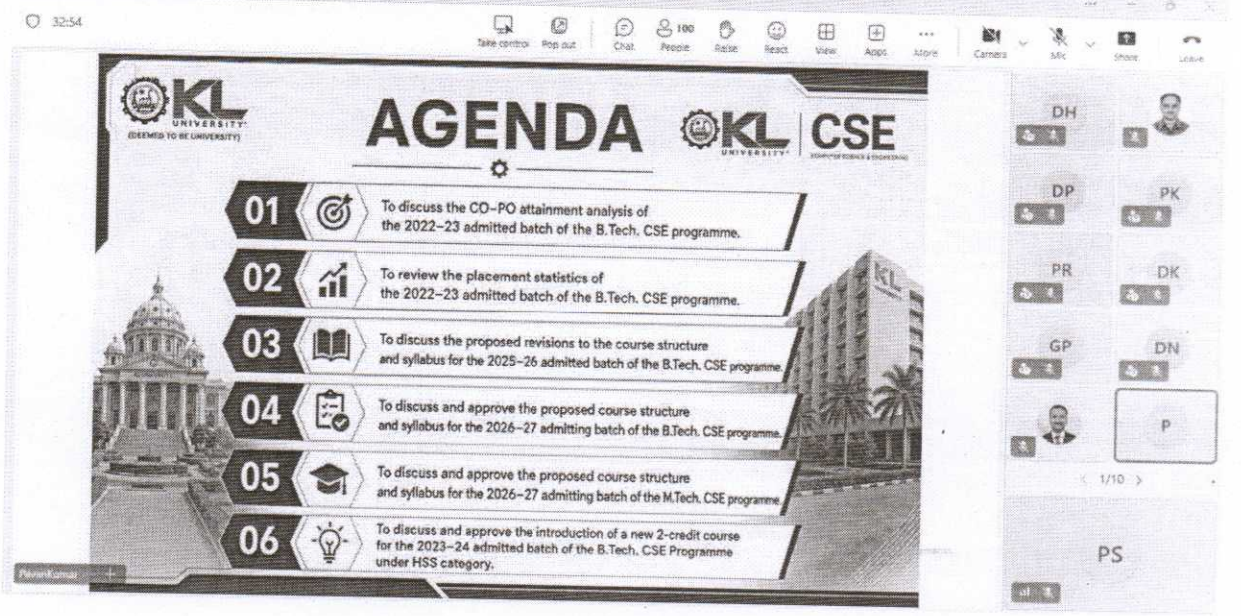


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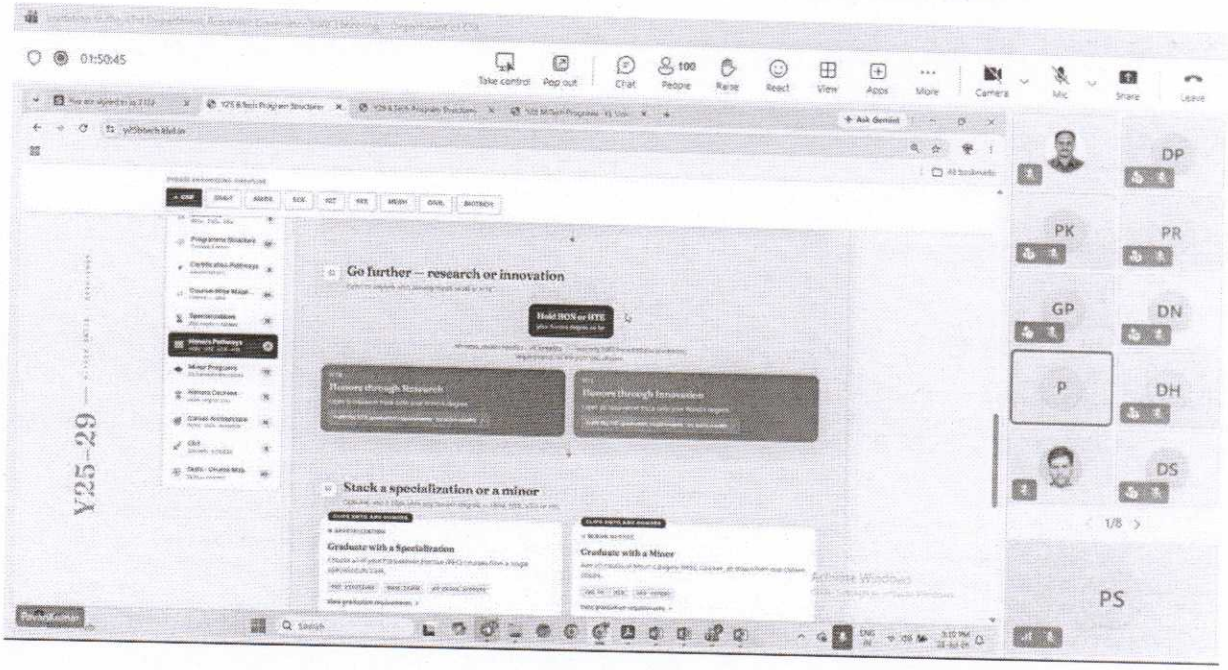


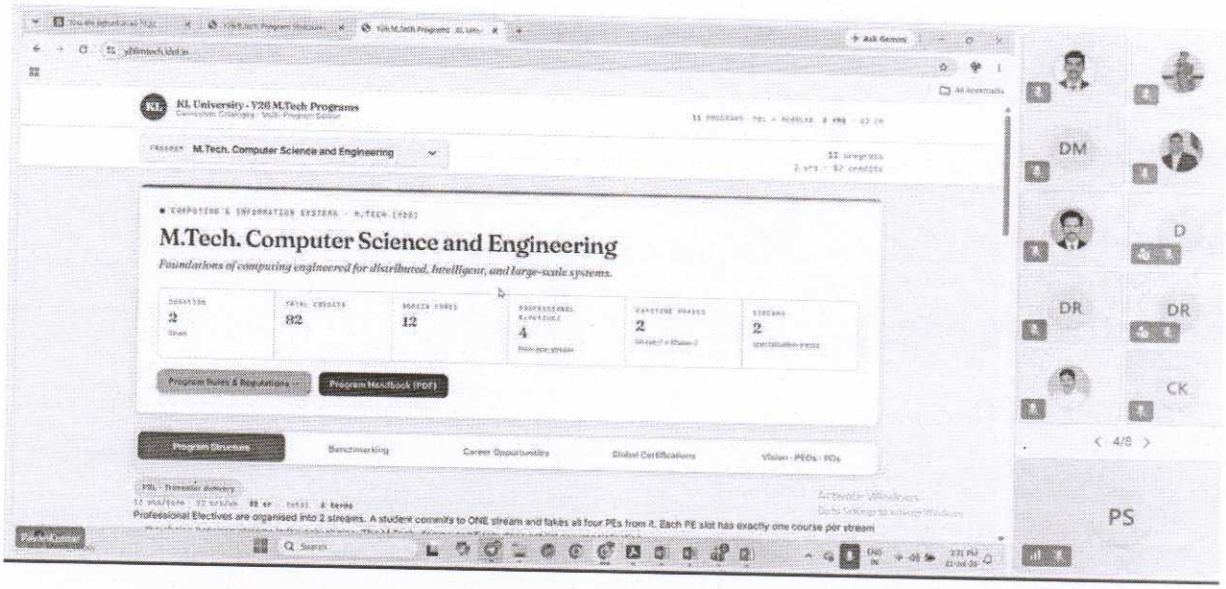


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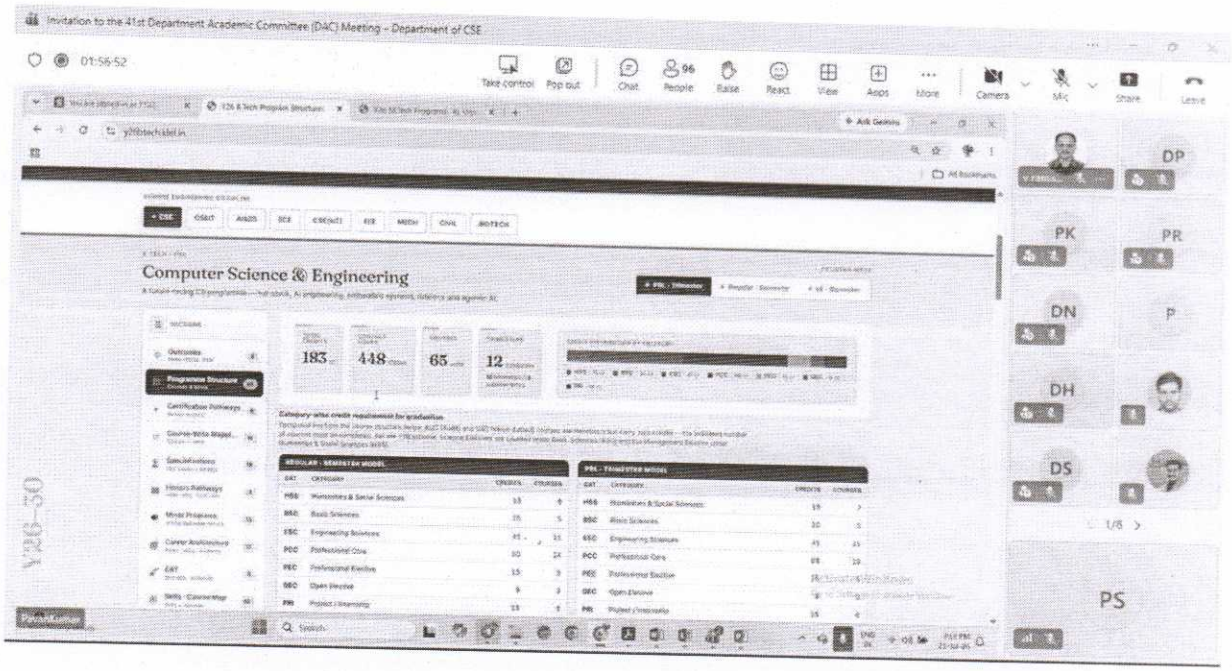




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Chairman DAC

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ANNEXURES

1. Stakeholders feedback on the existing curriculum is given in Annexure-1.
2. The detailed Course Structure proposed for 2026-27 admitting batch B.Tech-CSE and B.Tech-CSE (PBL) program is given in Annexure-2.
3. The detailed Course Structure proposed for 2026-27 admitting batch M.Tech-CSE program is given in Annexure-3.
4. The detailed syllabus for the list of proposed courses for 2026-27 admitting batch B.Tech-CSE is given in Annexure-4.
5. The detailed syllabus for the list of revised courses for 2026-27 admitting batch B.Tech - CSE is given in Annexure-5.
6. The detailed syllabus for the list of proposed courses for 2026-27 admitting batch M.Tech-CSE is given in Annexure-6.
7. The revised Course Structure for 2025-26 admitted batch B.Tech -CSE program is given in Annexure-7.
8. The Program Development Document (PDD) for B.Tech-Computer Science and Engineering is given in Annexure-8.
9. The Program Development Document (PDD) for M.Tech-Computer Science and Engineering is given in Annexure-9.

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Annexure-2

COURSE PROFILE 1: MATHEMATICS FOR COMPUTATION

Course Overview

- **Course Code:** 26MT1101 **Course Name:** Mathematics for Computation
- **L-T-P-S Structure:** 2-2-0-0 **Credits:** 4 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Apply propositional and predicate logic and construct rigorous mathematical proofs using standard proof techniques.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO2	Use set theory, relations and functions to model and reason about structured collections, equivalences, orderings and mappings.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO3	Apply combinatorial principles to count, arrange and bound discrete configurations.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO4	Apply number theory and modular arithmetic to reason about divisibility, primes, congruences and cryptography.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create
CO5	Model systems and networks with graphs and trees and reason about connectivity and traversal structure.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO6	Reason with algebraic and discrete structures that underpin digital logic, error-correcting codes, and cryptography.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Mathematical Logic & Proof Techniques	Propositions, logical connectives, truth tables. Tautologies, contradictions, contingencies. Logical equivalence and principal laws. Rules of inference and validity of arguments. Predicates and quantifiers. Normal forms (CNF, DNF). Methods of proof: direct, contraposition, contradiction, cases. Mathematical induction.
Module 2	Set Theory, Relations & Functions	Sets, subsets, power sets, set operations. Cartesian products, cardinality, inclusion-exclusion principle. Countable vs uncountable sets. Relations: definition, matrix/digraph representation, properties. Equivalence relations, partial

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		orders, Hasse diagrams, lattices. Functions: injective, surjective, bijective, composition. Pigeonhole principle.
Module 3	Combinatorics & Counting	Fundamental counting principles: sum and product rules. Permutations and combinations with/without repetition. Binomial theorem and coefficients. Generalised pigeonhole principle. Key-space sizing, birthday problem and collision counting. Recurrence relations.
Module 4	Number Theory & Cryptographic Foundations	Divisibility, division algorithm, GCD/LCM, Euclidean and Extended Euclidean algorithms. Primes, Fundamental Theorem of Arithmetic. Modular arithmetic: congruences, residue classes. Fermat's Little Theorem, Euler's theorem, Euler totient function. RSA derivation and correctness proof. Discrete logarithms, Diffie-Hellman key exchange.
Module 5	Graph Theory & Trees	Graphs: simple, multigraph, directed, weighted, degree, handshaking lemma. Representations: adjacency matrix/list. Walks, paths, cycles, connectivity. Euler and Hamiltonian paths/circuits. Shortest-path and minimum-spanning-tree properties. Planar graphs, graph colouring. Trees: rooted, binary, spanning trees, Cayley's formula.
Module 6	Algebraic & Discrete Structures	Boolean algebra: axioms, functions, identities, duality, Karnaugh-maps. Recurrence relations: homogeneous and non-homogeneous linear recurrences. Algebraic structures: semigroups, monoids, groups, subgroups, cyclic groups. Intro to rings and fields, finite fields GF(p), GF(2^n). Error-detecting/correcting codes, parity, Hamming distance.

Recommended Textbooks & Reference Literature

- *Discrete Mathematics and Its Applications*, Kenneth H. Rosen, McGraw-Hill, 2019 (8th ed.)
- *Discrete Mathematics with Applications*, Susanna S. Epp, Cengage, 2019 (5th ed.)
- *Concrete Mathematics: A Foundation for Computer Science*, Ronald Graham, Donald Knuth & Oren Patashnik, Addison-Wesley, 1994 (2nd ed.)
- *Elements of Discrete Mathematics*, C. L. Liu & D. P. Mohapatra, McGraw-Hill, 2017 (4th ed.)
- *An Introduction to the Theory of Numbers*, G. H. Hardy & E. M. Wright, Oxford University Press, 2008 (6th ed.)

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COURSE PROFILE 2: MATHEMATICS FOR AI

Course Overview

- **Course Code:** 26MT1202 **Course Name:** Mathematics for AI
- **L-T-P-S Structure:** 2-2-0-0 **Credits:** 4 **Prerequisite:** 26MT1101 (Mathematics for Computation)

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Represent and manipulate data and transformations with vectors and matrices, and reason geometrically about vector spaces.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL3. Apply
CO2	Apply eigen-analysis and matrix decompositions to understand variance and dimensionality structure in data.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO3	Use single- and multivariable calculus derivatives, gradients, and the chain rule to quantify changes.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL3. Apply
CO4	Formulate and solve optimization problems especially gradient-based minimisation of a loss.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create
CO5	Reason quantitatively under uncertainty using probability - random variables, distributions, and Bayes' theorem.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL3. Apply
CO6	Integrate linear algebra, calculus, optimization and probability to explain a simple learning algorithm.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Linear Algebra I: Vectors, Matrices & Linear Systems	Vectors in R^n, vector operations, linear combinations, dot product, norms, distance, cosine similarity. Matrices as data and transformations, matrix-matrix multiplication. Systems of linear equations, Gaussian elimination. Vector spaces, subspaces, span, linear independence, basis, rank, dimensionality. Orthogonality, projection.
Module 2	Linear Algebra II: Eigenvalues, Decompositions & AI Meaning	Eigenvalues and eigenvectors, computation and geometric meaning. Diagonalisation, symmetric matrices, quadratic forms, positive-definiteness. Singular Value Decomposition (SVD). Principal Component Analysis (PCA) mathematics: variance, covariance,

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		dimensionality reduction. Matrix factorisation foundations.
Module 3	Calculus for Learning: Derivatives, Gradients & Chain Rule	Limits, continuity, derivative as rate of change. Differentiation rules, single-variable chain rule. Multivariable functions, surfaces, partial derivatives, gradient vector. Multivariable chain rule for backpropagation. Jacobian and Hessian matrices. Taylor approximation. Integration essentials.
Module 4	Optimization: Minimising Loss & Training Models	Optimization framework for training models. Unconstrained optimization: critical points, gradients, Hessian, convexity. Gradient descent update rule, learning rate, convergence intuition. Stochastic Gradient Descent (SGD) and momentum awareness. Least squares optimization and normal equations. Constrained optimization and Lagrange multipliers.
Module 5	Probability: Reasoning Under Uncertainty	Sample spaces, events, conditional probability, independence. Law of total probability, Bayes' theorem. Random variables (discrete/continuous), PMF, PDF, CDF. Expectation, variance, standard deviation. Key distributions: Bernoulli, Binomial, Uniform, Gaussian/Normal, Poisson. Joint, marginal, conditional distributions; covariance, correlation. Law of Large Numbers, CLT.
Module 6	Putting It Together: The Mathematics of a Learning Algorithm	Data-to-model pipeline: data matrices -> function -> loss -> optimization -> trained model. Linear regression end-to-end: normal equations vs gradient descent. Logistic regression: sigmoid, cross-entropy loss, gradient descent. Single neuron and tiny neural network mathematics. Notation decoding in ML documentation.

Recommended Textbooks & Reference Literature

- *Mathematics for Machine Learning*, Marc Peter Deisenroth, A. Aldo Faisal & Cheng Soon Ong, Cambridge University Press, 2020
- *Introduction to Linear Algebra*, Gilbert Strang, Wellesley-Cambridge Press, 2023 (6th ed.)
- *Linear Algebra and Its Applications*, David A. Patterson & John L. Hennessy, Pearson, 2021 (6th ed.)
- *Calculus: Early Transcendentals*, James Stewart, Daniel Clegg & Saleem Watson, Cengage, 2020 (9th ed.)
- *A First Course in Probability*, Sheldon Ross, Pearson, 2019 (10th ed.)

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COURSE PROFILE 3: DIGITAL DESIGN & COMPUTER ARCHITECTURE

Course Overview

- **Course Code:** 26EC1202 **Course Name:** Digital Design & Computer Architecture
- **L-T-P-S Structure:** 2-0-0-4 **Credits:** 3 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Operate and explain a complete processor as a whole system - its instruction set (RISC-V) and fetch-decode-execute cycle.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO11	PSO1	BTL3. Apply
CO2	Build the single-cycle datapath and the control unit that decodes instructions.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create
CO3	Build the register file and the instruction/data memory the datapath uses.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create
CO4	Design and build sequential logic (latches, flip-flops, registers, counters, FSMs).	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create
CO5	Design and build combinational logic and the Arithmetic Logic Unit (ALU).	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create
CO6	Rebuild every layer from logic gates up and extend it with new instructions/peripherals.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	The Whole Computer: ISA, Programs & Datapath as Black Boxes	Stored-program model (von Neumann/Harvard); hardware vs software. Instruction Set Architecture (ISA) contract; RISC-V subset (add, sub, and, or, slt, addi, lw, sw, beq, jal). Data representation: binary, hex, two's-complement. Instruction formats and decoding. Fetch-decode-execute cycle. Datapath components overview.
Module 2	Opening the Architecture: Single-Cycle Datapath & Control Unit	Single-cycle datapath organisation: wiring PC, memories, register file, and ALU for single clock cycle execution. Instruction flow by class: arithmetic, load/store, branch/jump. Control unit combinational logic: truth tables and decoders mapping opcodes to signals. Multiplexers and routing paths. Branch/jump execution.
Module 3	Opening the Storage: Memory	Addressable storage concepts, address and data lines. Register file internals: reading two registers and writing

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	& the Register File	one per clock cycle via decoders/multiplexers. Instruction and data memory layouts. Memory hierarchy: registers, cache, main memory, storage. Speed-vs-size-vs-cost trade-offs. Von Neumann bottleneck.
Module 4	Opening State & Sequencing: Sequential Logic	Combinational limits and need for state feedback. Latches and flip-flops: SR latch, D latch, edge-triggered D flip-flop. Clock and synchronous design principles; setup/hold times. Multi-bit registers, counters, and Program Counter logic. Finite State Machines (FSMs): states, transitions, diagrams, and tables.
Module 5	Opening Computation: Combinational Logic & the ALU	Combinational logic principles. Minimisation using Karnaugh maps (K-maps). Arithmetic circuits: half/full adders, ripple-carry adders, carry propagation latency. Adder/subtractor design using two's complement. Decoders, encoders, multiplexers and comparators. ALU synthesis combining arithmetic and logical operations.
Module 6	The Bedrock & Machine Extension: Gates, Bits, Build & Future	Logic gates (AND, OR, NOT, NAND, NOR, XOR) truth tables and electrical logic levels. Boolean algebra laws and sum-of-products. Universality of NAND/NOR gates. Complete CPU integration top-to-bottom. Extending the ISA with custom instructions. Memory-mapped I/O peripherals. Pipelining, caching, and performance metrics.

Recommended Textbooks & Reference Literature

- *Digital Design and Computer Architecture: RISC-V Edition*, Sarah L. Harris & David Harris, Morgan Kaufmann, 2021
- *Computer Organization and Design: RISC-V Edition*, David A. Patterson & John L. Hennessy, Morgan Kaufmann, 2020 (2nd ed.)
- *Digital Design*, M. Morris Mano & Michael D. Ciletti, Pearson, 2018 (6th ed.)
- *Digital Fundamentals*, Thomas L. Floyd, Pearson, 2014 (11th ed.)
- *The RISC-V Reader: An Open Architecture Atlas*, David Patterson & Andrew Waterman, 2017

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COURSE PROFILE 4: FULL STACK DEVELOPMENT - FRONT END FRAMEWORKS

Course Overview

- **Course Code:** 26SC1204 **Course Name:** Full Stack Development - Front End Frameworks
- **L-T-P-S Structure:** 2-0-2-4 **Credits:** 4 **Prerequisite:** PSPJ

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Engineer semantic, accessible, well-structured HTML documents.	PO1, PO2, PO3, PO5, PO9, PO11	PSO1	BTL3. Apply
CO2	Engineer advanced, responsive and modern CSS layout systems.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL6. Create
CO3	Program interactive behaviour with JavaScript and TypeScript.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL6. Create
CO4	Build component-based, reactive interfaces with React and charting dashboards.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL6. Create
CO5	Build interfaces with Angular and explicitly compare it with React.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL6. Create
CO6	Work as a professional front-end engineer using AI-augmented workflows, Git, and testing.	PO1, PO2, PO3, PO5, PO8, PO9, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Web Foundations & Engineering-Grade Semantic HTML	Client-server architecture, HTTP/HTTPS protocols, URLs. Browser rendering pipeline: parsing, DOM/CSSOM, layout, paint. Semantic HTML markup elements (header, nav, main, section, etc.). Accessibility (a11y) guidelines, ARIA attributes, keyboard navigation. Forms validation, native inputs, and media element performance optimization.
Module 2	Advanced CSS & Responsive, Futuristic Design Engineering	CSS cascade, specificity, inheritance, box model. Modern layout grids: Flexbox and CSS Grid. Responsive design: mobile-first, media queries, fluid units (rem, em, clamp(), vh/vw). Custom properties, container queries, :has() selector. CSS architecture (BEM), utility-first styling (Tailwind CSS), transitions/animations.
Module 3	JavaScript & TypeScript: Language of	JS execution engine, types, scopes, closures. Modern ES6+: arrow functions, destructuring, spread/rest, ES modules. Array methods (map, filter, reduce). DOM APIs and event

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	Interactive Front Ends	handling/delegation. Asynchronous JS: promises, async/await, Fetch API. TypeScript syntax: static types, interfaces, type aliases, generics.
Module 4	Component-Based Architecture & React: Dynamic UIs & Dashboards	Component paradigm, declarative UI, virtual DOM, reconciliation. React hooks: useState, useEffect, useContext. Forms, lists, conditional rendering. Interactive components: modals, dropdowns, tabs, tables. Data Visualisation dashboards using charting engines (Recharts, Chart.js, D3 foundations); real-time streaming updates.
Module 5	Angular & the Framework-Agnostic Mindset	Angular architecture, TypeScript-first opinionated structure. Building blocks: components, templates, directives, pipes. Data binding: interpolation, property/event/two-way binding. Dependency Injection and Angular Services. Framework-agnostic comparison (React vs Angular data flow, lifecycle). Visual landscape overview: Svelte, Vue.
Module 6	Professional Front-End Engineering: Toolchains, Security & Deployment	Front-end tools (npm/pnpm, Vite). Engineering-grade Git/GitHub workflows. AI-assisted development (GitHub Copilot, agentic workflows with Claude Code). Testing suites (Vitest, React Testing Library, Playwright E2E). Browser security: OWASP themes, XSS mitigation, DOMPurify, Content Security Policy (CSP). CI/CD deployment (Vercel, Netlify).

Recommended Textbooks & Reference Literature

- *HTML and CSS: Design and Build Websites*, Jon Duckett, Wiley, 2014
- *CSS: The Definitive Guide*, Eric A. Meyer & Estelle Weyl, O'Reilly, 2023 (5th ed.)
- *Eloquent JavaScript*, Marijn Haverbeke, No Starch Press, 2024 (4th ed.)
- *Programming TypeScript*, Boris Cherny, O'Reilly, 2019
- *The Road to React*, Robin Wieruch, 2024

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COURSE PROFILE 5: COMPUTATIONAL FOUNDATIONS FOR AI

Course Overview

- **Course Code:** 26SC1306 **Course Name:** Computational Foundations for AI
- **L-T-P-S Structure:** 2-0-0-4 **Credits:** 3 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Write Python programs for data and AI, working fluently in modern notebook environments.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL3. Apply
CO2	Represent and manipulate data as arrays with NumPy and realise linear algebra computationally.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO3	Load, clean, transform and combine real-world tabular data with pandas.	PO1, PO2, PO3, PO4, PO5, PO9, PO11	PSO1	BTL4. Analyze
CO4	Explore and visualise data and compute its descriptive statistics via EDA.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO5	Implement the mathematics of learning in code (loss functions, gradient descent).	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create
CO6	Build, train and evaluate a first machine-learning model end-to-end pipeline.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	From Java to Python & the Computational Environment	Python as lingua franca for AI. Java bridge syntax, dynamic typing, code indentation. Core constructs: structures, lists, tuples, dictionaries, sets. Pythonic idioms: comprehensions, slicing, loops. Package ecosystem (pip, NumPy, pandas, matplotlib, scikit-learn). Jupyter Notebooks, Colab, reproducible Git pipelines.
Module 2	Data as Arrays: NumPy & the Math of AI in Code	NumPy ndarray structures, dimension array creation, slicing, boolean masking. Vectorisation vs loops. Array broadcasting. Linear algebra syntax mapping: vector dot products, matrix tensor operations. Aggregations,

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		random number generation seeds. Precision representation and floating point limits.
Module 3	Working with Real Data: pandas & Data Wrangling	pandas Series and DataFrame attributes. Loading heterogeneous formats (CSV, JSON). Selection, conditional filtering via loc/iloc. Missing data imputation pipelines, duplicates removal, structural type mapping. Table transformations, Groupby split-apply-combine paradigms. Merges, joins, tidy data reshaping.
Module 4	Seeing the Data: Visualisation & Exploratory Data Analysis	Exploratory Data Analysis (EDA) core tenets. Custom plotting with matplotlib (figure/axes canvas mapping). Statistical visualizations with seaborn (histograms, boxplots, pairplots). Descriptive statistics coding. Skewness, variance, outliers. Multivariate correlation tracking vs causality fallacies.
Module 5	The Math of Learning: Probability, Statistics & Optimisation in Code	Probability simulation, statistical estimators. Loss/cost formulations: Mean Squared Error (MSE). Optimization computations: gradients tracking, numerical derivatives. Manual update rules for Gradient Descent. Tracking convergence curves. Computational mapping of loss minimization routines.
Module 6	A First Learning Machine: Pipeline & AI Frontier	Feature matrix arrays creation, target vector separation. Train/validation/test split evaluation boundaries. Manual scratch linear regression vs scikit-learn pipeline interfaces. Evaluation metrics tracking (RMSE, classification accuracy indices). Overfitting diagnostic tracking. Responsible AI bias tracking.

Recommended Textbooks & Reference Literature

- *Python for Data Analysis*, Wes McKinney, O'Reilly, 2022 (3rd ed.)
- *Python Data Science Handbook*, Jake VanderPlas, O'Reilly, 2023 (2nd ed.)
- *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow*, Aurélien Géron, O'Reilly, 2022
- *Mathematics for Machine Learning*, Marc Peter Deisenroth et al., Cambridge Press, 2020
- *Automate the Boring Stuff with Python*, Al Sweigart, No Starch Press, 2019

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COURSE PROFILE 6: DATA STRUCTURES & ALGORITHMS - 1

Course Overview

- **Course Code:** 26SC1203 **Course Name:** Data Structures & Algorithms - 1
- **L-T-P-S Structure:** 2-0-0-4 **Credits:** 3 **Prerequisite:** PSPJ

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse time/space complexity of algorithms with Big-O and optimize solutions.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO2	Think and solve recursively, reasoning about base/recursive cases and the call stack.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL4. Analyze
CO3	Recognise and apply core array/string problem patterns (two-pointers, sliding window, prefix sums).	PO1, PO2, PO3, PO5, PO11	PSO1	BTL6. Create
CO4	Apply binary search on sorted data and binary-search-on-the-answer techniques.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL4. Analyze
CO5	Implement and analyse elementary and efficient sorting algorithms (mergesort, quicksort).	PO1, PO2, PO3, PO5, PO11	PSO1	BTL4. Analyze
CO6	Implement linear data structures (linked lists, stacks, queues) and monotonic patterns.	PO1, PO2, PO3, PO5, PO8, PO9, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Complexity & Algorithmic Thinking	Algorithm attributes: correctness and resource efficiency. Asymptotic notation boundaries: Big-O, Big-Omega, Theta scaling. Dominant complexity classes: O(1), O(log n), O(n), O(n log n), O(n^2), O(2^n). Auxiliary space tracking. Worst, average, best case scenarios. Feasibility boundaries based on constraint limits.
Module 2	Recursion & Recursive Thinking	Recursion core definitions: base condition vs recurrence steps. Call stack trace analysis, frame footprint overheads. Design mechanics: smaller sub-problem delegation. Mathematical sequences, string transformations, subset/permutation generation. Iteration conversions. Head vs tail recursion structures.

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Module 3	Arrays, Strings & Core Patterns	Contiguous data allocation, random access costs. Dynamic arrays sizing overheads. Two-pointer strategies: opposite ends, convergence tracking. Sliding window architectures: fixed length vs variable dynamic criteria. Prefix sum maps: array range accumulator processing. String pattern tracking mechanics.
Module 4	Searching & Binary Search	Linear scanning limits. Binary search mechanics over monotonic arrays: invariant checking, boundary state logic. Search variants: lower bound, upper bound tracking, rotation index handling. Binary-search-on-the-answer pattern: feasibility validation across solution search fields.
Module 5	Sorting (and a First Taste of Divide & Conquer)	Elementary sorts: bubble, insertion, selection criteria. Divide and conquer paradigm integration: recursive partitioning. Mergesort: stable sorting, external mapping. Quicksort: pivot selection strategies, worst-case handling. Lower bounds criteria. Library sorting structures validation.
Module 6	Linked Lists, Stacks & Queues (+ Their Patterns)	Linear list structures: singly, doubly, circular node wiring; operations trade-offs. Fast-slow pointer cycles checking. Stacks: LIFO configurations, balance evaluations. Monotonic stack structures. Queues: FIFO mechanisms, circular layouts. Monotonic deque sliding range lookups.

Recommended Textbooks & Reference Literature

- *Introduction to Algorithms*, Cormen, Leiserson, Rivest & Stein, MIT Press, 2022 (4th ed.)
- *Grokking Algorithms*, Aditya Bhargava, Manning, 2024 (2nd ed.)
- *Data Structures and Algorithms in Java*, Michael T. Goodrich et al., Wiley, 2014
- *Elements of Programming Interviews*, Aziz, Lee & Prakash, 2018
- *Data Structures and Algorithms Made Easy*, Narasimha Karumanchi, CareerMonk, 2016

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COURSE PROFILE 7: FULL STACK DEVELOPMENT - DATABASE SYSTEMS & BACK END ENGINEERING

Course Overview

- **Course Code:** 26SC1307 **Course Name:** Full Stack Development - Database Systems & Back End Engineering
- **L-T-P-S Structure:** 2-0-2-4 **Credits:** 4 **Prerequisite:** PSPJ

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Engineer relational databases - advanced data modelling, normalisation, and index tuning.	PO1, PO2, PO3, PO5	PSO1	BTL6. Create
CO2	Engineer NoSQL data stores and make polyglot-persistence decisions via CAP theorem.	PO1, PO2, PO3, PO5	PSO1	BTL5. Evaluate
CO3	Build backend services and REST APIs across Spring Boot, Node/Express, and FastAPI.	PO1, PO2, PO3, PO5	PSO1	BTL6. Create
CO4	Design APIs and integration patterns at depth (contracts, gateways, inter-service sync/async).	PO1, PO2, PO3, PO5	PSO1	BTL6. Create
CO5	Design and build a microservices architecture based on SOA principles.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL6. Create
CO6	Test and secure the backend (OAuth2/JWT, OWASP) and deliver enterprise systems.	PO1, PO2, PO3, PO5, PO7, PO8, PO9, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Relational Database Engineering (SQL Systems)	Advanced entity-relationship modelling, data integrity. Normalization algorithms (1NF, 2NF, 3NF, BCNF) and performance denormalization trade-offs. Complex SQL syntax: nested queries, CTEs, window analytics. Transaction processing, ACID criteria, isolation locks. B-Tree/Hash indexes, execution planner tuning. PostgreSQL engine.
Module 2	NoSQL Database Engineering	Distributed storage motivations, data shape variations. Document stores (MongoDB): hierarchical sub-document embedding vs link referencing, aggregate processing pipelines. Key-value caches (Redis): eviction patterns

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		(LRU), session persistence. Columnar, graph models introduction. CAP theorem metrics, final consistency balances.
Module 3	Backend Development: Spring Boot, Express & FastAPI	Transcendent backend mechanics: request lifecycle tracking, routers, interceptors, dependency injection models. Spring Boot (Java): enterprise persistence with JPA/Hibernate. Node.js (Express): event driven JS runtimes. FastAPI (Python): asynchronous type safe code. ORM/ODM engine bindings. REST design blueprints.
Module 4	APIs, Integration & Service Communication	Advanced API tracking: resource patterns, version schemes, state transitions. Contract assertions via OpenAPI/Swagger specs. API Gateways patterns. Synchronous invocations (REST, gRPC wrappers). Asynchronous event logging: brokers (RabbitMQ, Apache Kafka core tracks). Idempotency safeguards, backoff retry limits.
Module 5	Microservices & Service-Oriented Architecture (SOA)	Monolithic breakdowns vs SOA service bounds. Domain-driven design contexts. Inter-service discovery mechanics. Application containment via Docker packaging; container orchestration ecosystem (Kubernetes track). Distributed data access balances: database per service, Saga flow coordination patterns.
Module 6	Testing, Security & Enterprise Application Lifecycle	Testing hierarchies: mock unit isolates, container database integration checks, contract validations, wiremock flows. Security tokens tracks: OAuth2 delegation, signed JWT profiles, encryption fields. Defensive coding: OWASP API Top 10 shields. Distributed microservices observability logs tracing pipelines.

Recommended Textbooks & Reference Literature

- *Designing Data-Intensive Applications*, Martin Kleppmann, O'Reilly, 2017
- *Database System Concepts*, Silberschatz, Korth & Sudarshan, McGraw-Hill, 2019
- *Building Microservices*, Sam Newman, O'Reilly, 2021 (2nd ed.)
- *Spring in Action / Node.js Design Patterns / FastAPI Official Documentation*, 2020-2023
- *Web API Design / Web Security for Developers*, 2017-2020

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COURSE PROFILE 8: MACHINE LEARNING

Course Overview

- **Course Code:** 26SC2110 **Course Name:** Machine Learning
- **L-T-P-S Structure:** 2-0-4-0 **Credits:** 4 **Prerequisite:** 26SC1306 (Computational Foundations for AI)

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyze the end-to-end ML system lifecycle from data ingestion to monitoring.	PO1, PO2, PO3, PO4, PO5	PSO1	BTL4. Analyze
CO2	Apply linear supervised-learning models and reason about regularisation.	PO1, PO2, PO3, PO4, PO5	PSO1	BTL3. Apply
CO3	Apply tree-based supervised-learning models and reason about feature importance.	PO1, PO3	PSO1	BTL3. Apply
CO4	Apply unsupervised-learning techniques to discover structure in unlabelled data.	PO1, PO2	PSO1	BTL3. Apply
CO5	Analyze model performance using validation metrics and hyperparameter search.	PO1, PO2, PO4	PSO1	BTL4. Analyze
CO6	Apply ML-engineering practices to deploy a production-style ML system.	PO1, PO3, PO5	PSO1	BTL3. Apply

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Placement Predict as a System - The ML Lifecycle	System execution profiles. Core production loops: ingestion pipelines -> validation modules -> extraction weights -> serving registry trackers -> performance drifting validations. Supervised vs unsupervised split. Training serving boundaries, skew errors. FastAPI microservice inference tracking code bases.
Module 2	Supervised Learning - Linear Models at Depth	Linear regression matrix paths, gradient convergence tracking. Penalty formulations: Ridge L2, Lasso L1, ElasticNet balance bounds. Sparsity geometries. Binary classification logs: logistic sigmoid matrices, Cross Entropy loss bounds, multi-class Softmax layers. Feature scalers. Categorical encoding transforms.

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Module 3	Supervised Learning - Tree-Based Models	Decision tree paths: recursive partitioning nodes, impurities tracking (Gini, Information Entropy, MSE bounds). Overfit restriction: complexity pruners. Ensemble variants: Bagging tracks, Random Forest space selectors, Out of Bag validations. Boosting loops: Gradient Boosting steps, industrial engines (XGBoost, LightGBM). SHAP evaluation mappings.
Module 4	Unsupervised Learning	Centroid search tracking: Lloyd iterations k-means, clustering initializers k-means++. Silhouette score indices. Hierarchical clustering tracks. Density maps clustering: DBSCAN core points tracking. Visualizers pipelines: t-SNE bounds, UMAP embeddings tracking. Anomaly searchers: Isolation Forest, autoencoders preview paths.
Module 5	Model Evaluation, Selection, and Calibration	Validation discipline: cross validation splitting frameworks, Stratified k-fold folds, Nested CV loops. Metrics evaluations: Confusion matrices tracking, Precision-Recall AUC tracking, F1 scores balancing. Calibration mappings: Platt scaling equations, Isotonic regressions, reliability tracking charts. Hyperparameter searches.
Module 6	ML Engineering From Notebook to Production	Production code translation protocols. Operational feature stores (Feast blueprints). Package compilers: pickle risk frameworks, portable ONNX targets, containment packaging via Docker. Serving engines: FastAPI endpoints design, gRPC performance routes. Production drift monitoring indices: data/concept drift tracking.

Recommended Textbooks & Reference Literature

- *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, Aurélien Géron, O'Reilly, 2022
- *The Elements of Statistical Learning*, Trevor Hastie et al., Springer, 2017
- *An Introduction to Statistical Learning - with Applications in Python*, Gareth James et al., Springer, 2023
- *Pattern Recognition and Machine Learning*, Christopher M. Bishop, Springer, 2006
- *Designing Machine Learning Systems*, Chip Huyen, O'Reilly, 2022

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COURSE PROFILE 9: DATA STRUCTURES & ALGORITHMS - 2

Course Overview

- **Course Code:** 26SC1305 **Course Name:** Data Structures & Algorithms - 2
- **L-T-P-S Structure:** 2-0-2-4 **Credits:** 4 **Prerequisite:** 26SC1203 (DSA-1)

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Implement and traverse trees and binary search trees, using recursive patterns.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL4. Analyze
CO2	Implement self-balancing trees and heaps to apply prioritization patterns.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL4. Analyze
CO3	Implement hash tables and tries to solve dictionary/prefix matching problems.	PO1, PO2, PO3, PO5, PO11	PSO1	BTL6. Create
CO4	Represent graphs and traverse them with BFS and DFS modelling patterns.	PO1, PO2, PO3, PO4, PO5	PSO1	BTL4. Analyze
CO5	Apply weighted graph algorithms using greedy-on-graphs approaches.	PO1, PO2, PO3, PO4, PO5	PSO1	BTL6. Create
CO6	Choose and combine data structures to build a highly optimized problem engine.	PO1, PO2, PO3, PO5, PO8, PO9, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Trees & Binary Search Trees	Hierarchical data modeling vs linear arrays constraints. Structural attributes: height metrics, depth nodes. Binary tree specifications, linkage configurations. Systematic traversals: pre-order, in-order, post-order recursive traces, iterative frame lookups. BST ordering traits: searching bounds, node deletions. Balancing motivations.
Module 2	Balanced Trees & Heaps (Priority Queues) + Their Patterns	Balance invariants. AVL trees: tracking factor balances, structural pivot adjustments. Red-Black trees preview paths. Heaps architectures: structural max/min-heap traits, sequential array indices formula. Heapify construction loops. Patterns: sliding top-k filters, k-way stream mergers, running median double heap lookups.

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Module 3	Hashing & Tries: The Dictionary Problem (+ Patterns)	Instant indexing tracking: direct hash design, collision resolutions (chain link lists, open addressing steps). Resizing bounds. Lookup maps patterns: frequency tracking, target complement searches, deduplications. Prefix tree tries: string search maps, autocomplete indices. High speed LRU cache architectures configuration.
Module 4	Graphs: Modelling & Traversal (+ Patterns)	Network node relationship tracking matrices. Structural configurations: adjacency lists vs spatial matrices performance. Traversal queues: BFS layer traversals, unweighted short track indexing. Recursive stacks: DFS discovery path markings. Grid mapping patterns, flood fill component isolations. Topological sorting paths.
Module 5	Weighted Graphs & Greedy-on-Graphs	Weighted path metrics. Optimized shortest route configurations: Dijkstra priority queue trackers, negative limit processing boundaries (Bellman-Ford paths). Minimum Spanning Tree maps: Prim's matrix searches, Kruskal's edge sorts via Union-Find tracking. Disjoint set path compressions. Greedy structural proofs.
Module 6	Choosing & Combining Structures + the Bridge to the Paradigms	Synthesis lookup charts. Operational performance selection matrices. Multi-structure bindings: tracking entries via compound containers. Pattern handbook completions. Transition avenues to Algorithm Design Paradigms: Divide & Conquer, Greedy setups, Dynamic Programming induction foundations, Backtracking tracks.

Recommended Textbooks & Reference Literature

- *Introduction to Algorithms*, Cormen, Leiserson, Rivest & Stein, MIT Press, 2022
- *Data Structures and Algorithms in Java*, Michael T. Goodrich et al., Wiley, 2014
- *Algorithms*, Robert Sedgewick & Kevin Wayne, Addison-Wesley, 2011
- *Elements of Programming Interviews / Cracking the Coding Interview*, 2018-2020
- *Data Structures and Algorithms Made Easy*, Narasimha Karumanchi, CareerMonk, 2016

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COURSE PROFILE 10: DATA STRUCTURES & ALGORITHMS - 3

Course Overview

- **Course Code:** 26SC2109 **Course Name:** Data Structures & Algorithms - 3
- **L-T-P-S Structure:** 2-0-2-4 **Credits:** 4 **Prerequisite:** 26SC1305 (DSA-2)

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Design and analyse divide-and-conquer algorithms and solve recurrences.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL4. Analyze
CO2	Design greedy algorithms and prove correctness with exchange arguments.	PO1, PO2, PO3, PO4, PO11	PSO1	BTL5. Evaluate
CO3	Design dynamic-programming algorithms using state transitions and memoisation.	PO1, PO2, PO3, PO4, PO5, PO11	PSO1	BTL6. Create
CO4	Design advanced dynamic-programming (interval, tree, bitmask) and backtracking search.	PO1, PO2, PO3, PO4, PO11	PSO1	BTL6. Create
CO5	Apply advanced range data structures and deep string matching algorithms.	PO1, PO2, PO3, PO11	PSO1	BTL6. Create
CO6	Apply advanced graph network flow tracks and reason about NP-completeness.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO11	PSO1	BTL6. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Divide & Conquer Paradigm	Formal framework design: partitioning loops, recursion execution maps, combination routines. Master Theorem bounds evaluation: tracking case rules, asymptotic constraints. Computational variants: Closest pair search indices, max sub-array D&C matrices. Karatsuba fast numerical multiplication pipelines. Order stats tracks.
Module 2	Greedy Algorithms (and Proving Them Correct)	Greedy strategy tenets: local parameter optimization without correction phases. Classical optimization models: interval item scheduling, fractional packing weights. Compression lookups: Huffman prefix tree constructs. Rigorous proof frameworks: exchange arguments, greedy-stays-ahead models. Structural flaws tracking.

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Module 3	Dynamic Programming I: Foundations	Induction paradigms: overlapping state definitions, optimal parameter sub-problems traits. The DP design sequence: state index tracking, choice transition equations, base limits enforcement. Top-down memo mappings vs bottom-up grid tables. Classical models: longest increasing sub-sequence, Knapsack arrays, Edit distance text grids.
Module 4	Dynamic Programming II & Backtracking	Advanced state parameters tracking. Split interval models: matrix chain product chains. Tree constraints DP: bottom-up node valuations tracking. Combinatorial space optimization: Bitmask subset flags tracking, TSP grids. Digit DP preview tracks. Backtracking pruning steps: search trees depth reduction, constraint checkers.
Module 5	Advanced Range & String Structures	Spatial array sub-range lookups. Segment Tree architectures: interval splitting nodes, lazy update propagation arrays. Fenwick Binary Indexed Trees (BIT) index track masks. Deep string matching protocols: Knuth-Morris-Pratt (KMP) failure tracking lookups, Suffix tree arrays, Aho-Corasick automation filters.
Module 6	Advanced Graphs & Algorithmic Frontier	Flow network systems: Ford-Fulkerson augment tracks, Edmonds-Karp min capacities cuts, max-flow min-cut bounds. Graph connectivity isolates: strongly connected components loops (Tarjan, Kosaraju paths). Intractability boundaries: P, NP spaces, NP-Complete reduction logic, Approximation heuristics.

Recommended Textbooks & Reference Literature

- *Introduction to Algorithms*, Cormen, Leiserson, Rivest & Stein, MIT Press, 2022 (4th ed.)
- *Algorithm Design*, Jon Kleinberg & Éva Tardos, Pearson, 2013
- *Algorithms*, Sanjoy Dasgupta, Christos Papadimitriou & Umesh Vazirani, McGraw-Hill, 2006
- *Competitive Programming 4*, Steven Halim et al., 2020
- *The Algorithm Design Manual*, Steven S. Skiena, Springer, 2020 (3rd ed.)

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COURSE PROFILE 11: OPERATING SYSTEMS & SYSTEMS PROGRAMMING

Course Overview

- **Course Code:** 26CS2101 **Course Name:** Operating Systems & Systems Programming
- **L-T-P-S Structure:** 2-0-4-0 **Credits:** 4 **Prerequisite:** DSA1

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyze the operating system as a layered service abstraction kernel mode vs user mode, the syscall interface, the role of the shell as a user-space program and trace a simple command from typing it to its completion.	PO1, PO2	None	BTL4
CO2	Apply Unix process-control primitives - fork, exec, wait, exit to write systems-programming code in C that creates, controls, and reaps child processes correctly.	PO1, PO3, PO5	PSO1	BTL3
CO3	Apply inter-process communication mechanisms anonymous pipes, named pipes (FIFOS), Unix domain sockets, signals, and shared memory - to design simple multi-process applications.	PO1, PO3	PSO1	BTL3
CO4	Analyze virtual memory - paging, address translation, the TLB, page faults, demand paging, copy-on-write and explain at the system level what happens when a process accesses memory.	PO1, PO2	None	BTL4
CO5	Analyze file-system abstractions - inodes, directory entries, the virtual file system layer, mount points, read/write/seek semantics and use the file-I/O syscalls to read and write structured data robustly.	PO1, PO3	PSO1	BTL4
CO6	Apply concurrency primitives POSIX threads, mutexes, condition variables, counting semaphores to write correct concurrent C programs and reason about race conditions, deadlocks, and starvation.	PO1, PO3, PO4	PSO1	BTL3

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	The OS as a Service Layer	A working shell running on day one. The kernel/user-space split: privileged mode vs unprivileged mode. The syscall as

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		the only legitimate way for a user program to ask the kernel for service. Tracing a command end-to-end with strace. Linux as the working example: kernel architecture overview (monolithic with modules), the role of glibc as the user-space syscall wrapper. Reading and writing C systems code: the man-pages discipline, the errno convention, return-value checking.
Module 2	Processes and Process Control	The process abstraction: PCB contents (PID, PPID, state, registers, page table, file descriptors, working directory). Process lifecycle: created, running, blocked, terminated, zombie. fork(): the duplicate-then-diverge model. exec() family: replacing the current process image. wait() and waitpid(): reaping zombies; the SIGCHLD signal as the alternative. exit() and _exit(). Process scheduling: CFS in Linux, time slices, priorities, nice values. Common pitfalls: fork bombs.
Module 3	Inter-Process Communication	Anonymous pipes: pipe() syscall, the read-end and write-end file descriptors, dup2(). Named pipes (FIFOs): mkfifo(), persistence in the filesystem. Signals: the asynchronous notification mechanism; common signals (SIGINT, SIGTERM, SIGCHLD, SIGSEGV, SIGPIPE). Signal handlers: writing them safely, sigaction() API. Process groups and sessions. Unix domain sockets. Shared memory and semaphores: mmap() with MAP_SHARED.
Module 4	Memory Management	The virtual-memory illusion: kernel maintains page tables. Address translation: virtual physical via page tables; the TLB as a cache. Page faults: minor and major page faults; demand-paging strategy. The Linux process address-space layout: text, data, BSS, heap, mmap region, stack, kernel. malloc() and free() as user-space wrappers around brk()/sbrk() and mmap(). Common bugs: segmentation faults. Copy-on-write at fork(). Valgrind and AddressSanitizer.
Module 5	File Systems	The 'everything is a file' Unix abstraction: regular files, directories, devices, sockets, FIFOs, symbolic links. Inodes vs directory entries; hard links and symlinks. Virtual File System (VFS) layer. File descriptors and the open file table. open(), read(), write(), lseek(), close() canonical file-I/O syscalls. Buffered vs unbuffered I/O. Memory-mapped I/O via mmap(). A glimpse at filesystem implementation: ext4 layout.
Module 6	Concurrency Primitives	Threads vs processes: shared address space, separate stacks. POSIX threads: pthread_create, pthread_join, pthread_exit. Race conditions. Mutual exclusion: pthread_mutex_t; lock/unlock discipline. Condition

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		variables: pthread_cond_t; wait/signal/broadcast; 'wait inside a loop' idiom. Counting semaphores: sem_t; use in producer-consumer patterns. Deadlock: the four conditions, lock ordering defense. Higher-level constructs.

Recommended Textbooks & Reference Literature

- *Operating System Concepts*, Abraham Silberschatz, Peter Baer Galvin & Greg Gagne, Wiley, 2018 (10th Ed.)
- *Operating Systems: Three Easy Pieces*, Remzi H. Arpaci-Dusseau & Andrea C. Arpaci-Dusseau, Free PDF Wisconsin, 2023 (1.10 Ed.)
- *Modern Operating Systems*, Andrew S. Tanenbaum & Herbert Bos, Pearson, 2022 (5th Ed.)
- *Advanced Programming in the UNIX Environment*, W. Richard Stevens & Stephen A. Rago, Addison-Wesley, 2013 (3rd Ed.)
- *The Linux Programming Interface - A Linux and UNIX System Programming Handbook*, Michael Kerrisk, No Starch Press, 2010
- *Computer Systems: A Programmer's Perspective*, Randal E. Bryant & David R. O'Hallaron, Pearson, 2015 (3rd Ed.)
- **Web Resource:** https://y26btech.klef.in

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COURSE PROFILE 12: SYSTEM DESIGN FOR SCALABILITY & RELIABILITY

Course Overview

- **Course Code:** 26CS2305 **Course Name:** System Design for Scalability & Reliability
- **L-T-P-S Structure:** 2-0-4-0 **Credits:** 4 **Prerequisite:** OSYS

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Evaluate distributed-system requirements (scale, latency, consistency, availability, durability, cost) and design a layered architecture that meets them, with explicit trade-offs and rejected alternatives.	PO1, PO2, PO3, PO4	PSO1	BTL5
CO2	Apply scalability patterns - horizontal scaling, load balancing, partitioning by key, sharding strategies, caching tiers (CDN, application cache, database cache), read replicas, asynchronous fan-out - to design systems that scale predictably.	PO1, PO3	PSO1	BTL3
CO3	Analyze the consistency-availability-partition-tolerance trade-off (CAP, PACELC), consensus algorithms (Paxos, Raft at intuition level), quorum-based replication, eventual consistency, and CRDTs and choose appropriate guarantees per workload.	PO1, PO2, PO4	PSO1	BTL4
CO4	Apply reliability-engineering patterns - timeouts, retries with jitter, circuit breakers, bulkheads, rate limiting, graceful degradation, the failure-mode analysis discipline - to design systems that survive partial failures.	PO1, PO3, PO4	PSO1	BTL3
CO5	Analyze capacity and performance-back-of-the-envelope estimation, queueing theory at intuition level (Little's law, utilisation), load testing methodology, bottleneck identification - to plan for projected scale and to verify the plan empirically.	PO1, PO2, PO4	None	BTL4
CO6	Apply chaos engineering - hypothesis-driven fault injection, game-day exercises, the steady-state verification ritual, blast-radius scoping - to verify a system's resilience claims empirically rather than aspirationally.	PO1, PO3, PO4, PO9	PSO1	BTL3

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	The Distributed System as a System	A working multi-region GlobePost running on day one. The canonical distributed-system stack: clients -> DNS / GeoDNS -> CDN -> load balancer -> application fleet -> caches -> primary stores -> async fanout -> analytics. The eight fallacies of distributed computing. Latency math: speed of light, intercontinental round-trip, intra-DC vs inter-DC vs cross-region. System-design interviews: requirements clarification, capacity estimation, high-level design, deep dive, bottlenecks.
Module 2	Scalability Patterns	Horizontal vs vertical scaling: appropriateness and cost curves. Statelessness as the prerequisite: pushing all state to dedicated stores. Load balancing: L4 vs L7, sticky sessions vs stateless, health-checked target pools. Partitioning data: by key range, by hash, by directory; resharding minimization. Sharding strategies: consistent hashing, virtual-nodes. Caching tiers: CDN at edge, application cache, database cache; cache-aside vs read-through vs write-through. Cache pitfalls: stampedes, thundering herd. Asynchronous fan-out.
Module 3	Consistency and Coordination	The CAP theorem and common misreadings; PACELC framing. Strong consistency primitives: linearisability, sequential consistency. Weaker consistency primitives: causal, read-your-writes, monotonic. Quorum-based replication: R+W>N; DynamoDB-style quorum reads/writes. Consensus algorithms: Paxos, Raft; leader election; log replication. CRDTs (Conflict-free Replicated Data Types) intuition. Distributed transactions and two-phase commit vs the Saga pattern. DynamoDB vs Spanner.
Module 4	Reliability Engineering	Failure-mode analysis: host crash, network partition, disk full, OOM, slow consumer, deployment regression. Timeouts: timeout budget propagation down the call tree. Retries with exponential backoff and jitter: avoiding synchronized-retry stampedes; AWS guidance on full jitter. Circuit breakers: closed/open/half-open. Bulkheads: isolating critical traffic; thread-pool partitioning. Rate limiting: token bucket vs leaky bucket vs fixed window. Graceful degradation. Idempotency.
Module 5	Capacity Planning and Performance	Back-of-the-envelope estimation: powers-of-two as the mental currency; canonical Jeff-Dean numbers. QPS estimation, storage estimation, bandwidth estimation; peak-vs-average ratios. Little's law: L = lambda * W reasoning. Utilisation and the queueing tax: M/M/1 result intuition. Load testing methodology: open vs closed model. Profiling production: continuous profiling (pprof / async-profiler), flame graphs. Tail latency: p99 vs p99.9.

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Module 6	Chaos Engineering and Game Days	Why chaos engineering: Netflix discipline of breaking things on purpose. The chaos-engineering hypothesis: 'in steady state X, when fault Y is injected, the system continues to satisfy SLO Z'. Fault categories: instance termination, dependency failure, network partition, latency injection, packet loss, clock skew, disk-full simulation. Tooling: Chaos Mesh, Gremlin, AWS Fault Injection Service. Blast radius management. Game days protocol.

Recommended Textbooks & Reference Literature

- *Designing Data-Intensive Applications*, Martin Kleppmann, O'Reilly, 2017
- *Site Reliability Engineering - How Google Runs Production Systems*, Betsy Beyer, Chris Jones, Jennifer Petoff & Niall Richard Murphy (eds.), O'Reilly / Google, 2016
- *Release It! - Design and Deploy Production-Ready Software*, Michael T. Nygard, Pragmatic Bookshelf, 2018 (2nd Ed.)
- *System Design Interview An Insider's Guide (Volume 1)*, Alex Xu, ByteByteGo, 2020
- *System Design Interview An Insider's Guide Volume 2*, Alex Xu & Sahn Lam, ByteByteGo, 2022
- *Chaos Engineering - System Resiliency in Practice*, Casey Rosenthal & Nora Jones, O'Reilly, 2020
- *Designing Building Microservices Fine-Grained Systems*, Sam Newman, O'Reilly, 2021 (2nd Ed.)
- *Database Internals - A Deep Dive Into How Distributed Data Systems Work*, Alex Petrov, O'Reilly, 2019
- **Web Resource:** https://y26btech.klef.in

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COURSE PROFILE 13: EMBEDDED AI & TINY ML

- **Course Code:** 26EC3113 **Course Name:** Embedded AI & Tiny ML
- **L-T-P-S Structure:** 2-0-4-0 **Credits:** 4 **Prerequisite:** DLRN

Course Outcomes (COs)

CO#	Course Outcome (CO)	PO	PSO	BTL
CO1	Understand the embedded-AI motivation and constraints: cloud-vs-edge trade-offs, TinyML resource envelope, and application landscape.	PO1, PO2, PO5	PSO1	BTL2
CO2	Understand modern embedded-platform architectures: ARM Cortex, ESP32, STM32, RISC-V, Nordic MCUs, and select an appropriate MCU for workloads.	PO1, PO2, PO3, PO5	PSO1	BTL2
CO3	Apply neural-network compression techniques: quantization, pruning, distillation, NAS (MCUNet, MobileNetV3).	PO1, PO2, PO3, PO4, PO5	PSO1	BTL3
CO4	Apply embedded-inference frameworks: TFLite Micro, ExecuTorch, ONNX Runtime, Edge Impulse, CMSIS-NN, TensorRT.	PO1, PO2, PO3, PO5	PSO1	BTL3
CO5	Apply sensor-integration techniques: IMU, MEMS mic, camera modules, environmental sensors with pre-processing for ML pipelines.	PO1, PO2, PO3, PO5	PSO1	BTL3
CO6	Analyze low-power design, OTA updates, security, and TinyMLOps for deployment in Indian-context applications.	PO1, PO2, PO3, PO5, PO6, PO7	PSO1	BTL4

Module-wise Syllabus

Module #	Module Title	Topics Covered & Conceptual Mapping
M1	Edge-AI Motivation & The TinyML Envelope	Cloud vs edge vs fog computing; latency/bandwidth/privacy/energy trade-offs; Indian examples (Aadhaar, smart-meter, e-Sanjeevani); TinyML definition & resource envelope (<1 MB Flash, <256 KB RAM,

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		<100 mW); application taxonomy (KWS, visual wake words, anomaly detection, gesture recognition, predictive maintenance, sensor fusion); richer edge platforms (Raspberry Pi, Jetson, Coral, Hailo, Kria); industry NPUs; Indian context (Ola Krutrim, Sarvam-1); energy budgets; hardware-software co-design (MCUNet). Lab: Power-profile MobileNetV2 on ESP32-S3.
M2	Embedded Platforms – MCU Architectures & Boards	ARM Cortex-M families (M0–M85); CMSIS-NN; ESP32 family; Raspberry Pi Pico; STM32 families; Nordic nRF; RISC-V edge (BL808, CH32V, SiFive, Shakti); SBCs (Raspberry Pi 5, Jetson Orin Nano, Coral Dev Board). Lab: Dev environment setup on Arduino Nano 33 BLE Sense, ESP32-S3, Raspberry Pi Pico W; benchmark CoreMark & MLPerf Tiny.
M3	Model Compression for the Edge	Quantization (PTQ, QAT, INT8/INT4/INT2); pruning (structured/unstructured, N:M sparsity); knowledge distillation; NAS (MCUNet, MicroNets). Lab: Compress Hindi keyword-spotting model for ESP32-S3; compare accuracy, size, latency.
M4	Edge Inference Frameworks	TFLite Micro, ExecuTorch, ONNX Runtime, Edge Impulse, microTVM; vendor SDKs (X-CUBE-AI, NXP eIQ, Renesas e-AI); larger-edge frameworks (TensorRT, OpenVINO, Edge TPU compiler). Lab: Deploy MobileNetV2 SSDLite on Arduino Nano 33 BLE Sense via TFLM & Edge Impulse; benchmark accuracy, RAM, FPS.
M5	Sensors, Signal Processing & On-Device Features	IMU sensors (MPU-6050, LSM6DSOX, ICM-42670); MEMS microphones (PDM/I2S); audio features (STFT, MFCC, log-Mel); camera modules (OV2640, OV5640, HM01B0); environmental sensors (BME280, SHT41, MQ-series, PM2.5); CMSIS-DSP; sensor fusion filters (Kalman, Madgwick, Mahony). Lab: Build Hindi keyword-spotter on Arduino Nano 33 BLE Sense with MFCC features + CNN.
M6	Low Power, Security, OTA & TinyMLOps	Low-power modes; energy harvesting (solar, RF, vibration); wireless connectivity (BLE, LoRa, NB-IoT, Zigbee, Thread/Matter); secure boot, OTA updates, signed firmware; TinyMLOps (model versioning, fleet management); Indian deployments (SatSure, CropIn, Stellapps, Detect Technologies). Lab: End-to-end TinyML deployment on

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		solar-powered ESP32-S3 + LoRa node; field report with energy, accuracy, connectivity.

Reference Books & Literature

- *TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers, Pete Warden & Daniel Situnayake, O'Reilly Media, 2019*
- *TinyML Cookbook: Combine artificial intelligence and ultra-low-power embedded devices to make the world smarter, Gian Marco Iodice, Packt Publishing, 2023 (2nd Ed.)*
- *AI at the Edge – Solving Real-World Problems with Embedded Machine Learning, Daniel Situnayake & Jenny Plunkett, O'Reilly Media, 2023*
- *Deep Learning for Vision Systems, Mohamed Elgendy, Manning Publications, 2020*
- *Machine Learning Systems: Principles and Practices of Engineering Artificially Intelligent Systems, Vijay Janapa Reddi (Editor), Harvard / CS249r open textbook, 2024 (continuously updated)*
- *Practical Deep Learning for Cloud, Mobile, and Edge, Anirudh Koul, Siddha Ganju & Meher Kasam, O'Reilly Media, 2019*
- *Embedded Machine Learning for Cyber-Physical, IoT, and Edge Computing, Sudeep Pasricha & Muhammad Shafique (Eds.), Springer, 2024*

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Annexure – 3(a)

Y26 - Syllabus Revision

Course Code	Course Name	Course Category	Existing Syllabus (as per Annexure-3)	New Syllabus (as per Annexure-3)	Topics Added/Removed /Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
26UC0017	Indian Knowledge Systems	AUC	Indian Ancient Knowledge Systems - Vedic Mathematics is an Audit Course that introduces India's rich knowledge heritage with a focus on Vedic Mathematics — fast, elegant calculation techniques drawn from the sutras. — INSIDE-OUT classroom-paced sister. Students build the same capability module-by-module through focused module-level labs rather than the VedicMathLab sprint; no anchor project. Ancient methods meet modern STEM, competitive exams, algorithmic thinking, and AI. Pre-requisite: none. Enables: faster quantitative aptitude, competitive-exam readiness, and appreciation of India's scientific heritage.		L-T-P-S Revision			

*Overall Revision Percentage= sum of percentage of Course Outcome revision. Any revision to the tune of 25% or above is considered as a new course. In all other cases the course code is changed and the course is considered as a revised course.
Each CO revision percentage is calculated based on the extent to which the outcome has been revised through addition or deletion of topics.

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Course Code	Course Name	Course Category	Existing Syllabus (as per Annexure-3)	New Syllabus (as per Annexure-3)	Topics Added/Removed/Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
26UC1137	DTI&E	HSS	Module 1: Introduction to Design Thinking • What innovation is and isn't • Human-centred design philosophy • Design-thinking mindset • Double Diamond and 5-stage models • Design Thinking vs Traditional Problem Solving • Applications of Design Thinking • Famous Design Thinking Successes • Roles, Teams and Creative Process Module 2: Empathize • User research fundamentals • User interviews • Observation	Module 1: Design Thinking Foundations & Empathy (Discover + Define) • What Design Thinking is and why it matters • Human-centred innovation and innovator mindset • d.school 5-stage model and Double Diamond model • Divergent vs Convergent Thinking • User research (Observation, Interviews, Contextual Inquiry) • Empathy Maps, Personas, Journey Maps • Jobs-To-Be-Done (JTBD) Framework • Problem Framing	The syllabus has been comprehensively updated by introducing divergent and convergent thinking, Jobs-To-Be-Done (JTBD) framework, contextual inquiry, stakeholder analysis, research ethics, accessibility and inclusive design, assumption validation, deep-tech opportunity identification, structured creativity techniques (Brainwriting, Crazy-8s, Worst Possible Idea), innovation frameworks (Innovation Funnel, Three Horizons, Technology Push vs. Market Pull), desirability–feasibility–viability analysis, value hypothesis, generative AI for ideation, modern prototyping technologies (3D printing, AR/VR, Figma, Wizard-of-Oz prototypes, Proof-of-	CO1 5%	Modified to incorporate emerging technologies, entrepreneurship, UX design, and industry-oriented innovation practices in alignment with NEP 2020 and AICTE guidelines, thereby enhancing students' design thinking, problem-solving, employability, and startup capabilities.	20%

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			• Empathy Maps • Personas • User Journey Maps • Latent Needs • Synthesizing Insights Module 3: Define • Point-of-View Statements • How Might We Questions • Reframing Problems • Prioritizing Needs • Design Challenges • Success Criteria • Avoiding Solution Bias Module 4: Ideate • Brainstorming Principles • Divergent & Convergent Thinking • SCAMPER • Mind Mapping • Lateral Thinking • Creative	and Reframing • Stakeholder Analysis, Ethics, Accessibility & Inclusion • Assumption Validation and Deep-Tech Opportunity Identification Integrated with Module 1 • User Interviews and Observation • Contextual Inquiry • Non-leading Interview Techniques (The Mom Test) • Empathy Maps, Personas, Journey Maps • Latent vs Stated Needs • Jobs-To-Be-Done Perspective • Research Ethics and Consent Integrated with Module 1 • POV Statements • How Might We	Concept), UX principles, Norman's design principles, Nielsen's usability heuristics, information architecture, visual design, entrepreneurship lifecycle, Business Model Canvas, Lean Canvas, Value Proposition Canvas, Lean Startup methodology, intellectual property, deep-tech ventures, startup funding ecosystem, unit economics, go-to-market strategy, market research, TAM–SAM–SOM analysis, SWOT analysis, Porter's Five Forces, customer validation, data analytics, storytelling, pitch deck preparation, and presentation skills. Existing topics on empathy, problem definition, ideation, prototyping, usability testing, and AI-assisted design have been restructured, expanded, and aligned with current industry practices and	CO5 5% CO6 10%		

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			Confidence • Idea Clustering • Prioritization Module 5: Prototype • Importance of Prototyping • Low & High Fidelity Prototypes • Paper Prototypes • Digital Prototypes • Storyboards • MVP • Rapid Iteration Module 6: Test, Iterate & AI-Amplified Design • Usability Testing • Feedback Collection • Build-Measure-Learn Loop • Design Sprints • Generative AI for Ideation & Prototyping • AI-assisted User Research • Human vs AI in Design	Questions • Problem Statements • Needs vs Features vs Solutions • Assumption Mapping • Problem Validation Before Solution Development • Stakeholder Constraints Module 2: Ideation, Creativity & Innovation • Psychology of Creativity • Brainstorming & Brainwriting • SCAMPER, Mind Mapping • Crazy-8s Technique • Worst Possible Idea Technique • Lateral Thinking & Analogous Inspiration • Innovation Types (Incremental, Radical, Disruptive)	entrepreneurship-oriented learning outcomes.			

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				• Innovation Funnel & Three Horizons Framework • Technology Push vs Market Pull • Idea Evaluation using Desirability–Feasibility–Viability • Value Hypothesis & Concept Statement • Generative AI for Ideation Module 3: Prototyping & Modern Prototyping Technologies • Prototype as Learning Tool • Low & High Fidelity Prototypes • MVP Concept • 3D Printing for Rapid Prototyping • AR/VR Prototyping • AI-Assisted Prototyping • Figma-based UI Prototyping • Wizard-of-Oz Prototypes • Prototype				

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				Selection Strategy • Proof-of-Concept for Deep-Tech Products Module 4: UX Design, Usability & Testing • UX vs UI Concepts • Norman's Design Principles • Nielsen's Usability Heuristics • Interaction Design & Information Architecture • Visual Design Principles • Accessibility & Inclusive Design • Usability Testing • Think-Aloud Protocol • Severity Rating & Iteration • Market-Ready User Experience Module 5: Entrepreneurship Lifecycle & Deep-Tech Ventures (New Module)				

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				• Entrepreneurship Lifecycle • Business Model Canvas & Lean Canvas • Value Proposition Canvas • Lean Startup Methodology • Deep-Tech Ventures • Intellectual Property Basics • Funding Sources (Incubators, Accelerators, Angels, VC) • Unit Economics • Go-to-Market Strategy • Founder Mindset Module 6: Market Study, Analytics & Storytelling/Pitching (New Module) • Market Research Methods • TAM–SAM–SOM Analysis • SWOT & Porter's Five Forces				

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				• Customer Validation & Traction Metrics • Data Analytics & Visualization • Storytelling for Innovation • Product & Startup Pitching • Pitch Deck Preparation • Presentation Skills & Q&A Handling				

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26SC1101	Problem Solving Using Programming (Java)	ESC	The existing syllabus covers computational thinking, algorithms, Java foundations, variables, data types, operators, control statements, methods, recursion, arrays, object-oriented modelling, exception handling, strings, file handling, collections, generics, lambda	The revised syllabus is redesigned as a dedicated Object-Oriented Programming with Java course with strong emphasis on modern Java development. It introduces OOP mental models, the four pillars of OOP, Java ecosystem (JDK/JRE/JVM), JDK 21 LTS, IntelliJ IDEA, VS Code, Maven, Gradle, compile-run cycle, GitHub-based programming workflow, advanced encapsulation practices, equals() and hashCode() contract, Object class, abstract classes, interfaces,	Added: Modern Java ecosystem, JDK 21, IDEs, Maven, Gradle, GitHub workflow, advanced OOP principles, Object class, equals() & hashCode(), composition over inheritance, default interface methods, java.nio.file API, Concurrent Collections, modern Generics, Records, Sealed Classes, Optional, Stream API, Virtual Threads, AI-assisted programming, Project Loom, modern labs, API design, industry coding practices. Removed/Reduced: Computational thinking, algorithms, pseudocode, flowcharts, detailed control statements, recursion, arrays, string manipulation, procedural	CO5 – 10% (Strings replaced by Collections Framework,	The syllabus has been comprehensively revised to align with Java 21 LTS, contemporary object-oriented software engineering practices, and current industry requirements. The revision shifts the focus from introductory programming concepts to advanced object-oriented design, modern Java language features, enterprise development	20%

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			expressions, streams, Optional, and functional programming concepts. It emphasizes programming fundamentals, procedural problem solving, Java language basics, object-oriented modelling at an introductory level, and practical use of Java libraries for application development.	default interface methods, composition over inheritance, modern exception handling using try-with-resources, java.nio.file API, Collections Framework architecture, modern generics, ConcurrentHashMap, CopyOnWriteArrayList, lambda expressions, functional interfaces, Stream API, Optional, Records, Sealed Classes, local variable type inference (var), Virtual Threads (Project Loom), AI-assisted Java development using GitHub Copilot/Claude/Cursor, modern coding practices, code review, API design	programming patterns, file parsing fundamentals, and introductory Java programming topics. Replaced: Introductory programming-centric approach with a modern object-oriented software development approach aligned with current Java industry standards.	Generics and Comparators), CO6 – 10% (Functional programming significantly expanded with Records, Sealed Classes, Virtual Threads and AI-assisted development).	practices, AI-assisted programming, software architecture, and professional coding workflows. New technologies such as Maven, Gradle, GitHub, Records, Sealed Classes, Virtual Threads, modern Collections Framework, Stream API enhancements, and AI-enabled development environments prepare students for enterprise software development, higher studies, and current software industry	

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				principles, and industry-oriented laboratory exercises. Traditional computational thinking, recursion, arrays, detailed control structures, strings, and procedural programming topics are reduced or shifted to prerequisite programming courses, while modern object-oriented software engineering practices become the primary focus.			expectations while ensuring alignment with Outcome-Based Education (OBE) and NEP recommendations.	

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26EC1101	Fundamentals of IoT & Sensors	ESC	M1 – The module introduces the fundamentals of embedded systems and the IoT landscape, including the concept of embedded systems, IoT architecture, building blocks of IoT products such as sensors, controllers, actuators, connectivity and cloud, datasheet and specification reading, interpretation of pin diagrams and wiring guides, understanding electrical units and sensor specifications, block diagram development, bill of materials preparation, and safety and good	M1 – The module covers the fundamentals of IoT system architecture, including the canonical definition of IoT, the four-layer IoT reference architecture (Perception, Network, Middleware, and Application layers), IoT vs. traditional embedded systems, IoT scalability and engineering implications, IoT application verticals (smart home, Industry 4.0, healthcare, agriculture, and smart cities), and practical analysis of real-world IoT products by identifying the	he syllabus has been comprehensively revised by strengthening the existing concepts of embedded systems and IoT with IoT system architecture based on the four-layer reference model (Perception, Network, Middleware, and Application), IoT vs. Embedded Systems, large-scale IoT ecosystem and application verticals, advanced sensor and actuator interfacing, analog and digital sensors, communication interfaces (GPIO,	CO5-10% CO6-10%	The syllabus has been revised to align with AICTE curriculum recommendations, Industry 4.0 requirements, and current IoT technology trends by strengthening the foundation of IoT system design and introducing modern IoT architectures, advanced microcontroller platforms (ESP32, STM32, Raspberry Pi Pico), industry-standard communication protocols (MQTT, CoAP, LoRaWAN, NB-IoT, Matter),	20%

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			hardware handling practices. M2 –The module covers the fundamentals of sensors, including different sensor families, analog and digital sensors, sensor specifications, calibration, noise and drift, sensor selection, environmental considerations, placement techniques, and the concept of combining multiple sensors for sensing applications. M3 –The module focuses on controller boards, digital and analog input/output, PWM, communication interfaces such as I2C, SPI and UART, use of software libraries, powering embedded systems, pin configuration, debugging using serial	functional role of each architectural layer. M2 – The module introduces advanced sensor and actuator technologies, including sensor categories, sensor specifications, analog versus digital sensors, actuator types, sensor interfacing techniques, communication interfaces (ADC, GPIO, I2C, SPI, UART), and practical implementation of sensor-actuator integration using microcontrollers for real-time monitoring and control applications. M3 – The module focuses on modern microcontroller platforms, including Microcontroller vs. Microprocessor architecture, Arduino	ADC, I2C, SPI, UART), modern microcontroller platforms (ESP32, STM32, Raspberry Pi Pico), timers, interrupts, MicroPython programming, wireless communication technologies (Bluetooth Low Energy, LoRa/LoRaWAN, NB-IoT, Zigbee, Thread, Matter), application-layer protocols (MQTT, CoAP, HTTP/REST), MQTT broker architecture and QoS, cloud IoT platforms (AWS IoT Core, Azure IoT Hub, ThingsBoard), time-series databases (InfluxDB, AWS Timestream), Grafana		cloud-based IoT platforms (AWS IoT Core, Azure IoT Hub, ThingsBoard), real-time data visualization, device provisioning, over-the-air (OTA) updates, and secure IoT deployment practices. The revised syllabus also incorporates IoT cybersecurity, TinyML, Edge AI, 5G-enabled IoT, and AI-assisted IoT development, enabling students to acquire practical skills in designing, deploying, securing, and managing scalable IoT solutions. These modifications enhance students' technical competency, industry readiness, employability, and	

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			communication, and practical development using plug-and-play hardware modules. M4 – The module introduces actuators and mechanical components, including servo, DC and stepper motors, motor driver modules, motion control, mechanical assemblies, gears, wheels, chassis, power management for motors, actuator selection, and the integration of sensing, actuation and mechanical systems for simple robotic applications. M5 –The module covers IoT connectivity concepts, including wired and wireless communication, Wi-Fi, Bluetooth/BLE, HTTP and MQTT messaging, cloud dashboards, IoT platforms, telemetry,	UNO, ESP32, Raspberry Pi Pico, STM32, GPIO, ADC, PWM, timers and interrupts, and programming using Arduino C/C++ and MicroPython, together with practical development using multiple sensor interfaces and timer-based data acquisition. M4 – The module introduces advanced IoT communication technologies, including Bluetooth Low Energy (BLE), Wi-Fi, LoRa/LoRaWAN, NB-IoT, Zigbee, Thread, Matter protocol, application-layer protocols HTTP/REST, MQTT, and CoAP, MQTT broker architecture, publish–subscribe communication, QoS	dashboards, device provisioning, over-the-air (OTA) firmware updates, remote device management, IoT cybersecurity concepts including TLS, X.509 certificates, Secure Boot, signed firmware updates, IoT threat landscape, Edge AI, TinyML, 5G-enabled IoT, AI-assisted IoT development using Generative AI tools, and industrial-scale cloud deployment and security practices. The laboratory component has also been significantly enhanced with real-time sensor interfacing using ESP32, MQTT-based cloud		ability to develop smart connected systems for real-world and Industry 4.0 applications.	

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			JSON-based communication, connectivity reliability, beginner-level security practices, privacy, and remote monitoring and control of IoT devices. M6 – The module focuses on system integration using the sense–think–act paradigm, decision logic, feedback concepts, integration of sensors, controllers, actuators and connectivity, power management, debugging, testing, documentation, and the transition from embedded systems to introductory robotics applications.	mechanisms, and practical implementation of cloud communication using MQTT brokers. M5 – The module covers Cloud-IoT integration, including AWS IoT Core, Azure IoT Hub, ThingsBoard, InfluxDB, AWS Timestream, Grafana dashboards, cloud-based data storage and visualization, device provisioning, over-the-air (OTA) firmware updates, remote device configuration, and deployment of real-time IoT dashboards for monitoring connected devices. M6 – The module focuses on IoT security and emerging technologies, including the IoT threat landscape, TLS encryption, X.509	communication, ThingsBoard dashboard development, cloud data visualization, secure IoT deployment, TLS-enabled communication, and practical implementation of AI-assisted IoT applications, replacing the earlier emphasis on basic embedded hardware, mechanical components, and introductory robotics integration, thereby aligning the course with current Industry 4.0 and Industrial IoT requirements.			

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				certificates, Secure Boot, signed firmware updates, TinyML, Edge AI, 5G-enabled IoT, AI-assisted IoT development using Generative AI tools, and practical implementation of secure IoT communication with TLS-enabled cloud deployment, security evaluation, and analysis of industrial IoT security practices.				

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26EC2106	Embedded System Design & IoT	ESC	The course covers STM32 microcontroller architecture, ARM Cortex-M7 architecture, STM32H7 memory organization, clock tree, NVIC interrupt model, boot sequence, STM32CubeMX and STM32CubeIDE, GPIO, ADC, timers, PWM, interrupt handling, DMA, periodic task scheduling, discrete-time PID control, motor drive fundamentals, H-bridge control, BLDC and stepper motors, current sensing, CAN bus fundamentals,	The course covers STM32 microcontroller architecture, ARM Cortex-M7 architecture, STM32H7 memory organization, clock tree, NVIC interrupt model, boot sequence, STM32CubeMX and STM32CubeIDE, GPIO, ADC, timers, PWM, interrupt handling, DMA, periodic task scheduling, discrete-time PID control, motor drive fundamentals, H-bridge control, BLDC and stepper motors,	L-T-P-S revised			

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			FDCAN peripheral configuration, CAN communication, and practical laboratory exercises using STM32 development boards.	current sensing, CAN bus fundamentals, FDCAN peripheral configuration, CAN communication, and practical laboratory exercises using STM32 development boards.				

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26CS2203	Computer Networks & Network Programming	PCC	The course covers the fundamentals of computer networking, including networking concepts, OSI and TCP/IP models, network topologies, physical and data link layers, Ethernet, MAC addressing, switching, Wi-Fi, IPv4 and IPv6 addressing, subnetting, routing, NAT, ICMP, TCP and UDP protocols, congestion control, HTTP,	The course introduces networking through a system-level application perspective using a multi-user chat application, covering the TCP/IP layered architecture, OSI model, encapsulation, Wireshark-based packet analysis, network performance metrics, application-layer protocols (HTTP/1.1, HTTP/2, HTTP/3, WebSocket, DNS, TLS), application protocol design,	The syllabus has been significantly revised by introducing application-driven networking using a multi-user chat application, network performance metrics (bandwidth, throughput, latency), application protocol design, protocol versioning, schema evolution, backward compatibility, socket programming APIs (socket(), bind(), listen(), accept(), connect(), send(), recv(), close()), blocking and non-blocking I/O, I/O multiplexing using select(), poll(), epoll(), scalable server architectures (C10K/C10M), protocol framing techniques, backpressure handling, graceful shutdown mechanisms, common networking bugs, network observability tools	CO5 – 10%, CO6 – 10%.	The syllabus has been revised to align with AICTE recommendations, NEP 2020, and modern networking industry practices by shifting from a predominantly theoretical study of networking protocols toward application-oriented network programming and protocol implementation. The revised curriculum strengthens students' understanding of layered network architecture through real-world	20%

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			scaling laws, embeddings, vector databases, ANN indexing, RAG, prompt engineering, in-context learning, fine-tuning (LoRA, QLoRA, RLHF, DPO), orchestration frameworks, observability, safety, privacy, compliance, and LLM platform engineering.	ecosystem, API-based GenAI development, prompt engineering, structured output, RAG, API-level fine-tuning, AI agents, production evaluation, observability, deployment, and AI engineering practices with industry-oriented hands-on laboratories.	Engineering consolidated into the final module.		LangSmith, Qdrant, OpenAI APIs, Anthropic APIs, and Vercel have been incorporated to improve employability and prepare students for current AI Engineer roles. The revised syllabus emphasizes practical implementation over theoretical model architecture while retaining core GenAI concepts.	

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			DNS, email protocols, SSH, WebSockets, network security fundamentals, cryptography, TLS, PKI, firewalls, intrusion detection systems, common network attacks, Zero Trust architecture, network observability, and practical laboratory exercises using Wireshark, socket programming, subnetting, traceroute, DNS analysis, HTTPS configuration,	transport-layer concepts including TCP, UDP, flow control, congestion control, retransmission, connection management, network-layer concepts such as IPv4, CIDR, subnetting, routing, NAT, ICMP and IPv6, link-layer concepts including Ethernet, ARP, switching, VLANs, Wi-Fi, error detection mechanisms, physical media, socket programming, blocking and non-blocking I/O, I/O multiplexing using select(),	(tcpdump, ss/netstat, iperf3, mtr), and practical network programming concepts. The emphasis on email protocols, advanced cryptography, PKI, Let's Encrypt, IDS/IPS, Zero Trust Architecture, eBPF-based networking, cloud security, and advanced network security topics has been reduced or shifted, resulting in a stronger focus on networking fundamentals, protocol implementation, and practical network application development.		applications while introducing socket programming, scalable server development, protocol design, non-blocking I/O, network observability, and practical debugging tools. These modifications enhance students' practical networking skills, software development capabilities, protocol analysis, debugging proficiency, and readiness for careers in network programming, distributed systems, cloud computing, and modern	

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			and firewall implementation.	poll(), epoll(), scalable network server design, protocol framing, backpressure handling, network debugging tools, observability techniques, and secure network programming practices, emphasizing practical implementation of networked applications.			communication technologies.	

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26EC2310	Embedded Software Development	PCC	The existing syllabus covers Embedded Software Foundations, Communication Peripherals, RTOS Fundamentals, Real-Time Scheduling, Driver Development Patterns, and Modern Embedded Systems, including memory-mapped I/O, Cortex-M architecture, toolchains, debugging, UART, SPI, I2C, CAN, USB, BLE, Wi-Fi, FreeRTOS, Zephyr RTOS, scheduling	The proposed syllabus retains Embedded Software Foundations, Communication Peripherals, RTOS Fundamentals, Real-Time Scheduling, Driver Development Patterns, and Modern Embedded Systems with identical coverage of memory-mapped I/O, Cortex-M architecture, embedded toolchains, debugging techniques, communication	No topics have been added, removed, revised, or replaced. The existing and proposed syllabi are identical in terms of module organization, course outcomes, technical content, laboratory exercises, learning objectives, and sequence of topics.	L-T-P-S revised		

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			algorithms, priority inversion, DMA, embedded driver development, Rust for embedded systems, TinyML, OTA updates, secure boot, firmware observability, AI-assisted embedded development, and comprehensive hands-on laboratory exercises using STM32/ESP32 platforms.	peripherals, RTOS concepts, scheduling algorithms, embedded driver development, Rust, TinyML, secure boot, OTA updates, AI-assisted embedded development, and the same laboratory exercises using STM32/ESP32 platforms.				

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26AD2305	Big Data Engineering & Data Pipelines	PCC	INSIDE-OUT classroom-paced course on big-data engineering and modern data-pipeline architecture for data-track engineering students. Builds the data-engineering toolkit — distributed storage (HDFS, S3, Iceberg), distributed compute (Spark, Flink), streaming (Kafka, Pulsar), orchestration (Airflow, Dagster, Prefect), modern data warehousing (Snowflake, BigQuery, Databricks Lakehouse),	INSIDE-OUT classroom-paced course on big-data engineering and modern data-pipeline architecture for data-track engineering students. Builds the data-engineering toolkit — distributed storage (HDFS, S3, Iceberg), distributed compute (Spark, Flink), streaming (Kafka, Pulsar), orchestration (Airflow, Dagster, Prefect), modern data warehousing	L-T-P-S-REVISION			

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			transformation (dbt), observability (Monte Carlo, DataHub) — in the canonical Berkeley CS186 / MIT 6.830 / CMU 15-721 / Stanford CS245 sequencing, extended with the 2025-2026 modern data stack (Iceberg, Hudi, Delta Lake, DuckDB, Polars, Materialize). All labs are hands-on Python + SQL grounded in Indian-scale data scenarios (UPI transaction streams, IRCTC booking events, Zerodha trade ticks). Enables Data Science capstone, ML Engineering	(Snowflake, BigQuery, Databricks Lakehouse), transformation (dbt), observability (Monte Carlo, DataHub) — in the canonical Berkeley CS186 / MIT 6.830 / CMU 15-721 / Stanford CS245 sequencing, extended with the 2025-2026 modern data stack (Iceberg, Hudi, Delta Lake, DuckDB, Polars, Materialize). All labs are hands-on Python + SQL grounded in Indian-scale data scenarios (UPI transaction streams, IRCTC booking events,				

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			specialization, and Cloud-Native Data Architecture.	Zerodha trade ticks). Enables Data Science capstone, ML Engineering specialization, and Cloud-Native Data Architecture.				

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26CS2202	Advanced Object Oriented Programming	PCC	Object Oriented Programming Using Java is the classroom-paced course on OOP fundamentals through Java. The Regular track is INSIDE-OUT: students learn classes/objects/encapsulation, then inheritance/polymorphism/interfaces, then exceptions/I-O, then collections/generics, and finally modern Java idioms (lambdas, streams, records) plus the AI-coding-assistant era's effect on the Java developer's daily work. Labs are independent exercises rather than a single project. Strict no-overlap: PBL Java introduction belongs to PSPJ (T01); advanced Java + design patterns + concurrency belong to AOOP (T05); database-side Java belongs to DBMS (S04). OOPJ owns the OOP-fundamentals foundation that every backend-aware course downstream draws on. Pre-	Advanced Object-Oriented Programming teaches the toolkit modern Java engineers reach for daily — deep generics with wildcards and variance, functional interfaces and lambdas, the Stream API, the canonical design patterns at depth, the java.util.concurrent ecosystem, and JVM-level concepts. Pedagogy is INSIDE-OUT: AOOP is a toolkit of parallel	**Added:** Advanced Generics (wildcards, variance), Functional Interfaces, Lambda Expressions, Stream API, Advanced Design Patterns, Java Concurrency (java.util.concurrent), JVM Internals, Refactoring-based Project, Parallel Programming Concepts. **Removed:** Basic OOP concepts (Classes, Objects, Encapsulation, Inheritance, Polymorphism, Interfaces), Exception Handling, File I/O, Basic Collections, Introductory Java programming exercises. **Replaced:** Standalone laboratory exercises are	CO6-15%		15%

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			requisite: PSTC, DAST. Enables: FSWD, DBMS, every Java-aware course downstream. Placement corridor: ₹6-15 LPA campus-drive roles at service companies (TCS, Infosys, Wipro, Cognizant, Capgemini, Accenture, IBM India) for Java-backend trainee tracks; ₹8-20 LPA at India product companies and BFSI-tech (Goldman Sachs Bengaluru, JPMorgan Hyderabad, Morgan Stanley Bengaluru, Wells Fargo Hyderabad, Citi tech). Java fluency is the single most-tested language skill in the BFSI-tech corridor, which represents one of the largest hiring pools for Indian CS graduates.	capabilities, not a hierarchical system, so the modules accumulate features linearly rather than peeling layers from a system. The project is a refactoring journey — students take a PSPJ-style codebase and progressively modernise it across twelve weeks, introducing one toolkit feature per module. Pre-requisite: PSPJ. Enables: SDSR (distributed concurrency), DLAC (parallel computing), every backend and platform	replaced with a semester-long refactoring project that progressively modernizes an existing Java application using advanced language features.			

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				engineering course downstream. Placement corridor: ₹15-30 LPA Java backend roles at product companies (Razorpay, Flipkart, PhonePe, Swiggy) and global Java shops (Goldman Sachs, Morgan Stanley, JPMorgan Chase) where deep Java fluency is decisive at the senior-fresher level.				

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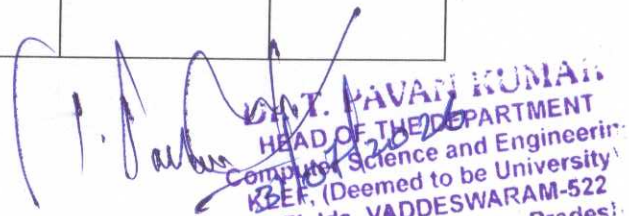
Course Code	Course Name	Course Category	Existing Syllabus (as per Annexure-3)	New Syllabus (as per Annexure-3)	Topics Added/Removed/Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
26AD2202	Generative AI & AI Platform Engineering	PCC	The existing syllabus covers The Generative AI Platform as a System, Foundations of Generative Models, Embeddings and Vector Stores (RAG), Prompt Engineering and In-Context Learning, Fine-Tuning and Adaptation, and AI Platform Engineering. It includes the GenAI platform architecture, transformer fundamentals, tokenization, attention mechanism,	The proposed syllabus covers The GenAI Landscape and Foundation Models, Prompting and Structured Generation, Embeddings and Retrieval-Augmented Generation (RAG), Fine-Tuning at the API Level, Agentic Patterns and Tool Use, and Evaluation, Safety, Cost, and the AI Engineer Role. It introduces the latest foundation-model	Added: Foundation-model ecosystem (GPT, Claude, Gemini, Llama, Qwen, Mistral), API provider landscape, self-hosted models, structured output, function calling, ReAct, Reflexion, Tree-of-Thoughts, AI agents, LangGraph, CrewAI, LangSmith, production evaluation, cost optimization, AI Engineer role, deployment through Vercel. Removed/Reduced: Detailed transformer architecture, scaling laws, autoregressive generation, ANN indexing (HNSW/IVF), RLHF/DPO theory, orchestration framework comparison, platform-level operational engineering. Reorganized: Prompt engineering moved earlier in the course, Fine-Tuning shifted before Agentic AI, Evaluation and Production AI	CO1 – 10% CO6 – 10%	The syllabus has been redesigned to align with the rapidly evolving Generative AI and AI Engineering ecosystem. The focus shifts from understanding LLM platform internals to building production-ready GenAI applications using prompting, RAG, fine-tuning APIs, AI agents, structured outputs, evaluation, and deployment. Industry tools such as	20%

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26AD3207	Natural Language Processing & LLM Engineering	PCC	INSIDE-OUT classroom-paced course in modern NLP and LLM engineering for AI-adjacent engineering students. Builds the full toolkit — from classical NLP (tokenization, embeddings, RNNs) through transformer architectures (BERT, GPT, T5) to production LLM systems (prompt engineering, fine-tuning, RAG, agentic frameworks). Sequencing	INSIDE-OUT classroom-paced course in modern NLP and LLM engineering for AI-adjacent engineering students. Builds the full toolkit — from classical NLP (tokenization, embeddings, RNNs) through transformer architectures (BERT, GPT, T5) to production LLM systems (prompt engineering, fine-tuning, RAG, agentic frameworks). Sequencing	**No topics added, removed, or replaced.** The course continues to cover classical NLP, word embeddings, RNNs, transformer architectures (BERT, GPT, T5), prompt engineering, fine-tuning, Retrieval-Augmented Generation (RAG), agentic frameworks, and the modern LLM production ecosystem (HuggingFace, LangChain, LlamaIndex, vLLM, Ollama). Hands-on PyTorch and transformer-based labs using Indian-language NLP applications remain unchanged.	**No change in course outcomes.** Students continue to gain the knowledge and practical skills required to design, develop, fine-tune, evaluate, and deploy modern NLP and Large Language Model (LLM) applications using state-of-the-art frameworks and	The existing syllabus is comprehensive and already aligned with current advancements in Natural Language Processing and Large Language Models. It incorporates the latest transformer architectures, production LLM frameworks, and Indian-language AI applications, ensuring students are well-prepared for advanced	L-T-P-S REVISION

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			follows the canonical Stanford CS224N / MIT 6.864 / CMU 11-611 / IIT-M CS6360 ordering, extended with the 2025-2026 LLM production stack (HuggingFace, LangChain, LlamaIndex, vLLM, Ollama). Every module ends in a hands-on PyTorch + transformers lab grounded in Indian-language NLP applications where applicable (AI4Bharat IndicTrans, Bhashini,	follows the canonical Stanford CS224N / MIT 6.864 / CMU 11-611 / IIT-M CS6360 ordering, extended with the 2025-2026 LLM production stack (HuggingFace, LangChain, LlamaIndex, vLLM, Ollama). Every module ends in a hands-on PyTorch + transformers lab grounded in Indian-language NLP applications where applicable (AI4Bharat IndicTrans, Bhashini,		production tools.	AI engineering, Generative AI, and Agentic AI roles. Therefore, no modifications were required.	



			Sarvam-1, IIT-M IndicBERT). Enables Large Language Models elective, Generative AI capstone, AAAE / Production AI Systems, and the Agentic AI specialization.	Sarvam-1, IIT-M IndicBERT). Enables Large Language Models elective, Generative AI capstone, AAAE / Production AI Systems, and the Agentic AI specialization.				

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26CS4107	Adaptive Software Engineering	PCC	Adaptive Software Engineering and Architecture — Regular variant. INSIDE-OUT classroom-paced sister to ASEG-PBL: students learn architecture as a toolkit — architectural styles, quality attributes, system-scale design patterns, evolutionary architecture and the architect's reasoning practices — paced module-	vAdaptive Software Engineering and Architecture — Regular variant. INSIDE-OUT classroom-paced sister to ASEG-PBL: students learn architecture as a toolkit — architectural styles, quality attributes, system-scale design patterns, evolutionary architecture and the architect's reasoning practices — paced module-	L-**No topics added, removed, or replaced.** The course continues to cover software architectural styles, quality attributes, system-level design patterns, evolutionary architecture, architectural decision records (ADRs), fitness-function-based architecture evaluation, design reviews, and architectural reasoning practices through module-level laboratory exercises. The prerequisite structure and course scope remain unchanged.	**No change in course outcomes.** Students continue to develop the ability to analyze, design, evaluate, and evolve scalable software architectures using industry-standard architectural practices, quality-driven design principles, and architecture evaluation techniques	The existing syllabus is already aligned with modern software architecture practices and industry expectations. It provides comprehensive coverage of architectural reasoning, design evaluation, and system-level engineering concepts required for advanced software engineering and enterprise architecture roles.	L-T-P-S **Revision**

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			by-module rather than through a portfolio sprint. No anchor project — focused module-level architecture labs (ADRs, fitness-function exercises, design reviews) applied to systems built earlier in the program. Strict no-overlap: distributed-system theory belongs to SDSR; deployment to CICD; OO patterns at the code level to AOOP. ASEG owns the meta-discipline of architectural	by-module rather than through a portfolio sprint. No anchor project — focused module-level architecture labs (ADRs, fitness-function exercises, design reviews) applied to systems built earlier in the program. Strict no-overlap: distributed-system theory belongs to SDSR; deployment to CICD; OO patterns at the code level to AOOP. ASEG owns the meta-		suitable for enterprise-scale software systems.	Therefore, no content revision was required.	

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			reasoning at the system level. Pre-requisite: AOOP, SDSR, CICD, CDIS, every PCC course in the program. Enables: every Staff+ track. Placement corridor: ASEG is the corridor-multiplier course — it lifts placement outcomes by ₹3-7 LPA across the corridor; the architectural fluency it produces distinguishes upper-quartile offers in interview panels.	discipline of architectural reasoning at the system level. Pre-requisite: AOOP, SDSR, CICD, CDIS, every PCC course in the program. Enables: every Staff+ track. Placement corridor: ASEG is the corridor-multiplier course — it lifts placement outcomes by ₹3-7 LPA across the corridor; the architectural fluency it produces distinguishes upper-quartile offers in interview panels.				

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26AD3308	**Agentic AI & Autonomous Enterprise Systems**	PCC	INSIDE-OUT classroom-paced course on agentic AI systems and autonomous enterprise deployment for AI-track engineering students. Builds the agentic-AI engineering toolkit — LLM agents, tool use, planning, memory, multi-agent orchestration, evaluation — and the enterprise deployment stack (LangGraph,	INSIDE-OUT classroom-paced course on agentic AI systems and autonomous enterprise deployment for AI-track engineering students. Builds the agentic-AI engineering toolkit — LLM agents, tool use, planning, memory, multi-agent orchestration, evaluation — and the enterprise deployment stack (LangGraph, CrewAI,	**No topics added, removed, or replaced.** The course continues to cover LLM agents, tool use, planning, memory, multi-agent orchestration, agent evaluation, enterprise deployment frameworks (LangGraph, CrewAI, AutoGen, OpenAI Assistants, Claude Computer Use, AWS Bedrock Agents, MCP), and the latest agentic AI technologies (Model Context Protocol, A2A, ACP). The hands-on Python labs and enterprise API integrations (Razorpay, Aadhaar eKYC, GSTN, DigiLocker, RBI Account Aggregator) remain unchanged.	**No change in course outcomes.** Students continue to develop the ability to design, develop, deploy, evaluate, and manage production-ready agentic AI systems and autonomous enterprise applications using modern AI frameworks and enterprise integration technologies.	The existing syllabus is comprehensive and fully aligned with current industry requirements and emerging trends in Agentic AI and autonomous enterprise systems. It already incorporates the latest AI frameworks, production deployment tools, enterprise APIs, and hands-on learning required for advanced AI	L-T-P-S **Revision**

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			CrewAI, AutoGen, OpenAI Assistants, Claude Computer Use, AWS Bedrock Agents, MCP). Sequencing follows the canonical Stanford CS329S (Production ML) / Berkeley CS294-188 (LLM Agents) / MIT 6.S965 (TinyML) / CMU 11-667 (Generative AI) ordering, extended with the 2025-2026 agentic-AI production stack (Model Context	AutoGen, OpenAI Assistants, Claude Computer Use, AWS Bedrock Agents, MCP). Sequencing follows the canonical Stanford CS329S (Production ML) / Berkeley CS294-188 (LLM Agents) / MIT 6.S965 (TinyML) / CMU 11-667 (Generative AI) ordering, extended with the 2025-2026 agentic-AI production stack (Model Context Protocol, A2A, ACP). All modules are			engineering roles, making further revision unnecessary.	

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			Protocol, A2A, ACP). All modules are hands-on Python, building agentic systems against real Indian enterprise APIs (Razorpay, Aadhaar eKYC, GSTN, DigiLocker, RBI account-aggregator). Enables Agentic AI capstone, the AAM specialization, and Production AI Systems.	hands-on Python, building agentic systems against real Indian enterprise APIs (Razorpay, Aadhaar eKYC, GSTN, DigiLocker, RBI account-aggregator). Enables Agentic AI capstone, the AAM specialization, and Production AI Systems.				

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Annexure – 3(b)

Report- Analysis of Feedback on curriculum – received from the stake holders prior to the commencement of the 2026-27 ODD Semester

Feedback from different stake holders has been collected in respect of the curriculum offered for the academic year 2024-25

S. No.	Type of Stake holder	Number of feedback
1	Students	701
2	Parents	45
3	Alumni	15
4	Faculty	250
5	Academic Peers	20
6	Industry Persons	20
Total		**1051**

S.No	Stakeholder Category	Stakeholder Feedback / Recommendation	ATR
1	ACADEMIC PEER	Mr. Konkimalla Venkata Ranga Rao recommended introducing Mathematics for Computation to strengthen students' analytical, computational, and mathematical problem-solving skills required for modern computing.	It is resolved to introduce the "Mathematics for Computation" course for 2026–27 admitted batch students.
2	ACADEMIC PEER	N. Lakshmi Narayana recommended introducing Mathematics for AI covering linear algebra, probability, statistics, optimization, and calculus essential for Artificial Intelligence.	It is resolved to introduce the "Mathematics for AI" course for 2026–27 admitted batch students.
3	ALUMNI	Hanumanth Yaganti strongly recommended revising Digital Design & Computer Architecture to include modern processor architecture, FPGA concepts, digital logic optimization, and computer organization.	It is resolved to introduce the "Digital Design & Computer Architecture" course for 2026–27 admitted batch students.

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S.No	Stakeholder Category	Stakeholder Feedback / Recommendation	ATR
4	INDUSTRY PERSON	Sreeja Girija R. recommended introducing Full Stack Development – Front End Frameworks focusing on React, Angular, responsive UI development, state management, and modern web technologies.	It is resolved to introduce the "Full Stack Development – Front End Frameworks" course for 2026–27 admitted batch students.
5	ACADEMIC PEER	Dr. P. Harini recommended introducing Computational Foundations for AI to strengthen students' understanding of algorithms, optimization, search techniques, and computational intelligence.	It is resolved to introduce the "Computational Foundations for AI" course for 2026–27 admitted batch students.
6	FACULTY	Mr. T. Ravi Kumar recommended introducing Data Structures & Algorithms – I with emphasis on fundamental data structures, recursion, searching, sorting, and algorithm analysis.	It is resolved to introduce the "Data Structures & Algorithms – I" course for 2026–27 admitted batch students.
7	INDUSTRY PERSON	Abhinay Irala recommended introducing Full Stack Development – Database Systems & Back End Engineering covering SQL, NoSQL, REST APIs, Spring Boot, Node.js, authentication, and cloud databases.	It is resolved to introduce the "Full Stack Development – Database Systems & Back End Engineering" course for 2026–27 admitted batch students.
8	ALUMNI	Dr. Anveeksh Koneru strongly recommended strengthening Machine Learning by incorporating deep learning fundamentals, model evaluation, explainable AI, and practical projects using real-world datasets.	It is resolved to introduce the "Machine Learning" course for 2026–27 admitted batch students.
9	FACULTY	Mr. T. Ravi Kumar recommended introducing Data Structures & Algorithms – II focusing on advanced trees, graphs, heaps, hashing, greedy algorithms, and dynamic programming.	It is resolved to introduce the "Data Structures & Algorithms – II" course for 2026–27 admitted batch students.

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S.No	Stakeholder Category	Stakeholder Feedback / Recommendation	ATR
10	FACULTY	Dr. Raju Anitha recommended introducing Data Structures & Algorithms – III covering advanced algorithmic paradigms, string algorithms, computational geometry, and graph optimization techniques.	It is resolved to introduce the "Data Structures & Algorithms – III" course for 2026–27 admitted batch students.
11	FACULTY	Dr. T. S. Rajeshwari recommended revising Operating Systems & Systems Programming by incorporating process management, memory management, concurrency, Linux programming, and shell scripting.	It is resolved to introduce the "Operating Systems & Systems Programming" course for 2026–27 admitted batch students.
12	ACADEMIC PEER	Mr. Vaishnava Dhaatri recommended introducing System Design for Scalability & Reliability covering distributed systems, microservices, cloud architecture, scalability, fault tolerance, and high availability.	It is resolved to introduce the "System Design for Scalability & Reliability" course for 2026–27 admitted batch students.
13	INDUSTRY PERSON	Sai Anil Muthyala strongly recommended introducing Embedded AI & Tiny ML covering edge AI, TinyML frameworks, embedded machine learning, low-power AI devices, and intelligent embedded systems.	It is resolved to introduce the "Embedded AI & Tiny ML" course for 2026–27 admitted batch students.
14	FACULTY	Ms. Pathuri Bindu recommended revising Indian Knowledge Systems to provide awareness of India's scientific heritage, ethical values, traditional knowledge, and sustainable practices.	It is resolved to approve the revision of syllabus in "Indian Knowledge Systems" course for 2026–27 admitted batches.

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S.No	Stakeholder Category	Stakeholder Feedback / Recommendation	ATR
15	INDUSTRY PERSON	Karthik Parthiban strongly recommended revising the Design Thinking for Innovation & Entrepreneurship course by incorporating advanced design thinking methodologies, innovation frameworks, user-centric design approaches, entrepreneurship practices, and real-world problem-solving activities to strengthen students' creativity and innovation skills.	It is resolved to approve the revision of syllabus in "Design Thinking for Innovation & Entrepreneurship" course for 2026–27 admitted batches.
16	ACADEMIC PEER	Dr. Sanjit Ningthoujam recommended revising the Problem Solving Using Programming (Java) course by emphasizing logical thinking, algorithm design, object-oriented programming concepts, coding best practices, and problem-solving exercises using industry-standard programming techniques.	It is resolved to approve the revision of syllabus in "Problem Solving Using Programming (Java)" course for 2026–27 admitted batches.
17	INDUSTRY PERSON	Mr. Sagireddy Pulla Reddy recommended revising the Fundamentals of IoT & Sensors course by incorporating IoT architecture, smart sensors, embedded devices, cloud connectivity, IoT security, and practical laboratory exercises using industry-standard IoT development platforms.	It is resolved to approve the revision of syllabus in "Fundamentals of IoT & Sensors" course for 2026–27 admitted batches.
18	FACULTY	Mr. CH. Ramaiah recommended revising the Embedded System Design & IoT course by enhancing practical laboratory sessions covering embedded controllers, microcontrollers, IoT devices, communication protocols, sensor interfacing, and real-time industrial applications.	It is resolved to approve the revision of syllabus in "Embedded System Design & IoT" course for 2026–27 admitted batches.

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S.No	Stakeholder Category	Stakeholder Feedback / Recommendation	ATR
19	INDUSTRY PERSON	Poothabalan Somasundaram recommended revising the Computer Networks & Network Programming course by incorporating advanced networking protocols, socket programming, distributed computing, cloud networking, network security, and hands-on configuration and programming exercises.	It is resolved to approve the revision of syllabus in "Computer Networks & Network Programming" course for 2026–27 admitted batches.
20	ALUMNI	A. Aparna strongly recommended revising the Big Data Engineering & Data Pipelines course by including ETL pipelines, distributed computing, cloud-based data platforms, real-time data processing, data orchestration, and scalable big data frameworks with hands-on projects.	It is resolved to approve the revision of syllabus in "Big Data Engineering & Data Pipelines" course for 2026–27 admitted batches.
21	ACADEMIC PEER	Dr. P. Harini recommended revising the Advanced Object Oriented Programming course by strengthening software design principles, design patterns, reusable architecture, object-oriented best practices, and enterprise application development through project-based learning.	It is resolved to approve the revision of syllabus in "Advanced Object Oriented Programming" course for 2026–27 admitted batches.
22	INDUSTRY PERSON	Dr. P. Syam Sundar strongly recommended revising the Generative AI & AI Platform Engineering course by incorporating foundation models, prompt engineering, Retrieval-Augmented Generation (RAG), AI deployment, MLOps, enterprise AI platforms, and hands-on implementation using modern AI frameworks.	It is resolved to approve the revision of syllabus in "Generative AI & AI Platform Engineering" course for 2026–27 admitted batches.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

S.No	Stakeholder Category	Stakeholder Feedback / Recommendation	ATR
23	INDUSTRY PERSON	Madhu Bodapati recommended revising the Natural Language Processing & LLM Engineering course by incorporating transformer architectures, prompt engineering, fine-tuning techniques, Retrieval-Augmented Generation (RAG), vector databases, and enterprise AI applications supported by practical projects.	It is resolved to approve the revision of syllabus in "Natural Language Processing & LLM Engineering" course for 2026–27 admitted batches.
24	ACADEMIC PEER	N. Lakshmi Narayana recommended revising the Embedded Software Development course by strengthening firmware programming, RTOS concepts, embedded debugging techniques, hardware-software integration, device driver development, and industry-standard embedded software development practices.	It is resolved to approve the revision of syllabus in "Embedded Software Development" course for 2026–27 admitted batches.
25	FACULTY	Dr. Pragnyaban Mishra recommended revising the Adaptive Software Engineering course by incorporating Agile methodologies, DevOps practices, software evolution, CI/CD pipelines, software architecture patterns, resilient software design, and AI-assisted software engineering with industry-oriented case studies.	It is resolved to approve the revision of syllabus in "Adaptive Software Engineering" course for 2026–27 admitted batches.
26	ALUMNI	Mr. Uppala Gopala Rao strongly recommended revising the Agentic AI & Autonomous Enterprise Systems course by incorporating AI agents, autonomous workflows, multi-agent systems, enterprise automation, intelligent decision-making, and hands-on implementation using modern agentic AI frameworks and enterprise use cases.	It is resolved to approve the revision of syllabus in "Agentic AI & Autonomous Enterprise Systems" course for 2026–27 admitted batches.

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Annexure - 4

B. TECH 2026-27 ADMITTED BATCH CATEGORY WISE COURSE STRUCTURE

S.NO	SPECIALIZATION	CAT	Course Code	Course Title	Short Name	L	T	P	S	CR	CH	Pre Req	New/Revised/Retained	Stake Holder	Justification for considering the feedback	EES
1	NONE	AUC	26UC0017	INDIAN KNOWLEDGE SYSTEMS	IKSL	2	0	0	0	0	2	NIL	Revised	Faculty		Skill Development
2	NONE	AUC	26UC0032	INSIGHTS TO SUSTAINABLE DEVELOPMENT GOALS	SDGL	2	0	0	0	0	2	NIL	Retained			Skill Development
3	NONE	AUC	26UC0009	ECOLOGY & ENVIRONMENT	ECEN	2	0	0	0	0	2	NIL	Retained			Employability
4	NONE	AUC	26UC0008	INDIAN CONSTITUTION	INCT	2	0	0	0	0	2	NIL	Retained			Employability
				TOTAL COURSES AND CREDITS		**4**				**0**						
5	NONE	HSS	26UC1137	DESIGN THINKING FOR INNOVATION & ENTREPRENEURSHIP	DTIE	0	0	4	0	2	4	NIL	Revised	Industry Person	20%	Entrepreneurship
6	NONE	HSS	26UC1102	LANGUAGE SKILLS FOR ENGINEERS	LSFE	0	0	4	0	2	4	NIL	Retained			Skill Development
7	NONE	HSS	26UC1204	COMMUNICATION SKILLS FOR ENGINEERS	CSFE	0	0	4	0	2	4	LSFE	Retained			Skill Development

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S.NO	SPECIALIZATION	CAT	Course Code	Course Title	Short Name	L	T	P	S	CR	CH	Pre Req	New/Revised/Retained	Stake Holder	Justification for considering the feedback	EES
8	NONE	HSS	FLP	FOREIGN LANGUAGE PROFICIENCY	FLNG	0	0	4	0	2	4	NIL	Revised	Alumni		Skill Development
9	NONE	HSS	26UC0038	HUMAN VALUES GENDER EQUITY AND PROFESSIONAL ETHICS	ETHC	2	0	0	0	2	2	NIL	Retained			Skill Development
10	NONE	HSS	ME	MANAGEMENT ELECTIVE	MGMT	2	0	2	0	3	4	NIL	Revised			Skill Development
				TOTAL COURSES AND CREDITS		**6**				**13**						
11	NONE	BSC	26MT1101	MATHEMATICS FOR COMPUTATION	MTCP	2	2	0	0	4	4	NIL	New	Academic Peer		Skill Development
12	NONE	BSC	26MT1202	MATHEMATICS FOR AI	MTAI	2	2	0	0	4	4	MTCP	New	Academic Peer		Skill Development
13	NONE	BSC	26MT1303	MATHEMATICS FOR DATA SCIENCE AND ANALYTICS	MFDS	2	2	0	0	4	4	DIMS	Retained			Skill Development
14	NONE	BSC	SCE-1	SCIENCE ELECTIVE - 1	SCE1	3	0	2	0	4	5	NIL	Retained			
15	NONE	BSC	SCE-2	SCIENCE ELECTIVE - 2	SCE2	3	0	2	0	4	5	NIL	Retained			
				TOTAL COURSES AND CREDITS		**5**				**20**						

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16	NONE	ESC	26EC1202	DIGITAL DESIGN & COMPUTER ARCHITECTURE	DDCA	2	0	0	4	3	6	NIL	New	Alumni		Skill Development
17	NONE	ESC	26SC1101	PROBLEM SOLVING USING PROGRAMMING (JAVA)	PSPJ	2	0	0	8	4	10	NIL	Revised	Academic Peer	20%	Employability
18	NONE	ESC	26EC1101	FUNDAMENTALS OF IOT & SENSORS	FOIS	2	0	4	0	4	6	NIL	Revised	Industry Person	20%	Employability
19	NONE	ESC	26SC1204	FULL STACK DEVELOPMENT – FRONT END FRAMEWORKS	FSFE	2	0	2	4	4	8	PSPJ	New	Industry Person		Skill Development
20	NONE	ESC	26SC1306	COMPUTATIONAL FOUNDATIONS FOR AI	CFAI	2	0	0	4	3	6	NIL	New	Academic Peer		Skill Development
21	NONE	ESC	26SC1203	DATA STRUCTURES & ALGORITHMS – 1	DSA1	2	0	0	4	3	6	PSPJ	New	Faculty		Skill Development
22	NONE	ESC	26SC1307	FULL STACK DEVELOPMENT – DATABASE SYSTEMS & BACK END ENGINEERING	FSBE	2	0	2	4	4	8	PSPJ	New	Industry Person		Employability
23	NONE	ESC	26SC2110	MACHINE LEARNING	MLRN	2	0	4	0	4	6	CFAI	New	Alumni		Employability
24		ESC	26EC2106	EMBEDDED SYSTEM DESIGN & IOT	ESDI	2	0	4	0	4	6	FOIS	Revised	Faculty		Entrepreneurship

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25		ESC	26SC1305	DATA STRUCTURES & ALGORITHMS – 2	DSA2	2	0	2	4	4	8	DSA1	New	Faculty		Skill Development
26		ESC	26SC2109	DATA STRUCTURES & ALGORITHMS – 3	DSA3	2	0	2	4	4	8	DSA2	New	Faculty		Skill Development
				TOTAL COURSES AND CREDITS		**11**				**41**						
27	NONE	PCC	26CS2101	OPERATING SYSTEMS & SYSTEMS PROGRAMMING	OSYS	2	0	4	0	4	6	DSA1	New	Faculty		Skill Development
28	NONE	PCC	26CS2203	COMPUTER NETWORKS & NETWORK PROGRAMMING	CNET	2	0	0	4	3	6	NIL	Revised	Industry Person	20%	Employability
29	NONE	PCC	26EC2310	EMBEDDED SOFTWARE DEVELOPMENT	ESWD	2	0	4	0	4	6	ESDI	Revised	Academic Peer		Skill Development
30	NONE	PCC	26AD2305	BIG DATA ENGINEERING & DATA PIPELINES	BGDT	2	0	0	4	3	6	MLRN	Revised	Alumni		Skill Development
31	NONE	PCC	26CS2202	ADVANCED OBJECT ORIENTED PROGRAMMING	AOOP	2	0	2	4	4	8	PSPJ	Revised	Academic Peer	15%	Employability
32	NONE	PCC	26AD2202	GENERATIVE AI & AI PLATFORM ENGINEERING	GNAI	2	0	4	0	4	6	MLRN	Revised	Industry Person	20%	Entrepreneurship

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33	NONE	PCC	26CS2204	CLOUD INFRASTRUCTURE & SERVICES	CLDI	2	0	0	4	3	6	FSBE	Retained			Employability
34	NONE	PCC	26CS2305	SYSTEM DESIGN FOR SCALABILITY & RELIABILITY	SDSR	2	0	4	0	4	6	OSYS	New	Academic Peer		Employability
35	NONE	PCC	26AD2304	DEEP LEARNING WITH ACCELERATED COMPUTING	DLRN	2	0	0	4	3	6	MLRN	Retained			Employability
36	NONE	PCC	26EC3113	EMBEDDED AI & TINY ML	EATM	2	0	4	0	4	6	DLRN	New	Industry Person		Entrepreneurship
37	NONE	PCC	26CS2306	CI/CD AND CLOUD DEVOPS	CICD	2	0	0	4	3	6	FSBE	Retained			Employability
38	NONE	PCC	26AD3207	NATURAL LANGUAGE PROCESSING & LLM ENGINEERING	NLLM	2	0	4	0	4	6	MLRN	Revised	Industry Person		Skill Development
39	NONE	PCC	26CS4107	ADAPTIVE SOFTWARE ENGINEERING	ADSW	2	1	2	0	4	5	OSYS	Revised	Faculty		Employability
40	NONE	PCC	26AD3308	AGENTIC AI & AUTONOMOUS ENTERPRISE SYSTEMS	AGAI	2	0	0	4	3	6	DLRN	Revised	Alumni		Entrepreneurship
				TOTAL COURSES AND CREDITS		**14**				**50**						
41	NONE	PEC	PE-1	PROFESSIONAL ELECTIVE - 1	PEC1	2	0	0	4	3	6	NIL	Retained			

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42	NONE	PEC	PE-2	PROFESSIONAL ELECTIVE - 2	PEC2	2	0	0	4	3	6	PE-1	Retained			
43	NONE	PEC	PE-3	PROFESSIONAL ELECTIVE - 3	PEC3	2	0	0	4	3	6	PE-1	Retained			
44	NONE	PEC	PE-4	PROFESSIONAL ELECTIVE - 4	PEC4	2	0	0	4	3	6	PE-1	Retained			
45	NONE	PEC	PE-4	PROFESSIONAL ELECTIVE - 5	PEC5	2	0	0	4	3	6	PE-1	Retained			
				TOTAL COURSES AND CREDITS		**5**				**15**						
46	NONE	PRI	26IE2040	SOCIAL INTERNSHIP	INTS	0	0	4	0	0	4	NIL	Retained			Skill Development
47	NONE	PRI	26IE3041	TECHNICAL INTERNSHIP	INTT	0	0	4	0	0	4	NIL	Retained			Employability
48	NONE	PRI	26IE4101	TERM PAPER	TMPR	0	0	6	0	3	6	NIL	Retained			Skill Development
49	NONE	PRI	26IE4053	CAPSTONE PROJECT – 1	CAP1	0	0	12	0	6	12	TMPR	Retained			Employability
50	NONE	PRI	26IE4054	CAPSTONE PROJECT – 2	CAP2	0	0	12	0	6	12	CAP1	Retained			Entrepreneurship
				TOTAL COURSES AND CREDITS		**5**				**15**						

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51	NONE	OEC	OE-1	OPEN ELECTIVE - 1	OEC1	2	0	2	0	3	4	NIL	Revised			Skill Development
52	NONE	OEC	OE-2	OPEN ELECTIVE - 2	OEC2	2	0	2	0	3	4	NIL	Revised			Skill Development
53	NONE	OEC	OE-3	OPEN ELECTIVE - 3	OEC3	2	0	2	0	3	4	NIL	Revised			Skill Development
				TOTAL COURSES AND CREDITS		**3**				**9**						
54	NONE	VAC	VAC-1	VALUE ADDED COURSE 1 - SPORTS	VAC1	0	0	0	2	0	2	NIL	Retained			Skill Development
55	NONE	VAC	VAC-2	VALUE ADDED COURSE 2 - TECHNICAL GLOBAL CERTIFICATION 1	VAC2	0	0	0	2	0	2	NIL	Retained			Skill Development
56	NONE	VAC	VAC-3	VALUE ADDED COURSE 3 - TECHNICAL GLOBAL CERTIFICATION 2	VAC3	0	0	0	2	0	2	NIL	Retained			Skill Development
57	NONE	VAC	VAC-4	VALUE ADDED COURSE 4 - TECHNICAL GLOBAL CERTIFICATION 3	VAC4	0	0	0	2	0	2	NIL	Retained			Skill Development
				TOTAL COURSES AND CREDITS		**4**				**0**						

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				TOTAL NO. OF COURSES AND CREDITS		57				163						
				FOREIGN LANGUAGE												
1	NONE	HSS	26FL3055	GERMAN LANGUAGE	GL	0	0	4	0	2	4	NIL	Retained			Skill Development
2	NONE	HSS	26FL3058	JAPANESE LANGUAGE	JP	0	0	4	0	2	4	NIL	Retained			Skill Development
3	NONE	HSS	26FL3064	KOREAN LANGUAGE	KR	0	0	4	0	2	4	NIL	Retained			Skill Development
	STREAM			**MANAGEMENT ELECTIVE**												
1	AI-DRIVEN PRODUCT MANAGEMENT	MGEL	26MGPM03	AI BUSINESS MODELS, PRICING STRATEGY & MONETISATION	MPM3	2	0	2	0	3	4	OPM1+OPM2+OPM3	Retained			Entrepreneurship
2	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	MGEL	26MGCA03	CREATIVE ENTREPRENEURSHIP & DIGITAL MEDIA VENTURE STRATEGY	MCA3	2	0	2	0	3	4	OCA1+OCA2+OCA3	Retained			Entrepreneurship

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3	DIGITAL ECONOMICS & PLATFORM MARKET INTELLIGENCE	MGEL	26MGDE03	INNOVATION ECONOMICS, VENTURE STRATEGY & DISRUPTIVE MARKET DEVELOPMENT	MDE3	2	0	2	0	3	4	ODE1 +ODE 2+ODE3	Retained			Skill Development
4	DIGITAL HEALTH & HEALTHCARE INFORMATICS	MGEL	26MGDH03	HEALTH POLICY, ETHICS & GLOBAL HEALTHCARE INNOVATION	MDH3	2	0	2	0	3	4	ODH1 +ODH 2+ODH3	Retained			Employability
5	FINTECH & DIGITAL FINANCIAL SERVICES	MGEL	26MGFT03	INSURTECH, EMBEDDED FINANCE & OPEN BANKING	MFT3	2	0	2	0	3	4	OFT1 +OFT 2+OFT3	Retained			Employability
6	PRECISION AGRICULTURE & AGRITECH	MGEL	26MGPA03	GLOBAL FOOD SYSTEMS, AGRICULTURAL POLICY & FOOD SECURITY	MPA3	2	0	2	0	3	4	OPA1 +OPA 2+OPA3	Retained			Skill Development
7	SUPPLY CHAIN & LOGISTICS INTELLIGENCE	MGEL	26MGSC03	AI, BLOCKCHAIN & AUTONOMOUS SYSTEMS IN FUTURE SUPPLY CHAINS	MSC3	2	0	2	0	3	4	OSC1 +OSC 2+OSC3	Retained			Entrepreneurship
				SCIENCE ELECTIVES												

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1	NONE	SCE-1 / SCE-2	26BS4001	INFORMATION THEORY & CODING	ITCD	3	0	2	0	4	5	P&S	Retained			Skill Development
2	NONE	SCE-1 / SCE-2	26BS4002	QUANTUM INFORMATION SCIENCE	QISC	3	0	2	0	4	5	Linear Algebra/Engineering physics	Retained			Employability
3	NONE	SCE-1 / SCE-2	26BS4003	ACTUARIAL SCIENCES	ACTS	3	0	2	0	4	5	P&S /Calculus	Retained			Employability
4	NONE	SCE-1 / SCE-2	26BS4004	COMPUTATIONAL NEUROSCIENCE	CNUE	3	0	2	0	4	5	ODES /Basic Biology/Python	Retained			Skill Development
5	NONE	SCE-1 / SCE-2	26BS4005	COMPUTATIONAL BIOLOGY	COMB	3	0	2	0	4	5	Programming / Basic	Retained			Entrepreneurship

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												Biology				
6	NONE	SCE-1 / SCE-2	26BS4006	SEMICONDUCTOR PHYSICS	SCPH	3	0	2	0	4	5	Engineering Physics / Basic Quantum	Retained			Employability
7	NONE	SCE-1 / SCE-2	26PH1005	ENGINEERING PHYSICS	EPHY	3	0	2	0	4	5	NIL	Retained			Skill Development
8	NONE	SCE-1 / SCE-2	26CY1001	ENGINEERING CHEMISTRY	ENGC	3	0	2	0	4	5	NIL	Retained			Employability
9	NONE	SCE-1 / SCE-2	26CY1002	ORGANIC & PHYSICAL CHEMISTRY FOR LIFE SCIENCES	OPCL	3	0	2	0	4	5	NIL	Retained			Skill Development
	STREAM			**OPEN ELECTIVES**												
1	AI-DRIVEN PRODUCT MANAGEMENT	OE-1	26OEPM01	FOUNDATIONS OF AI-DRIVEN PRODUCT THINKING	OPM1	2	0	2	0	3	4	NIL	Retained			Skill Development

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2	AI-DRIVEN PRODUCT MANAGEMENT	OE-2	26OEPM02	PRODUCT STRATEGY & ROADMAPPING IN AI MARKETS	OPM2	2	0	2	0	3	4	NIL	Retained			Employability
3	AI-DRIVEN PRODUCT MANAGEMENT	OE-3	26OEPM03	AI Product Metrics, Experimentation & Growth Analytics	OPM3	2	0	2	0	3	4	OPM1 + OPM2				
4	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	OE-1	26OECA01	CREATIVE ECONOMY & THE DIGITAL ARTS INDUSTRY	OCA1	2	0	2	0	3	4	NIL	Retained			Entrepreneurship
5	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	OE-2	26OECA02	MEDIA PRODUCTION BUSINESS, CONTENT STRATEGY & CREATOR ECONOMY	OCA2	2	0	2	0	3	4	OCA1	Retained			Entrepreneurship
6	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	OE-3	26OECA03	Gaming Industry: Business Models, Market Intelligence & Immersive Commerce	OCA3	2	0	2	0	3	4	OCA1 + OCA2				

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7	DIGITAL ECONOMICS & PLATFORM MARKET INTELLIGENCE	OE-1	26OEDE01	PLATFORM ECONOMICS & BUSINESS MODEL DESIGN	ODE1	2	0	2	0	3	4	NIL	Retained			Skill Development
8	DIGITAL ECONOMICS & PLATFORM MARKET INTELLIGENCE	OE-2	26OEDE02	MARKET INTELLIGENCE, COMPETITIVE ANALYTICS & STRATEGIC DECISION SCIENCE	ODE2	2	0	2	0	3	4	ODE1	Retained			Employability
9	DIGITAL ECONOMICS & PLATFORM MARKET INTELLIGENCE	OE-3	26OEDE03	Digital Consumer Economics, Behavioural Insights & Growth Strategy	ODE3	2	0	2	0	3	4	ODE1 + ODE2				
10	DIGITAL HEALTH & HEALTHCARE INFORMATICS	OE-1	26OEDH01	HEALTHCARE SYSTEMS & DIGITAL HEALTH ECOSYSTEM	OODH 1	2	0	2	0	3	4	NIL	Retained			Employability

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11	DIGITAL HEALTH & HEALTHCARE INFORMATICS	OE-2	26OEDH02	HEALTHCARE DATA ANALYTICS & POPULATION HEALTH INTELLIGENCE	ODH2	2	0	2	0	3	4	ODH 1	Retained			Skill Development
12	DIGITAL HEALTH & HEALTHCARE INFORMATICS	OE-3	26OEDH03	Hospital Operations, Healthcare Finance & Revenue Management	ODH3	2	0	2	0	3	4	ODH1 + ODH2				
13	FINTECH & DIGITAL FINANCIAL SERVICES	OE-1	26OEFT01	FINANCIAL ECOSYSTEM & DIGITAL BUSINESS MODELS	OFT1	2	0	2	0	3	4	NIL	Retained			Employability
14	FINTECH & DIGITAL FINANCIAL SERVICES	OE-2	26OEFT02	DIGITAL PAYMENTS & TRANSACTION ECONOMICS	OFT2	2	0	2	0	3	4	OFT1	Retained			Entrepreneurship
15	FINTECH & DIGITAL FINANCIAL SERVICES	OE-3	26OEFT03	Digital Lending, Credit Analytics & Risk Markets	OFT3	2	0	2	0	3	4	OFT1 + OFT2				
16	PRECISION AGRICULTUR	OE-1	26OEPA01	AGRI-BUSINESS STRATEGY & FOOD VALUE CHAIN MANAGEMENT	OPA1	2	0	2	0	3	4		Retained			Employability

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	E & AGRITECH															
17	PRECISION AGRICULTURE & AGRITECH	OE-2	26OEPA02	PRECISION AGRICULTURE & DATA-DRIVEN FARM MANAGEMENT	OPA2	2	0	2	0	3	4	OPA1	Retained			Skill Development
18	PRECISION AGRICULTURE & AGRITECH	OE-3	26OEPA03	AgriTech Entrepreneurship, Rural Finance & Innovation Ecosystems	OPA3	2	0	2	0	3	4	OPA1 + OPA2				
19	SUPPLY CHAIN & LOGISTICS INTELLIGENCE	OE-1	26OESC01	GLOBAL SUPPLY CHAIN STRATEGY & NETWORK DESIGN	OSC1	2	0	2	0	3	4		Retained			Employability
20	SUPPLY CHAIN & LOGISTICS INTELLIGENCE	OE-2	26OESC02	PROCUREMENT INTELLIGENCE & SUPPLIER ECOSYSTEM MANAGEMENT	OSC2	2	0	2	0	3	4		Retained			Skill Development
21	SUPPLY CHAIN & LOGISTICS INTELLIGENCE	OE-3	26OESC03	Logistics Operations & Last-Mile Intelligence	OSC3	2	0	2	0	3	4	OSC1 + OSC2				

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	SPECIALIZATION			**PROFESSIONAL ELECTIVES**									Retained			Skill Development
1	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC1	26AAM3111	AGENTIC AI SYSTEMS: ARCHITECTURES & REASONING FRAMEWORKS	AAM1	2	0	0	4	3	6	AIML / NLPL	Retained			Employability
2	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC2	26AAM3221	AUTONOMOUS PERCEPTION & MULTI-MODAL SENSOR FUSION	AAM2	2	0	0	4	3	6	AIML / DLAC	Retained			Skill Development
3	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC3	26AAM3231	MOTION PLANNING, CONTROL SYSTEMS & AUTONOMOUS SIMULATION	AAM3	2	0	0	4	3	6	AIML / AAM2	Retained			Employability
4	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC4	26AAM3341	V2X COMMUNICATIONS & CONNECTED MOBILITY INTELLIGENCE	AAM4	2	0	0	4	3	6	AIML / AAM3	Retained			Employability

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5	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC5	26AAM3351	AGENTIC AI DEPLOYMENT, SAFETY ENGINEERING & FIELD INTEGRATION	AAM5	2	0	0	4	3	6	AIML / AAM(1-3)	Retained			Employability
6	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC1	26DIN3111	RF & WIRELESS COMMUNICATIONS ENGINEERING	DIN1	2	0	0	4	3	6	SGPS/ MCMS	Retained			Skill Development
7	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC2	26DIN3221	OFDM & MULTICARRIER WIRELESS SYSTEMS	DIN2	2	0	0	4	3	6	DIN1	Retained			Employability
8	5G/6G & DECENTRALISED INTELLIGENT NETWORK	PEC3	26DIN3231	5G NR SYSTEMS ARCHITECTURE & ENGINEERING	DIN3	2	0	0	4	3	6	DIN1	Retained			Skill Development

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	TIME ANALYTICS			LAKEHOUSE ARCHITECTURE												
22	DATA ENGINEERING & REAL TIME ANALYTICS	PEC2	26DRT3221	STREAMING DATA ENGINEERING & REAL-TIME EVENT PROCESSING	DRT2	2	0	0	4	3	6	DRT1	Retained			Employability
23	DATA ENGINEERING & REAL TIME ANALYTICS	PEC3	26DRT3231	DATA PIPELINE ORCHESTRATION, DATAOPS & OBSERVABILITY	DRT3	2	0	0	4	3	6	DRT1	Retained			Employability
24	DATA ENGINEERING & REAL TIME ANALYTICS	PEC4	26DRT3341	REAL-TIME ANALYTICS ENGINEERING & ANALYTICAL QUERY SYSTEMS	DRT4	2	0	0	4	3	6	DRT2 /DRT 3	Retained			Skill Development
25	DATA ENGINEERING & REAL TIME ANALYTICS	PEC5	26DRT3351	AI-AUGMENTED DATA ENGINEERING & INTELLIGENT DATA PLATFORMS	DRT5	2	0	0	4	3	6	DRT3 /DRT 4	Retained			Employability
26	APPLIED CYBER SECURITY	PEC1	26ACS3111	OFFENSIVE SECURITY & ETHICAL HACKING	ACS1	2	0	0	4	3	6	CNAS /OPSY	Retained			Skill Development

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	ENGINEERING															
9	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC4	26DIN3341	6G SYSTEMS ARCHITECTURE & INTELLIGENT RADIO ACCESS NETWORKS	DIN4	2	0	0	4	3	6	DIN2/ DIN3	Retained			Entrepreneurship
10	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC5	26DIN3351	AI-NATIVE WIRELESS NETWORKS & COGNITIVE RADIO ENGINEERING	DIN5	2	0	0	4	3	6	DIN3/ DIN4	Retained			Skill Development
11	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC1	26GSA3111	GPU ARCHITECTURE & CUDA PROGRAMMING	GSA1	2	0	0	4	3	6	COAA /DSA 1/C++	Retained			Employability
12	GPU SYSTEMS ENGINEERING &	PEC2	26GSA3221	ADVANCED GPU SYSTEMS & PERFORMANCE OPTIMIZATION	GSA2	2	0	0	4	3	6	GSA1	Retained			Skill Development

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	ENGINEERING															
27	APPLIED CYBER SECURITY ENGINEERING	PEC2	26ACS3221	VULNERABILITY ASSESSMENT & ADVANCED PENETRATION TESTING	ACS2	2	0	0	4	3	6	ACS1	Retained			Employability
28	APPLIED CYBER SECURITY ENGINEERING	PEC3	26ACS3231	DIGITAL FORENSICS & CYBER INCIDENT RESPONSE	ACS3	2	0	0	4	3	6	ACS1 /OPSY	Retained			Employability
29	APPLIED CYBER SECURITY ENGINEERING	PEC4	26ACS3341	SOC ENGINEERING & CYBER THREAT INTELLIGENCE	ACS4	2	0	0	4	3	6	ACS2 /ACS3	Retained			Skill Development
30	APPLIED CYBER SECURITY ENGINEERING	PEC5	26ACS3351	AI-DRIVEN SECURITY OPERATIONS & ZERO TRUST ARCHITECTURE	ACS5	2	0	0	4	3	6	ACS3 /ACS4	Retained			Employability
31	CLOUD NATIVE PLATFORM	PEC1	26CNP3111	KUBERNETES ORCHESTRATION &	CNP1	2	0	0	4	3	6	CDIS / OPSY	Retained			Employability

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	ENGINEERING			CLOUD-NATIVE ARCHITECTURE								/ CNAS				
32	CLOUD NATIVE PLATFORM ENGINEERING	PEC2	26CNP3221	ZERO TRUST SECURITY & CLOUD-NATIVE NETWORK ENGINEERING	CNP2	2	0	0	4	3	6	CNP1	Retained			Employability
33	CLOUD NATIVE PLATFORM ENGINEERING	PEC3	26CNP3231	PLATFORM ENGINEERING & INTERNAL DEVELOPER PLATFORMS	CNP3	2	0	0	4	3	6	CNP1	Retained			Skill Development
34	CLOUD NATIVE PLATFORM ENGINEERING	PEC4	26CNP3341	DISTRIBUTED SYSTEMS DESIGN & CLOUD-NATIVE DATA ENGINEERING	CNP4	2	0	0	4	3	6	CNP2 /CNP 3	Retained			Employability
35	CLOUD NATIVE PLATFORM ENGINEERING	PEC5	26CNP3351	HYPERSCALE CLOUD ARCHITECTURE & SITE RELIABILITY ENGINEERING	CNP4	2	0	0	4	3	6	CNP3 /CNP 4	Retained			Skill Development
36	GAME DEVELOPMENT &	PEC1	26GDI3111	GAME ENGINE ARCHITECTURE & REAL-	GDI1	2	0	0	4	3	6	DSA1 /OOP /Line	Retained			Employability

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	ACCELERATED AI COMPUTING															
13	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC3	26GSA3231	PARALLEL & HETEROGENEOUS COMPUTING SYSTEMS	GSA3	2	0	0	4	3	6		Retained			Employability
14	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC4	26GSA3341	HIGH-PERFORMANCE COMPUTING & DISTRIBUTED GPU CLUSTERS	GSA4	2	0	0	4	3	6	GSA1	Retained			Employability
15	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC5	26GSA3351	ACCELERATED AI INFERENCE & GPU PLATFORM ENGINEERING	GSA5	2	0	0	4	3	6	GSA2/GSA3	Retained			Entrepreneurship
16	DISTRIBUTED LEDGER & BLOCKCHAIN	PEC1	26DLB3111	DISTRIBUTED LEDGER & BLOCKCHAIN PROTOCOL ENGINEERING	DLB1	2	0	0	4	3	6	GSA3/GSA4	Retained			Entrepreneurship
												CNAS/OPSY/DSA1				

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	ENGINEERING															
17	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC2	26DLB3221	SMART CONTRACT ENGINEERING & WEB3 APPLICATION DEVELOPMENT	DLB2	2	0	0	4	3	6	DLB1	Retained			Employability
18	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC3	26DLB3231	SMART CONTRACT SECURITY, AUDITING & FORMAL VERIFICATION	DLB3	2	0	0	4	3	6	DLB1	Retained			Entrepreneurship
19	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC4	26DLB3341	DEFI PROTOCOL ENGINEERING, TOKENOMICS & CROSS-CHAIN SYSTEMS	DLB4	2	0	0	4	3	6	DLB2 /DLB 3	Retained			Skill Development
20	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC5	26DLB3351	ZERO-KNOWLEDGE PROOFS, LAYER 2 SCALING & AI-NATIVE BLOCKCHAIN SYSTEMS	DLB5	2	0	0	4	3	6	DLB3 /DLB 4	Retained			Employability
21	DATA ENGINEERING & REAL	PEC1	26DRT3111	ADVANCED DATA MODELING, WAREHOUSING &	DRT1	2	0	0	4	3	6	DBMS /DW HM	Retained			Skill Development

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	IMMERSIVE TECHNOLOGIES			TIME RENDERING SYSTEMS								ar Algebra				
37	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC2	26GDI3221	GAMEPLAY SYSTEMS ENGINEERING & NETWORKED MULTIPLAYER ARCHITECTURE	GDI2	2	0	0	4	3	6	GDI1	Retained			Entrepreneurship
38	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC3	26GDI3231	AI-DRIVEN GAME SYSTEMS: PROCEDURAL GENERATION & GENERATIVE CONTENT	GDI3	2	0	0	4	3	6	GDI1	Retained			Skill Development
39	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC4	26GDI3341	EXTENDED REALITY (XR) ENGINEERING: VR, AR & MIXED REALITY	GDI4	2	0	0	4	3	6	GDI2/ GDI3	Retained			Employability
40	GAME DEVELOPMENT & IMMERSIVE	PEC5	26GDI3351	CLOUD-NATIVE GAME PLATFORM ENGINEERING & LIVE OPERATIONS	GDI5	2	0	0	4	3	6	GDI3/ GDI4	Retained			Skill Development

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	TECHNOLOGIES															
41	QUANTUM COMPUTING	PEC1	26QNC3111	QUANTUM COMPUTING FOUNDATIONS: CIRCUITS, HARDWARE & QUBITS	QNC1	2	0	0	4	3	6	Linear algebra/Probability	Retained			Skill Development
42	QUANTUM COMPUTING	PEC2	26QNC3221	QUANTUM ALGORITHMS & COMPUTATIONAL COMPLEXITY	QNC2	2	0	0	4	3	6	QNC1	Retained			Employability
43	QUANTUM COMPUTING	PEC3	26QNC3231	QUANTUM ERROR CORRECTION & FAULT-TOLERANT COMPUTING	QNC3	2	0	0	4	3	6	QNC1	Retained			Employability
44	QUANTUM COMPUTING	PEC4	26QNC3341	QUANTUM CRYPTOGRAPHY, SECURE COMMUNICATIONS & QUANTUM NETWORKS	QNC4	2	0	0	4	3	6	QNC2 /QNC3	Retained			Entrepreneurship
45	QUANTUM COMPUTING	PEC5	26QNC3351	QUANTUM MACHINE LEARNING & INDUSTRIAL QUANTUM APPLICATIONS	QNC5	2	0	0	4	3	6	QNC3 /QNC4	Retained			Employability
46	EMBEDDED AND EDGE AI SYSTEMS	PEC1	26EEA3111	REAL-TIME EMBEDDED SYSTEMS AND RTOS	EEA1	2	0	0	4	3	6	C programming/Di	Retained			Skill Development

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												gital Logic				
47	EMBEDDED AND EDGE AI SYSTEMS	PEC2	26EEA3221	ADVANCED NETWORKED EMBEDDED SYSTEMS AND INDUSTRIAL PROTOCOLS	EEA2	2	0	0	4	3	6	EEA1	Retained			Employability
48	EMBEDDED AND EDGE AI SYSTEMS	PEC3	26EEA3231	SECURE AND RELIABLE EDGE AI SYSTEMS	EEA3	2	0	0	4	3	6	EEA1	Retained			Skill Development
49	EMBEDDED AND EDGE AI SYSTEMS	PEC4	26EEA3341	EDGE AI SYSTEMS - NPU ARCHITECTURE, DEPLOYMENT AND OPTMIZATION	EEA4	2	0	0	4	3	6	EEA2 /EEA 3	Retained			Entrepreneurship
50	EMBEDDED AND EDGE AI SYSTEMS	PEC5	26EEA3351	AGENTIC EMBEDDED SYSTEMS AND INTELLIGENT EDGE ORCHESTRATION	EEA5	2	0	0	4	3	6	EEA3 /EEA 4				
				VALUE ADDED COURSE 1 - SPORTS									Retained			Skill Development
1	NONE	SPORTS	26SP2101	ATHLETICS		0	0	0	2	0	2	NIL	Retained			Skill Development

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2	NONE	SPORTS	26SP2102	BASKETBALL		0	0	0	2	0	2	NIL	Retained			Skill Development
3	NONE	SPORTS	26SP2103	BADMINTON		0	0	0	2	0	2	NIL	Retained			Skill Development
4	NONE	SPORTS	26SP2104	CRICKET		0	0	0	2	0	2	NIL	Retained			Skill Development
5	NONE	SPORTS	26SP2105	CHESS		0	0	0	2	0	2	NIL	Retained			Skill Development
6	NONE	SPORTS	26SP2108	KABADDI		0	0	0	2	0	2	NIL	Retained			Skill Development
7	NONE	SPORTS	26SP2109	KHO-KHO		0	0	0	2	0	2	NIL	Retained			Skill Development
8	NONE	SPORTS	26SP2110	TENNIS		0	0	0	2	0	2	NIL	Retained			Skill Development
9	NONE	SPORTS	26SP2111	TABLE TENNIS		0	0	0	2	0	2	NIL	Retained			Skill Development

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10	NONE	SPORTS	26SP2113	THROWBALL		0	0	0	2	0	2	NIL	Retained			Skill Development
11	NONE	SPORTS	26SP2114	VOLLEYBALL		0	0	0	2	0	2	NIL	Retained			Skill Development
12	NONE	SPORTS	26SP2116	YOGA		0	0	0	2	0	2	NIL	Retained			Skill Development
13	NONE	SPORTS	26SP2106	FOOTBALL		0	0	0	2	0	2	NIL				
	TRACK			**VALUE ADDED COURSE 2 - TECHNICAL GLOBAL CERTIFICATION 1**									Retained			Skill Development
1	PIONEER	VAC	CERT-1	AWS CERTIFIED SOLUTIONS ARCHITECT – ASSOCIATE (SAA-C03)	AWS	0	0	0	2	0	2	NIL	Retained			Skill Development
2	PIONEER	VAC	CERT-1	ORACLE CERTIFIED PROFESSIONAL: JAVA SE 17 (1Z0-829)	ORACLE	0	0	0	2	0	2	NIL	Retained			Skill Development
3	VOYAGER	VAC	CERT-1	ORACLE DATABASE SQL CERTIFIED ASSOCIATE (1Z0-071)	ORACLE	0	0	0	2	0	2	NIL	Retained			Skill Development

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4	VOYAGER	VAC	CERT-1	MICROSOFT AZURE FUNDAMENTALS (AZ-900)	MICROSOFT	0	0	0	2	0	2	NIL	Retained			Skill Development
5	EXPLORER	VAC	CERT-1	CERTIFIED ASSOCIATE PYTHON PROGRAMMER (PCAP)	PYTHON INSTITUTE	0	0	0	2	0	2	NIL	Retained			Skill Development
6	EXPLORER	VAC	CERT-1	AWS CERTIFIED CLOUD PRACTITIONER (CLF-C02)	AWS	0	0	0	2	0	2	NIL	Retained			Skill Development
	TRACK			**VALUE ADDED COURSE 3 - TECHNICAL GLOBAL CERTIFICATION 2**												
1	PIONEER	VAC	CERT-2	AWS CERTIFIED DEVELOPER – ASSOCIATE (DVA-C02)	AWS	0	0	0	2	0	2	NIL	Retained			Skill Development
2	PIONEER	VAC	CERT-2	AWS CERTIFIED DATA ENGINEER – ASSOCIATE (DEA-C01)	AWS	0	0	0	2	0	2	NIL	Retained			Skill Development
3	VOYAGER	VAC	CERT-2	OPENJS NODE.JS APPLICATION DEVELOPER (JSNAD)	OPENJS	0	0	0	2	0	2	NIL	Retained			Skill Development
4	VOYAGER	VAC	CERT-2	MICROSOFT FABRIC DATA ENGINEER ASSOCIATE (DP-700)	MICROSOFT	0	0	0	2	0	2	NIL	Retained			Skill Development

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5	EXPLORER	VAC	CERT-2	MONGODB ASSOCIATE DEVELOPER	MONGODB	0	0	0	2	0	2	NIL	Retained			Skill Development
6	EXPLORER	VAC	CERT-2	CNCF KUBERNETES & CLOUD NATIVE ASSOCIATE (KCNA)	CNCF	0	0	0	2	0	2	NIL				
	TRACK			**VALUE ADDED COURSE 4 - TECHNICAL GLOBAL CERTIFICATION 3**									Retained			Skill Development
1	PIONEER	VAC	CERT-3	AWS CERTIFIED GENERATIVE AI DEVELOPER – PROFESSIONAL (AIP-C01)	AWS	0	0	0	2	0	2	NIL	Retained			Skill Development
2	PIONEER	VAC	CERT-3	AWS CERTIFIED MACHINE LEARNING ENGINEER – ASSOCIATE (MLA-C01)	AWS	0	0	0	2	0	2	NIL	Retained			Skill Development
3	VOYAGER	VAC	CERT-3	DATABRICKS CERTIFIED GENERATIVE AI ENGINEER ASSOCIATE	DATABRICKS	0	0	0	2	0	2	NIL	Retained			Skill Development
4	VOYAGER	VAC	CERT-3	MICROSOFT AZURE AI ENGINEER ASSOCIATE (AI-102/103)	MICROSOFT	0	0	0	2	0	2	NIL	Retained			Skill Development
5	EXPLORER	VAC	CERT-3	AWS CERTIFIED AI PRACTITIONER (AIF-C01)	AWS	0	0	0	2	0	2	NIL	Retained			Skill Development

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6	EXPLORER	VAC	CERT-3	NVIDIA CERTIFIED ASSOCIATE: AI INFRASTRUCTURE	NVIDIA	0	0	0	2	0	2	NIL				

Total number of courses =116
Percentage of Syllabus Revision= (Total No. of courses revised + new courses) *100/Total Courses = ((18+13)*100)/109 = 28.44%
Percentage of Courses focusing on Employability= 44*100/109=40.36%
Percentage of Courses focusing on Entrepreneurship = 14*100/109=12.84%
Percentage of Courses focusing on Skill Development = 51*100/109=46.78%

31/07/2024
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Annexure – 5

B.TECH 2025-26 ADMITTED BATCH CATEGORY WISE COURSE STRUCTURE

S.NO	SPECIALIZATION	CAT	Course Code	Course Title	Short Name	L	T	P	S	CR	CH	Pre Req
1	NONE	AUC	25UC0017	INDIAN ANCIENT KNOWLEDGE SYSTEMS - VEDIC MATHEMATICS	IKGS	2	0	0	0	0	2	NIL
2	NONE	AUC	25UC0032	INSIGHTS TO SUSTAINABLE DEVELOPMENT GOALS	ISDG	2	0	0	0	0	2	NIL
3	NONE	AUC	25UC0009	ECOLOGY AND ENVIRONMENT	ECEN	2	0	0	0	0	2	NIL
4	NONE	AUC	25UC0008	INDIAN CONSTITUTION	INCT	2	0	0	0	0	2	NIL
				TOTAL COURSES AND CREDITS		**4**				**0**		
5	NONE	HSS	25UC1203	DESIGN THINKING FOR INNOVATION	DTFI	0	0	4	0	2	4	NIL
6	NONE	HSS	25UC1102	LANGUAGE SKILLS FOR ENGINEERS	LSFE	0	0	4	0	2	4	NIL
7	NONE	HSS	25UC1204	COMMUNICATION SKILLS FOR ENGINEERS	CSFE	0	0	4	0	2	4	LSFE
8	NONE	HSS	FL	FOREIGN LANGUAGE	FRLG	3	0	0	0	3	3	NIL
9	NONE	HSS	25UC0026	HUMAN VALUES GENDER EQUITY AND PROFESSIONAL ETHICS	HVEG	2	0	0	0	2	2	NIL
10	NONE	HSS	ME	MANAGEMENT ELECTIVE	MGEL	4	0	0	0	4	4	NIL
				TOTAL COURSES AND CREDITS		**6**				**15**		
11	NONE	BSC	25MT1002	DISCRETE MATHEMATICS	DIMS	2	2	0	0	4	4	NIL

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12	NONE	BSC	25MT1001	LINEAR ALGEBRA AND CALCULUS FOR ENGINEERS	LACE	2	2	0	0	4	4	NIL
13	NONE	BSC	25MT1306	MATHEMATICS FOR DATA SCIENCE AND ANALYTICS	MFDS	2	2	0	0	4	4	DIMS
14	NONE	BSC	SCE-1	SCIENCE ELECTIVE - 1	SCE1	3	0	2	0	4	5	NIL
15	NONE	BSC	SCE-2	SCIENCE ELECTIVE - 2	SCE2	3	0	2	0	4	5	NIL
				TOTAL COURSES AND CREDITS		**5**				**20**		
16	NONE	ESC	25SC1101	PROBLEM SOLVING THROUGH C	PSTC	3	0	2	4	5	9	NIL
17	NONE	ESC	25EC1102	DIGITAL SYSTEM DESIGN	DISD	3	0	2	0	4	5	NIL
18	NONE	ESC	25EC1101	BASIC ELECTRICAL AND ELECTRONIC CIRCUITS	BEEC	3	0	2	0	4	5	NIL
19	NONE	ESC	25SC1203	DATA STRUCTURES	DAST	3	0	2	4	5	9	PSTC
20	NONE	ESC	25SC2007	PYTHON PROGRAMMING	PYPG	2	0	2	0	3	4	NIL
21	NONE	ESC	25EC1203	FUNDAMENTALS OF IOT AND SENSORS	FOIS	2	0	2	0	3	4	NIL
22	NONE	ESC	25ME1103	DESIGN TOOLS WORKSHOP	DTWP	0	0	4	0	2	4	NIL
23	NONE	ESC	25SC2006	OBJECT ORIENTED PROGRAMMING USING JAVA	OOPJ	2	0	0	4	3	6	PSTC
				TOTAL COURSES AND CREDITS		**8**				**29**		
24	NONE	PCC	25EC1204	COMPUTER ORGANIZATION AND ARCHITECTURE	COAA	3	0	0	0	3	3	NIL
25	NONE	PCC	25EC2206	EMBEDDED SYSTEM DESIGN AND IOT	EBSD	2	0	0	4	3	6	DISD

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26	NONE	PCC	25AD2102	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	AIML	3	0	2	0	4	5	PYPG
27	NONE	PCC	25CS2102	OPERATING SYSTEMS	OPSY	3	0	2	0	4	5	DISD
28	NONE	PCC	25CS2101	FRONT END DEVELOPMENT FRAMEWORKS FOR WEB APPLICATIONS	FEDF	0	0	2	4	2	6	DAST
29	NONE	PCC	25AD2101	DATABASE MANAGEMENT SYSTEMS	DBMS	2	0	2	0	3	4	DIMS
30	NONE	PCC	25CS2218	DESIGN AND ANALYSIS OF ALGORITHMS	DAAA	3	0	2	0	4	5	DAST
31	NONE	PCC	25CS3112	DEEP LEARNING WITH ACCELERATED COMPUTING	DLAC	2	0	0	4	3	6	AIML
32	NONE	PCC	25EC2308	EMBEDDED SOFTWARE DEVELOPMENT	ESDT	2	0	0	4	3	6	EBSD
33	NONE	PCC	25CS2204	COMPUTER NETWORKS AND SECURITY	CNAS	2	0	0	4	3	6	DIMS
34	NONE	PCC	25CS2206	CLOUD INFRASTRUCTURE AND SERVICES	CDIS	2	0	0	4	3	6	OPSY
35	NONE	PCC	25CS2203	BACK END ENGINEERING FOR FULL STACK WEB APPLICATIONS	BEFS	2	0	0	4	3	6	FEDF
36	NONE	PCC	25CS3216	ADVANCED DATA STRUCTURES AND ALGORITHMS	ADSA	3	0	2	0	4	5	DAST
37	NONE	PCC	25CS2309	BIG DATA ENGINEERING AND DATA PIPELINES	BEDP	3	0	2	0	4	5	MFDA

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38	NONE	PCC	25CS2207	GENERATIVE AI AND AI PLATFORM ENGINEERING	GAPE	2	0	0	4	3	6	AIML
39	NONE	PCC	25CS2310	CI/CD AND CLOUD DEVOPS	CICD	2	0	0	4	3	6	CDIS
40	NONE	PCC	25CS3214	NATURAL LANGUAGE PROCESSING AND LLM ENGINEERING	NLPL	2	0	0	4	3	6	GAPE
41	NONE	PCC	25CS4117	ADAPTIVE SOFTWARE ENGINEERING	ASEG	2	0	2	0	3	4	CICD
42	NONE	PCC	25CS3315	AGENTIC AI AND AUTONOMOUS ENTERPRISE SYSTEMS	AAAE	3	0	2	0	4	5	NLPL
				TOTAL COURSES AND CREDITS		**19**				**62**		
43	NONE	PEC	PE-1	PROFESSIONAL ELECTIVE - 1	PEC1	2	0	0	4	3	6	NIL
44	NONE	PEC	PE-2	PROFESSIONAL ELECTIVE - 2	PEC2	2	0	0	4	3	6	PE-1
45	NONE	PEC	PE-3	PROFESSIONAL ELECTIVE - 3	PEC3	2	0	0	4	3	6	PE-1
46	NONE	PEC	PE-4	PROFESSIONAL ELECTIVE - 4	PEC4	2	0	0	4	3	6	PE-1
47	NONE	PEC	PE-4	PROFESSIONAL ELECTIVE - 5	PEC5	2	0	0	4	3	6	PE-1
				TOTAL COURSES AND CREDITS		**5**				**15**		
48	NONE	PRI	25IE2040	SOCIAL INTERNSHIP	SOIP	0	0	0	4	0	4	NIL
49	NONE	PRI	25IE3041	TECHNICAL INTERNSHIP	TEIP	0	0	0	4	0	4	NIL
50	NONE	PRI	25IE4101	TERM PAPER	TMPR	0	0	6	0	3	6	NIL
51	NONE	PRI	25IE4053	CAPSTONE PROJECT - 1	CAP1	0	0	8	8	6	16	TMPR
52	NONE	PRI	25IE4054	CAPSTONE PROJECT - 2	CAP2	0	0	8	8	6	16	CAP1
				TOTAL COURSES AND CREDITS		**5**				**15**		
53	NONE	OEC	OE-1	OPEN ELECTIVE - 1	OEC1	4	0	0	0	4	4	NIL

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54	NONE	OEC	OE-2	OPEN ELECTIVE - 2	OEC2	4	0	0	0	4	4	NIL
				TOTAL COURSES AND CREDITS		**2**				**8**		
55	NONE	VAC	VAC-1	VALUE ADDED COURSE 1 - SPORTS	VAC1	0	0	0	2	0	2	NIL
56	NONE	VAC	VAC-2	VALUE ADDED COURSE 2 - TECHNICAL GLOBAL CERTIFICATION 1	VAC2	0	0	0	2	0	2	NIL
57	NONE	VAC	VAC-3	VALUE ADDED COURSE 3 - TECHNICAL GLOBAL CERTIFICATION 2	VAC3	0	0	0	2	0	2	NIL
58	NONE	VAC	VAC-4	VALUE ADDED COURSE 4 - TECHNICAL GLOBAL CERTIFICATION 3	VAC4	0	0	0	2	0	2	NIL
				TOTAL COURSES AND CREDITS		**4**				**0**		
				TOTAL NO. OF COURSES AND CREDITS		**58**				**164**		
				FOREIGN LANGUAGE								
1	NONE		25FL3055	GERMAN LANGUAGE	GL	3	0	0	0	3	3	NIL
2	NONE		25FL3058	JAPANESE LANGUAGE	JP	3	0	0	0	3	3	NIL
3	NONE		25FL3064	KOREAN LANGUAGE	KR	3	0	0	0	3	3	NIL
	STREAM			**MANAGEMENT ELECTIVE**								
1	AI-DRIVEN PRODUCT MANAGEMENT	MGEL	25MGPM03	AI BUSINESS MODELS, PRICING STRATEGY & MONETISATION	MPM3	4	0	0	0	4	4	OPM1+OPM2

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2	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	MGEL	25MGCA03	CREATIVE ENTREPRENEURSHIP & DIGITAL MEDIA VENTURE STRATEGY	MCA3	4	0	0	0	4	4	OCA1+OCA3
3	DIGITAL ECONOMICS & PLATFORM MARKET INTELLIGENCE	MGEL	25MGDE03	INNOVATION ECONOMICS, VENTURE STRATEGY & DISRUPTIVE MARKET DEVELOPMENT	MDE3	4	0	0	0	4	4	ODE1+ODE3
4	DIGITAL HEALTH & HEALTHCARE INFORMATICS	MGEL	25MGDH03	HEALTH POLICY, ETHICS & GLOBAL HEALTHCARE INNOVATION	MDH3	4	0	0	0	4	4	ODH1+ODH2
5	FINTECH & DIGITAL FINANCIAL SERVICES	MGEL	25MGFT03	INSURTECH, EMBEDDED FINANCE & OPEN BANKING	MFT3	4	0	0	0	4	4	OFT1+OFT2
6	PRECISION AGRICULTURE & AGRITECH	MGEL	25MGPA03	GLOBAL FOOD SYSTEMS, AGRICULTURAL POLICY & FOOD SECURITY	MPA3	4	0	0	0	4	4	OPA1+OPA2
7	SUPPLY CHAIN & LOGISTICS INTELLIGENCE	MGEL	25MGSC03	AI, BLOCKCHAIN & AUTONOMOUS SYSTEMS IN FUTURE SUPPLY CHAINS	MSC3	4	0	0	0	4	4	OSC1+OSC3
				SCIENCE ELECTIVES								
1	NONE	SCE-1 / SCE-2	25BS4001	INFORMATION THEORY & CODING	ITCD	3	0	2	0	4	5	P&S
2	NONE	SCE-1 / SCE-2	25BS4002	QUANTUM INFORMATION SCIENCE	QISC	3	0	2	0	4	5	Linear Algebra/Engineering physics
3	NONE	SCE-1 / SCE-2	25BS4003	ACTUARIAL SCIENCES	ACTS	3	0	2	0	4	5	P&S /Calculus

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4	NONE	SCE-1 / SCE-2	25BS4004	COMPUTATIONAL NEUROSCIENCE	CNUE	3	0	2	0	4	5	ODES/Basic Biology/Python
5	NONE	SCE-1 / SCE-2	25BS4005	COMPUTATIONAL BIOLOGY	COMB	3	0	2	0	4	5	Programming / Basic Biology
6	NONE	SCE-1 / SCE-2	25BS4006	SEMICONDUCTOR PHYSICS	SCPH	3	0	2	0	4	5	Engineering Physics / Basic Quantum
7	NONE	SCE-1 / SCE-2	25PH1005	ENGINEERING PHYSICS	EPHY	3	0	2	0	4	5	NIL
8	NONE	SCE-1 / SCE-2	25CY1001	ENGINEERING CHEMISTRY	ENGC	3	0	2	0	4	5	NIL
9	NONE	SCE-1 / SCE-2	25CY1002	ORGANIC & PHYSICAL CHEMISTRY FOR LIFE SCIENCES	OPCL	3	0	2	0	4	5	NIL
	STREAM			**OPEN ELECTIVES**								
1	AI-DRIVEN PRODUCT MANAGEMENT	OE-1	25OEPM01	FOUNDATIONS OF AI-DRIVEN PRODUCT THINKING	OPM1	4	0	0	0	4	4	NIL
2	AI-DRIVEN PRODUCT MANAGEMENT	OE-2	25OEPM02	PRODUCT STRATEGY & ROADMAPPING IN AI MARKETS	OPM2	4	0	0	0	4	4	NIL
3	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	OE-1	25OECA01	CREATIVE ECONOMY & THE DIGITAL ARTS INDUSTRY	OCA1	4	0	0	0	4	4	NIL
4	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	OE-2	25OECA02	MEDIA PRODUCTION BUSINESS, CONTENT STRATEGY & CREATOR ECONOMY	OCA2	4	0	0	0	4	4	OCA1
5	DIGITAL ECONOMICS & PLATFORM	OE-1	25OEDE01	PLATFORM ECONOMICS & BUSINESS MODEL DESIGN	ODE1	4	0	0	0	4	4	NIL

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	MARKET INTELLIGENCE											
6	DIGITAL ECONOMICS & PLATFORM MARKET INTELLIGENCE	OE-2	25OEDE02	MARKET INTELLIGENCE, COMPETITIVE ANALYTICS & STRATEGIC DECISION SCIENCE	ODE2	4	0	0	0	4	4	ODE1
7	DIGITAL HEALTH & HEALTHCARE INFORMATICS	OE-1	25OEDH01	HEALTHCARE SYSTEMS & DIGITAL HEALTH ECOSYSTEM	ODH1	4	0	0	0	4	4	NIL
8	DIGITAL HEALTH & HEALTHCARE INFORMATICS	OE-2	25OEDH02	HEALTHCARE DATA ANALYTICS & POPULATION HEALTH INTELLIGENCE	ODH2	4	0	0	0	4	4	ODH1
9	FINTECH & DIGITAL FINANCIAL SERVICES	OE-1	25OEFT01	FINANCIAL ECOSYSTEM & DIGITAL BUSINESS MODELS	OFT1	4	0	0	0	4	4	NIL
10	FINTECH & DIGITAL FINANCIAL SERVICES	OE-2	25OEFT02	DIGITAL PAYMENTS & TRANSACTION ECONOMICS	OFT2	4	0	0	0	4	4	OFT1
11	PRECISION AGRICULTURE & AGRITECH	OE-1	25OEPA01	AGRI-BUSINESS STRATEGY & FOOD VALUE CHAIN MANAGEMENT	OPA1	4	0	0	0	4	4	
12	PRECISION AGRICULTURE & AGRITECH	OE-2	25OEPA02	PRECISION AGRICULTURE & DATA-DRIVEN FARM MANAGEMENT	OPA2	4	0	0	0	4	4	OPA1
13	SUPPLY CHAIN & LOGISTICS INTELLIGENCE	OE-1	25OESC01	GLOBAL SUPPLY CHAIN STRATEGY & NETWORK DESIGN	OSC1	4	0	0	0	4	4	

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14	SUPPLY CHAIN & LOGISTICS INTELLIGENCE	OE-2	25OESC02	PROCUREMENT INTELLIGENCE & SUPPLIER ECOSYSTEM MANAGEMENT	OSC2	4	0	0	0	4	4	
	SPECIALIZATION			**PROFESSIONAL ELECTIVES**								
1	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC1	25AAM3111	AGENTIC AI SYSTEMS: ARCHITECTURES & REASONING FRAMEWORKS	AAM1	2	0	0	4	3	6	AIML / NLPL
2	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC2	25AAM3221	AUTONOMOUS PERCEPTION & MULTI-MODAL SENSOR FUSION	AAM2	2	0	0	4	3	6	AIML / DLAC
3	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC3	25AAM3231	MOTION PLANNING, CONTROL SYSTEMS & AUTONOMOUS SIMULATION	AAM3	2	0	0	4	3	6	AIML / AAM2
4	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC4	25AAM3341	V2X COMMUNICATIONS & CONNECTED MOBILITY INTELLIGENCE	AAM4	2	0	0	4	3	6	AIML / AAM3
5	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC5	25AAM3351	AGENTIC AI DEPLOYMENT, SAFETY ENGINEERING & FIELD INTEGRATION	AAM5	2	0	0	4	3	6	AIML / AAM(1-3)

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6	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC1	25DIN3111	RF & WIRELESS COMMUNICATIONS ENGINEERING	DIN1	2	0	0	4	3	6	SGPS/MCMS
7	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC2	25DIN3221	OFDM & MULTICARRIER WIRELESS SYSTEMS	DIN2	2	0	0	4	3	6	DIN1
8	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC3	25DIN3231	5G NR SYSTEMS ARCHITECTURE & ENGINEERING	DIN3	2	0	0	4	3	6	DIN1
9	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC4	25DIN3341	6G SYSTEMS ARCHITECTURE & INTELLIGENT RADIO ACCESS NETWORKS	DIN4	2	0	0	4	3	6	DIN2/DIN3
10	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC5	25DIN3351	AI-NATIVE WIRELESS NETWORKS & COGNITIVE RADIO ENGINEERING	DIN5	2	0	0	4	3	6	DIN3/DIN4

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11	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC1	25GSA3111	GPU ARCHITECTURE & CUDA PROGRAMMING	GSA1	2	0	0	4	3	6	COAA/DSA1/C++
12	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC2	25GSA3221	ADVANCED GPU SYSTEMS & PERFORMANCE OPTIMIZATION	GSA2	2	0	0	4	3	6	GSA1
13	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC3	25GSA3231	PARALLEL & HETEROGENEOUS COMPUTING SYSTEMS	GSA3	2	0	0	4	3	6	GSA1
14	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC4	25GSA3341	HIGH-PERFORMANCE COMPUTING & DISTRIBUTED GPU CLUSTERS	GSA4	2	0	0	4	3	6	GSA2/GSA3
15	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC5	25GSA3351	ACCELERATED AI INFERENCE & GPU PLATFORM ENGINEERING	GSA5	2	0	0	4	3	6	GSA3/GSA4
16	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC1	25DLB3111	DISTRIBUTED LEDGER & BLOCKCHAIN PROTOCOL ENGINEERING	DLB1	2	0	0	4	3	6	CNAS/OPSY/DSA1

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17	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC2	25DLB3221	SMART CONTRACT ENGINEERING & WEB3 APPLICATION DEVELOPMENT	DLB2	2	0	0	4	3	6	DLB1
18	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC3	25DLB3231	SMART CONTRACT SECURITY, AUDITING & FORMAL VERIFICATION	DLB3	2	0	0	4	3	6	DLB1
19	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC4	25DLB3341	DEFI PROTOCOL ENGINEERING, TOKENOMICS & CROSS-CHAIN SYSTEMS	DLB4	2	0	0	4	3	6	DLB2/DLB3
20	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC5	25DLB3351	ZERO-KNOWLEDGE PROOFS, LAYER 2 SCALING & AI-NATIVE BLOCKCHAIN SYSTEMS	DLB5	2	0	0	4	3	6	DLB3/DLB4
21	DATA ENGINEERING & REAL TIME ANALYTICS	PEC1	25DRT3111	ADVANCED DATA MODELING, WAREHOUSING & LAKEHOUSE ARCHITECTURE	DRT1	2	0	0	4	3	6	DBMS/DWHM
22	DATA ENGINEERING & REAL TIME ANALYTICS	PEC2	25DRT3221	STREAMING DATA ENGINEERING & REAL-TIME EVENT PROCESSING	DRT2	2	0	0	4	3	6	DRT1
23	DATA ENGINEERING & REAL TIME ANALYTICS	PEC3	25DRT3231	DATA PIPELINE ORCHESTRATION, DATAOPS & OBSERVABILITY	DRT3	2	0	0	4	3	6	DRT1

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24	DATA ENGINEERING & REAL TIME ANALYTICS	PEC4	25DRT3341	REAL-TIME ANALYTICS ENGINEERING & ANALYTICAL QUERY SYSTEMS	DRT4	2	0	0	4	3	6	DRT2/DRT3
25	DATA ENGINEERING & REAL TIME ANALYTICS	PEC5	25DRT3351	AI-AUGMENTED DATA ENGINEERING & INTELLIGENT DATA PLATFORMS	DRT5	2	0	0	4	3	6	DRT3/DRT4
26	APPLIED CYBER SECURITY ENGINEERING	PEC1	25ACS3111	OFFENSIVE SECURITY & ETHICAL HACKING	ACS1	2	0	0	4	3	6	CNAS/OPSY
27	APPLIED CYBER SECURITY ENGINEERING	PEC2	25ACS3221	VULNERABILITY ASSESSMENT & ADVANCED PENETRATION TESTING	ACS2	2	0	0	4	3	6	ACS1
28	APPLIED CYBER SECURITY ENGINEERING	PEC3	25ACS3231	DIGITAL FORENSICS & CYBER INCIDENT RESPONSE	ACS3	2	0	0	4	3	6	ACS1/OPSY
29	APPLIED CYBER SECURITY ENGINEERING	PEC4	25ACS3341	SOC ENGINEERING & CYBER THREAT INTELLIGENCE	ACS4	2	0	0	4	3	6	ACS2/ACS3
30	APPLIED CYBER SECURITY ENGINEERING	PEC5	25ACS3351	AI-DRIVEN SECURITY OPERATIONS & ZERO TRUST ARCHITECTURE	ACS5	2	0	0	4	3	6	ACS3/ACS4
31	CLOUD NATIVE PLATFORM ENGINEERING	PEC1	25CNP3111	KUBERNETES ORCHESTRATION & CLOUD-NATIVE ARCHITECTURE	CNP1	2	0	0	4	3	6	CDIS / OPSY / CNAS

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

S.NO	SPECIALIZATION	CAT	Course Code	Course Title	Short Name	L	T	P	S	CR	CH	Pre Req
32	CLOUD NATIVE PLATFORM ENGINEERING	PEC2	25CNP3221	ZERO TRUST SECURITY & CLOUD-NATIVE NETWORK ENGINEERING	CNP2	2	0	0	4	3	6	CNP1
33	CLOUD NATIVE PLATFORM ENGINEERING	PEC3	25CNP3231	PLATFORM ENGINEERING & INTERNAL DEVELOPER PLATFORMS	CNP3	2	0	0	4	3	6	CNP1
34	CLOUD NATIVE PLATFORM ENGINEERING	PEC4	25CNP3341	DISTRIBUTED SYSTEMS DESIGN & CLOUD-NATIVE DATA ENGINEERING	CNP4	2	0	0	4	3	6	CNP2/CNP3
35	CLOUD NATIVE PLATFORM ENGINEERING	PEC5	25CNP3351	HYPERSCALE CLOUD ARCHITECTURE & SITE RELIABILITY ENGINEERING	CNP4	2	0	0	4	3	6	CNP3/CNP4
36	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC1	25GDI3111	GAME ENGINE ARCHITECTURE & REAL-TIME RENDERING SYSTEMS	GDI1	2	0	0	4	3	6	DSA1/OOP/Linear Algebra
37	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC2	25GDI3221	GAMEPLAY SYSTEMS ENGINEERING & NETWORKED MULTIPLAYER ARCHITECTURE	GDI2	2	0	0	4	3	6	GDI1
38	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC3	25GDI3231	AI-DRIVEN GAME SYSTEMS: PROCEDURAL GENERATION & GENERATIVE CONTENT	GDI3	2	0	0	4	3	6	GDI1

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39	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC4	25GDI3341	EXTENDED REALITY (XR) ENGINEERING: VR, AR & MIXED REALITY	GDI4	2	0	0	4	3	6	GDI2/GDI3
40	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC5	25GDI3351	CLOUD-NATIVE GAME PLATFORM ENGINEERING & LIVE OPERATIONS	GDI5	2	0	0	4	3	6	GDI3/GDI4
41	QUANTUM COMPUTING	PEC1	25QNC3111	QUANTUM COMPUTING FOUNDATIONS: CIRCUITS, HARDWARE & QUBITS	QNC1	2	0	0	4	3	6	Linear algebra/Probability
42	QUANTUM COMPUTING	PEC2	25QNC3221	QUANTUM ALGORITHMS & COMPUTATIONAL COMPLEXITY	QNC2	2	0	0	4	3	6	QNC1
43	QUANTUM COMPUTING	PEC3	25QNC3231	QUANTUM ERROR CORRECTION & FAULT-TOLERANT COMPUTING	QNC3	2	0	0	4	3	6	QNC1
44	QUANTUM COMPUTING	PEC4	25QNC3341	QUANTUM CRYPTOGRAPHY, SECURE COMMUNICATIONS & QUANTUM NETWORKS	QNC4	2	0	0	4	3	6	QNC2/QNC3
45	QUANTUM COMPUTING	PEC5	25QNC3351	QUANTUM MACHINE LEARNING & INDUSTRIAL QUANTUM APPLICATIONS	QNC5	2	0	0	4	3	6	QNC3/QNC4
46	EMBEDDED AND EDGE AI SYSTEMS	PEC1	25EEA3111	REAL-TIME EMBEDDED SYSTEMS AND RTOS	EEA1	2	0	0	4	3	6	C programming/Digital Logic

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47	EMBEDDED AND EDGE AI SYSTEMS	PEC2	25EEA3221	ADVANCED NETWORKED EMBEDDED SYSTEMS AND INDUSTRIAL PROTOCOLS	EEA2	2	0	0	4	3	6	EEA1
48	EMBEDDED AND EDGE AI SYSTEMS	PEC3	25EEA3231	SECURE AND RELIABLE EDGE AI SYSTEMS	EEA3	2	0	0	4	3	6	EEA1
49	EMBEDDED AND EDGE AI SYSTEMS	PEC4	25EEA3341	EDGE AI SYSTEMS - NPU ARCHITECTURE, DEPLOYMENT AND OPTMIZATION	EEA4	2	0	0	4	3	6	EEA2/EEA3
50	EMBEDDED AND EDGE AI SYSTEMS	PEC5	25EEA3351	AGENTIC EMBEDDED SYSTEMS AND INTELLIGENT EDGE ORCHESTRATION	EEA5	2	0	0	4	3	6	EEA3/EEA4
				VALUE ADDED COURSE 1 - SPORTS								
1	NONE	SPORTS	25SP2101	ATHLETICS		0	0	0	2	0	2	NIL
2	NONE	SPORTS	25SP2102	BASKETBALL		0	0	0	2	0	2	NIL
3	NONE	SPORTS	25SP2103	BADMINTON		0	0	0	2	0	2	NIL
4	NONE	SPORTS	25SP2104	CRICKET		0	0	0	2	0	2	NIL
5	NONE	SPORTS	25SP2105	CHESS		0	0	0	2	0	2	NIL
6	NONE	SPORTS	25SP2108	KABADDI		0	0	0	2	0	2	NIL
7	NONE	SPORTS	25SP2109	KHO-KHO		0	0	0	2	0	2	NIL
8	NONE	SPORTS	25SP2110	TENNIS		0	0	0	2	0	2	NIL
9	NONE	SPORTS	25SP2111	TABLE TENNIS		0	0	0	2	0	2	NIL
10	NONE	SPORTS	25SP2113	THROWBALL		0	0	0	2	0	2	NIL

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S.NO	SPECIALIZATION	CAT	Course Code	Course Title	Short Name	L	T	P	S	CR	CH	Pre Req
11	NONE	SPORTS	25SP2114	VOLLEYBALL		0	0	0	2	0	2	NIL
12	NONE	SPORTS	25SP2116	YOGA		0	0	0	2	0	2	NIL
13	NONE	SPORTS	25SP2106	FOOTBALL		0	0	0	2	0	2	NIL
	TRACK			**VALUE ADDED COURSE 2 - TECHNICAL GLOBAL CERTIFICATION 1**								
1	PIONEER	VAC	CERT-1	AWS CERTIFIED SOLUTIONS ARCHITECT – ASSOCIATE (SAA-C03)	AWS	0	0	0	2	0	2	NIL
2	PIONEER	VAC	CERT-1	ORACLE CERTIFIED PROFESSIONAL: JAVA SE 17 (1Z0-829)	ORACLE	0	0	0	2	0	2	NIL
3	VOYAGER	VAC	CERT-1	ORACLE DATABASE SQL CERTIFIED ASSOCIATE (1Z0-071)	ORACLE	0	0	0	2	0	2	NIL
4	VOYAGER	VAC	CERT-1	MICROSOFT AZURE FUNDAMENTALS (AZ-900)	MICROSOFT	0	0	0	2	0	2	NIL
5	EXPLORER	VAC	CERT-1	CERTIFIED ASSOCIATE PYTHON PROGRAMMER (PCAP)	PYTHON INSTITUTE	0	0	0	2	0	2	NIL
6	EXPLORER	VAC	CERT-1	AWS CERTIFIED CLOUD PRACTITIONER (CLF-C02)	AWS	0	0	0	2	0	2	NIL
	TRACK			**VALUE ADDED COURSE 3 - TECHNICAL GLOBAL CERTIFICATION 2**								

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1	PIONEER	VAC	CERT-2	AWS CERTIFIED DEVELOPER – ASSOCIATE (DVA-C02)	AWS	0	0	0	2	0	2	NIL
2	PIONEER	VAC	CERT-2	AWS CERTIFIED DATA ENGINEER – ASSOCIATE (DEA-C01)	AWS	0	0	0	2	0	2	NIL
3	VOYAGER	VAC	CERT-2	OPENJS NODE.JS APPLICATION DEVELOPER (JSNAD)	OPENJS	0	0	0	2	0	2	NIL
4	VOYAGER	VAC	CERT-2	MICROSOFT FABRIC DATA ENGINEER ASSOCIATE (DP-700)	MICROSOFT	0	0	0	2	0	2	NIL
5	EXPLORER	VAC	CERT-2	MONGODB ASSOCIATE DEVELOPER	MONGODB	0	0	0	2	0	2	NIL
6	EXPLORER	VAC	CERT-2	CNCF KUBERNETES & CLOUD NATIVE ASSOCIATE (KCNA)	CNCF	0	0	0	2	0	2	NIL
TRACK				**VALUE ADDED COURSE 4 - TECHNICAL GLOBAL CERTIFICATION 3**								
1	PIONEER	VAC	CERT-3	AWS CERTIFIED GENERATIVE AI DEVELOPER – PROFESSIONAL (AIP-C01)	AWS	0	0	0	2	0	2	NIL
2	PIONEER	VAC	CERT-3	AWS CERTIFIED MACHINE LEARNING ENGINEER – ASSOCIATE (MLA-C01)	AWS	0	0	0	2	0	2	NIL
3	VOYAGER	VAC	CERT-3	DATABRICKS CERTIFIED GENERATIVE AI ENGINEER ASSOCIATE	DATABRICKS	0	0	0	2	0	2	NIL

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4	VOYAGER	VAC	CERT-3	MICROSOFT AZURE AI ENGINEER ASSOCIATE (AI-102/103)	MICROSOFT	0	0	0	2	0	2	NIL
5	EXPLORER	VAC	CERT-3	AWS CERTIFIED AI PRACTITIONER (AIF-C01)	AWS	0	0	0	2	0	2	NIL
6	EXPLORER	VAC	CERT-3	NVIDIA CERTIFIED ASSOCIATE: AI INFRASTRUCTURE	NVIDIA	0	0	0	2	0	2	NIL

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B.TECH 2025-26 ADMITTED BATCH CATEGORY WISE COURSE STRUCTURE (PBL)

Sl No	SPECIALIZATION	CAT	COURSE CODE	COURSE TITLE	ACR	L	T	P	S	Cr	CH	PRE-REQ	PBL
1	NONE	AUC	25UC0032E	INSIGHTS TO SUSTAINABLE DEVELOPMENT GOALS	ISDG	2	0	0	0	0	2	NIL	
2	NONE	AUC	25UC0017E	INDIAN KNOWLEDGE SYSTEMS	IKGS	2	0	0	0	0	2	NIL	
3	NONE	AUC	25UC0009E	ECOLOGY AND ENVIRONMENT	ECEN	2	0	0	0	0	2	NIL	
4	NONE	AUC	25UC0008E	INDIAN CONSTITUTION	INCT	2	0	0	0	0	2	NIL	ACTV
5	NONE	BSC	25MT1002E	DISCRETE MATHEMATICS	DMS	2	0	4	0	4	6	NIL	CASE
6	NONE	BSC	25MT1205E	MATHEMATICS FOR AI	MFAI	2	0	4	0	4	6	DMS	CASE
7	NONE	BSC	25MT1306E	MATHEMATICS FOR DATA SCIENCE AND ANALYTICS	MFDS	2	0	4	0	4	6	DMS	CASE
8	NONE	BSC	SCI-1	SCIENCE ELECTIVE - 1	SCE1	2	0	4	0	4	6	NIL	
9	NONE	BSC	SCI-2	SCIENCE ELECTIVE - 2	SCE2	2	0	4	0	4	6	NIL	CASE
10	NONE	ESC	25SC1105E	PROBLEM SOLVING THROUGH PROGRAMMING (JAVA)	PSPJ	2	0	2	6	4.5	10	NIL	CAPS
11	NONE	ESC	25SC1104E	FUNDAMENTALS OF WEB DEVELOPMENT	FOWD	2	0	0	6	3.5	8	NIL	FULL
12	NONE	ESC	25SC1204E	DATA STRUCTURES AND ALGORITHMS - 1	DSA1	2	0	2	4	4	8	PSPJ	CASE
13	NONE	ESC	25CS1201E	FRONT END DEVELOPMENT FRAMEWORKS AND UI ENGINEERING	FDFU	0	0	4	4	3	8	FOWD	FULL
14	NONE	ESC	25EC2101E	DIGITAL DESIGN AND COMPUTER ARCHITECTURE	DDCA	2	0	0	4	3	6	NIL	FULL
15	NONE	ESC	25SC1306E	COMPUTATIONAL FOUNDATIONS FOR ARTIFICIAL INTELLIGENCE	CFAI	2	0	0	4	3	6	MFAI	CASE

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16	NONE	ESC	25SC1305E	DATA STRUCTURES AND ALGORITHMS - 2	DSA2	2	0	2	4	4	8	DSA1	CASE
17	NONE	ESC	25SC2107E	MACHINE LEARNING	MLNG	2	0	2	4	4	8	CFAI	CASE
18	NONE	HSS	25UC1203E	DESIGN THINKING FOR INNOVATION	DTFI	0	0	4	0	2	4	NIL	ACTV
19	NONE	HSS	25UC1102E	LANGUAGE SKILLS FOR ENGINEERS	LSFE	0	0	4	0	2	4	NIL	ACTV
20	NONE	HSS	25UC1204E	COMMUNICATION SKILLS FOR ENGINEERS	CSFE	0	0	4	0	2	4	LSFE	ACTV
21	NONE	HSS	FLP-1	FOREIGN LANGUAGE PROFICIENCY - 1	FLP1	0	0	4	0	2	4	NIL	ACTV
22	NONE	HSS	FLP-2	FOREIGN LANGUAGE PROFICIENCY - 2	FLP2	0	0	4	0	2	4	FLP-1	ACTV
23	NONE	HSS	ME	MANAGEMENT ELECTIVE	MGEL	2	0	4	0	4	6	NIL	CASE
24	NONE	HSS	25UC0026E	HUMAN VALUES, GENDER EQUALITY & PROFESSIONAL ETHICS	HGPE	2	0	0	0	2	2	NIL	ACTV
25	NONE	OEC	OE-1	OPEN ELECTIVE - 1	OEC1	2	0	4	0	4	6	NIL	CASE
26	NONE	OEC	OE-2	OPEN ELECTIVE - 2	OEC2	2	0	4	0	4	6	NIL	CASE
27	NONE	PCC	25CS1302E	DATABASE SYSTEMS ENGINEERING AND DISTRIBUTED BACKEND DEVELOPMENT	DEDB	2	0	2	4	4	8	DMS	FULL
28	NONE	PCC	25CS2103E	DATA STRUCTURES AND ALGORITHMS - 3	DSA3	2	0	2	4	4	8	DSA2	CASE
29	NONE	PCC	25EC2206E	EMBEDDED SYSTEM DESIGN AND IOT	EBSD	2	0	0	8	4	10	DDCA	FULL

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30	NONE	PCC	25CS2104E	OPERATING SYSTEMS AND SYSTEMS PROGRAMMING	OSSP	2	0	2	4	4	8	DDCA	CAPS
31	NONE	PCC	25CS2205E	ADVANCED OBJECT ORIENTED PROGRAMMING	AOOP	2	0	2	4	4	8	PSPJ	CASE
32	NONE	PCC	25CS2206E	CLOUD INFRASTRUCTURE AND SERVICES	CDIS	2	0	2	4	4	8	OSSP	CASE
33	NONE	PCC	25CS2208E	COMPUTER NETWORKS AND NETWORK PROGRAMMING	CNNP	2	0	0	4	3	8	DMS	CAPS
34	NONE	PCC	25CS2207E	GENERATIVE AI AND AI PLATFORM ENGINEERING	GALE	2	0	0	8	4	10	MLNG	CASE
35	NONE	PCC	25CS2309E	BIG DATA ENGINEERING AND DATA PIPELINES	BEDP	2	0	0	8	4	10	MFDA	CASE
36	NONE	PCC	25CS2310E	CI/CD AND CLOUD DEVOPS	CICD	2	0	0	4	3	8	CDIS	FULL
37	NONE	PCC	25EC2308E	EMBEDDED SOFTWARE DEVELOPMENT	ESDT	2	0	0	8	4	10	EBSD	FULL
38	NONE	PCC	25CS2311E	SYSTEM DESIGN FOR SCALABILITY AND RELIABILITY	SDSR	2	0	2	4	4	8	AOOP	CASE
39	NONE	PCC	25CS3112E	DEEP LEARNING WITH ACCELERATED COMPUTING	DLAC	2	0	0	8	4	10	MLNG	CASE
40	NONE	PCC	25CS3113E	EMBEDDED AI AND TINY ML	EATM	2	0	0	8	4	10	EBSD	CASE
41	NONE	PCC	25EC3111E	FOUNDATIONS OF ROBOTICS AND MECHATRONIC SYSTEMS	FRMS	2	0	0	4	3	6	EBSD	CASE
42	NONE	PCC	25CS3214E	NATURAL LANGUAGE PROCESSING AND LLM ENGINEERING	NLPL	2	0	0	8	4	10	GALE	CASE
43	NONE	PCC	25EC3214E	ROBOTIC PERCEPTION, COMPUTER VISION AND SENSOR FUSION	RPCS	2	0	0	4	3	8	FRMS	FULL

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44	NONE	PCC	25CS3315E	AGENTIC AI AND AUTONOMOUS ENTERPRISE SYSTEMS	AAAE	2	0	2	4	4	8	NLPL	FULL
45	NONE	PCC	25EC3316E	ROBOTIC MOTION PLANNING, NAVIGATION AND CONTROL SYSTEMS	RMNC	2	0	2	4	4	8	FRMS	FULL
46	NONE	PCC	25EC4117E	AUTONOMOUS ROBOTIC SYSTEMS AND HUMAN-ROBOT INTERACTION	ARHR	2	0	0	4	3	8	FRMS	FULL
47	NONE	PCC	25CS4117E	ADAPTIVE SOFTWARE ENGINEERING	ASEG	2	0	0	4	3	8	CICD	FULL
48	NONE	PCC	25EC4119E	AGENTIC EMBEDDED SYSTEMS AND INTELLIGENT EDGE ORCHESTRATION	AEEO	2	0	0	8	4	10	EATM	FULL
49	NONE	PEC	PE-1	PROFESSIONAL ELECTIVE - 1	PEC1	2	0	0	4	3	8	NIL	
50	NONE	PEC	PE-2	PROFESSIONAL ELECTIVE - 2	PEC2	2	0	0	4	3	8	PEC1	
51	NONE	PEC	PE-3	PROFESSIONAL ELECTIVE - 3	PEC3	2	0	0	4	3	8	PEC1	
52	NONE	PEC	PE-4	PROFESSIONAL ELECTIVE - 4	PEC4	2	0	0	4	3	8	PEC1	
53	NONE	PEC	PE-5	PROFESSIONAL ELECTIVE - 5	PEC5	2	0	0	4	3	8	PEC1	
54	NONE	PRI	25IE2040E	SOCIAL INTERNSHIP	SOIP	0	0	0	4	0	4	NIL	
55	NONE	PRI	25IE3041E	TECHNICAL INTERNSHIP	TEIP	0	0	0	8	0	8	NIL	
56	NONE	PRI	25IE4042E	RESEARCH / INDUSTRIAL INTERNSHIP	INTP	0	0	0	8	0	8	NIL	
57	NONE	PRI	25IE4101E	TERM PAPER	TMPR	0	0	6	0	3	6	NIL	
58	NONE	PRI	25IE4053E	CAPSTONE PROJECT - 1	CAP1	0	0	8	8	6	16	TMPR	FULL
59	NONE	PRI	25IE4054E	CAPSTONE PROJECT - 2	CAP2	0	0	8	8	6	16	CAP1	FULL
60	NONE	VAC	VAC-1	VALUE ADDED COURSE 1 - SPORTS	VAC1	0	0	0	2	0	2	NIL	

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Sl No	SPECIALIZATION	CAT	COURSE CODE	COURSE TITLE	ACR	L	T	P	S	Cr	CH	PRE-REQ	PBL
61	NONE	VAC	VAC-2	VALUE ADDED COURSE 2 - TECHNICAL GLOBAL CERTIFICATION 1	VAC2	0	0	0	2	0	2	NIL	
62	NONE	VAC	VAC-3	VALUE ADDED COURSE 3 - TECHNICAL GLOBAL CERTIFICATION 2	VAC3	0	0	0	2	0	2	NIL	
63	NONE	VAC	VAC-4	VALUE ADDED COURSE 4 - TECHNICAL GLOBAL CERTIFICATION 3	VAC4	0	0	0	2	0	2	NIL	
64	NONE	VAC	VAC-5	VALUE ADDED COURSE 5 - TECHNICAL GLOBAL CERTIFICATION 4	VAC5	0	0	0	2	0	2	NIL	
				FOREIGN LANGUAGE									
1	NONE		25FL1301E	GERMAN LANGUAGE PROFICIENCY - 1	GLP1	0	0	4	0	2	4	NIL	
2	NONE		25FL1302E	JAPANESE LANGUAGE PROFICIENCY - 1	JLP1	0	0	4	0	2	4	NIL	
3	NONE		25FL1303E	KOREAN LANGUAGE PROFICIENCY - 1	KLP1	0	0	4	0	2	4	NIL	
4	NONE		25FL2111E	GERMAN LANGUAGE PROFICIENCY - 2	GLP2	0	0	4	0	2	4	NIL	
5	NONE		25FL2112E	JAPANESE LANGUAGE PROFICIENCY - 2	JLP2	0	0	4	0	2	4	NIL	
6	NONE		25FL2113E	KOREAN LANGUAGE PROFICIENCY - 2	KLP2	0	0	4	0	2	4	NIL	
				SCIENCE ELECTIVES									

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1	NONE	SCE-1 / SCE-2	25BS4001E	INFORMATION THEORY & CODING	ITCD	2	0	4	0	4	6	P&S	
2	NONE	SCE-1 / SCE-2	25BS4002E	QUANTUM INFORMATION SCIENCE	QISC	2	0	4	0	4	6	Linear Algebra/Engineering physics	
3	NONE	SCE-1 / SCE-2	25BS4003E	ACTUARIAL SCIENCES	ACTS	2	0	4	0	4	6	P&S /Calculus	
4	NONE	SCE-1 / SCE-2	25BS4004E	COMPUTATIONAL NEUROSCIENCE	CNUE	2	0	4	0	4	6	ODES/Basic Biology/Python	
5	NONE	SCE-1 / SCE-2	25BS4005E	COMPUTATIONAL BIOLOGY	COMB	2	0	4	0	4	6	Programming / Basic Biology	
6	NONE	SCE-1 / SCE-2	25BS4006E	SEMICONDUCTOR PHYSICS	SCPH	2	0	4	0	4	6	Engineering Physics / Basic Quantum	
				OPEN ELECTIVES & MANAGEMENT ELECTIVE									
1	FINTECH & DIGITAL FINANCIAL SERVICES	OE-1	25OEFT01E	FINANCIAL ECOSYSTEM & DIGITAL BUSINESS MODELS	OFT1	2	0	4	0	4	6	NIL	

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2	FINTECH & DIGITAL FINANCIAL SERVICES	OE-2	25OEFT02E	DIGITAL PAYMENTS & TRANSACTION ECONOMICS	OFT2	2	0	4	0	4	6	OFT1	
3	FINTECH & DIGITAL FINANCIAL SERVICES	MGEL	25MGFT03E	INSURTECH, EMBEDDED FINANCE & OPEN BANKING	MFT3	2	0	4	0	4	6	OFT1+OFT2	
4	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	OE-1	25OECA01E	CREATIVE ECONOMY & THE DIGITAL ARTS INDUSTRY	OCA1	2	0	4	0	4	6	NIL	
5	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	OE-2	25OECA02E	MEDIA PRODUCTION BUSINESS, CONTENT STRATEGY & CREATOR ECONOMY	OCA2	2	0	4	0	4	6	OCA1	
6	COMPUTATIONAL ARTS & DIGITAL CREATIVE MEDIA	MGEL	25MGCA03E	CREATIVE ENTREPRENEURSHIP & DIGITAL MEDIA VENTURE STRATEGY	MCA3	2	0	4	0	4	6	OCA1+OCA3	
7	DIGITAL ECONOMICS & PLATFORM MARKET INTELLIGENCE	OE-1	25OEDE01E	PLATFORM ECONOMICS & BUSINESS MODEL DESIGN	ODE1	2	0	4	0	4	6	NIL	
8	DIGITAL ECONOMICS & PLATFORM MARKET INTELLIGENCE	OE-2	25OEDE02E	MARKET INTELLIGENCE, COMPETITIVE ANALYTICS & STRATEGIC DECISION SCIENCE	ODE2	2	0	4	0	4	6	ODE1	
9	DIGITAL ECONOMICS &	MGEL	25MGDE03E	INNOVATION ECONOMICS, VENTURE STRATEGY &	MDE3	2	0	4	0	4	6	ODE1+ODE3	

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	PLATFORM MARKET INTELLIGENCE			DISRUPTIVE MARKET DEVELOPMENT									
10	DIGITAL HEALTH & HEALTHCARE INFORMATICS	OE-1	25OEDH01E	HEALTHCARE SYSTEMS & DIGITAL HEALTH ECOSYSTEM	OODH1	2	0	4	0	4	6	NIL	
11	DIGITAL HEALTH & HEALTHCARE INFORMATICS	OE-2	25OEDH02E	HEALTHCARE DATA ANALYTICS & POPULATION HEALTH INTELLIGENCE	ODH2	2	0	4	0	4	6	OODH1	
12	DIGITAL HEALTH & HEALTHCARE INFORMATICS	MGEL	25MGDH03E	HEALTH POLICY, ETHICS & GLOBAL HEALTHCARE INNOVATION	MDH3	2	0	4	0	4	6	ODH1+ODH2	
13	AI DRIVEN PRODUCT MANAGEMENT	OE-1	25OEPM01E	FOUNDATIONS OF AI-DRIVEN PRODUCT THINKING	OPM1	2	0	4	0	4	6	NIL	
14	AI DRIVEN PRODUCT MANAGEMENT	OE-2	25OEPM02E	PRODUCT STRATEGY & ROADMAPPING IN AI MARKETS	OPM2	2	0	4	0	4	6	NIL	
15	AI DRIVEN PRODUCT MANAGEMENT	MGEL	25MGPM03E	AI BUSINESS MODELS, PRICING STRATEGY & MONETISATION	MPM3	2	0	4	0	4	6	OPM1+OPM2	
16	SUPPLY CHAIN LOGISTICS INTELLIGENCE	OE-1	25OESC01E	GLOBAL SUPPLY CHAIN STRATEGY & NETWORK DESIGN	OSC1	2	0	4	0	4	6	0	
17	SUPPLY CHAIN LOGISTICS INTELLIGENCE	OE-2	25OESC02E	PROCUREMENT INTELLIGENCE & SUPPLIER ECOSYSTEM MANAGEMENT	OSC2	2	0	4	0	4	6	0	

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18	SUPPLY CHAIN LOGISTICS INTELLIGENCE	MGEL	25MGSC03E	AI, BLOCKCHAIN & AUTONOMOUS SYSTEMS IN FUTURE SUPPLY CHAINS	MSC3	2	0	4	0	4	6	OSC1+OSC3	
19	PRECISION AGRICULTURE & AGRITECH	OE-1	25OEPA01E	AGRI-BUSINESS STRATEGY & FOOD VALUE CHAIN MANAGEMENT	OPA1	2	0	4	0	4	6	0	
20	PRECISION AGRICULTURE & AGRITECH	OE-2	25OEPA02E	PRECISION AGRICULTURE & DATA-DRIVEN FARM MANAGEMENT	OPA2	2	0	4	0	4	6	OPA1	
21	PRECISION AGRICULTURE & AGRITECH	MGEL	25MGPA03E	GLOBAL FOOD SYSTEMS, AGRICULTURAL POLICY & FOOD SECURITY	MPA3	2	0	4	0	4	6	OPA1+OPA2	
				PROFESSIONAL ELECTIVES									
1	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC1	25AAM3111E	AGENTIC AI SYSTEMS: ARCHITECTURES & REASONING FRAMEWORKS	AIML / NLPL	2	0	0	4	3	6	AIML/NLPL	
2	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC2	25AAM3221E	AUTONOMOUS PERCEPTION & MULTI-MODAL SENSOR FUSION	AIML / DLAC	2	0	0	4	3	6	AAM1/DLAC	
3	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC3	25AAM3231E	MOTION PLANNING, CONTROL SYSTEMS & AUTONOMOUS SIMULATION	AIML / AAM 2	2	0	0	4	3	6	AAM1/AAM2	
4	AGENTIC AI & AUTONOMOUS	PEC4	25AAM3341E	V2X COMMUNICATIONS & CONNECTED MOBILITY INTELLIGENCE	AIML /	2	0	0	4	3	6	AAM1/AAM3	

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	MOBILITY ENGINEERING				AAM 3								
5	AGENTIC AI & AUTONOMOUS MOBILITY ENGINEERING	PEC5	25AAM3351E	AGENTIC AI DEPLOYMENT, SAFETY ENGINEERING & FIELD INTEGRATION	AIML / AAM(1-3)	2	0	0	4	3	6	AAM4/AAM1/AAM3	
14	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC1	25DIN3111E	RF & WIRELESS COMMUNICATIONS ENGINEERING	SGPS /MCMS	2	0	0	4	3	6	NIL	
15	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC2	25DIN3221E	OFDM & MULTICARRIER WIRELESS SYSTEMS	DIN1	2	0	0	4	3	6	DIN1	
16	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC3	25DIN3231E	5G NR SYSTEMS ARCHITECTURE & ENGINEERING	DIN1	2	0	0	4	3	6	DIN1	
17	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC4	25DIN3341E	6G SYSTEMS ARCHITECTURE & INTELLIGENT RADIO ACCESS NETWORKS	DIN2 /DIN 3	2	0	0	4	3	6	DIN2 or DIN3	

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18	5G/6G & DECENTRALISED INTELLIGENT NETWORK ENGINEERING	PEC5	25DIN3351E	AI-NATIVE WIRELESS NETWORKS & COGNITIVE RADIO ENGINEERING	DIN3 /DIN 4	2	0	0	4	3	6	DIN3 or DIN4	
19	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC1	25GSA3111E	GPU ARCHITECTURE & CUDA PROGRAMMING	COAA /DSA 1/C++	2	0	0	4	3	6	NIL	
20	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC2	25GSA3221E	ADVANCED GPU SYSTEMS & PERFORMANCE OPTIMIZATION	GSA1	2	0	0	4	3	6	GSA1	
21	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC3	25GSA3231E	PARALLEL & HETEROGENEOUS COMPUTING SYSTEMS	GSA1	2	0	0	4	3	6	GSA1	
22	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC4	25GSA3341E	HIGH-PERFORMANCE COMPUTING & DISTRIBUTED GPU CLUSTERS	GSA2 /GSA 3	2	0	0	4	3	6	GSA2 or GSA3	
23	GPU SYSTEMS ENGINEERING & ACCELERATED AI COMPUTING	PEC5	25GSA3351E	ACCELERATED AI INFERENCE & GPU PLATFORM ENGINEERING	GSA3 /GSA 4	2	0	0	4	3	6	GSA3 or GSA4	
24	DISTRIBUTED LEDGER &	PEC1	25DLB3111E	DISTRIBUTED LEDGER & BLOCKCHAIN PROTOCOL ENGINEERING	CNAS /OPS	2	0	0	4	3	6	NIL	

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	BLOCKCHAIN ENGINEERING				Y/DS A1								
25	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC2	25DLB3221E	SMART CONTRACT ENGINEERING & WEB3 APPLICATION DEVELOPMENT	DLB1	2	0	0	4	3	6	DLB1	
26	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC3	25DLB3231E	SMART CONTRACT SECURITY, AUDITING & FORMAL VERIFICATION	DLB1	2	0	0	4	3	6	DLB1	
27	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC4	25DLB3341E	DEFI PROTOCOL ENGINEERING, TOKENOMICS & CROSS-CHAIN SYSTEMS	DLB2 /DLB 3	2	0	0	4	3	6	DLB2 or DLB3	
28	DISTRIBUTED LEDGER & BLOCKCHAIN ENGINEERING	PEC5	25DLB3351E	ZERO-KNOWLEDGE PROOFS, LAYER 2 SCALING & AI-NATIVE BLOCKCHAIN SYSTEMS	DLB3 /DLB 4	2	0	0	4	3	6	DLB3 or DLB4	
29	DATA ENGINEERING & REAL TIME ANALYTICS	PEC1	25DRT3111E	ADVANCED DATA MODELING, WAREHOUSING & LAKEHOUSE ARCHITECTURE	DBMS /DW HM	2	0	0	4	3	6	NIL	
30	DATA ENGINEERING & REAL TIME ANALYTICS	PEC2	25DRT3221E	STREAMING DATA ENGINEERING & REAL-TIME EVENT PROCESSING	DRT1	2	0	0	4	3	6	DRT1	

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31	DATA ENGINEERING & REAL TIME ANALYTICS	PEC3	25DRT3231E	DATA PIPELINE ORCHESTRATION, DATAOPS & OBSERVABILITY	DRT1	2	0	0	4	3	6	DRT1	
32	DATA ENGINEERING & REAL TIME ANALYTICS	PEC4	25DRT3341E	REAL-TIME ANALYTICS ENGINEERING & ANALYTICAL QUERY SYSTEMS	DRT2 /DRT 3	2	0	0	4	3	6	DRT2 or DRT3	
33	DATA ENGINEERING & REAL TIME ANALYTICS	PEC5	25DRT3351E	AI-AUGMENTED DATA ENGINEERING & INTELLIGENT DATA PLATFORMS	DRT3 /DRT 4	2	0	0	4	3	6	DRT3 or DRT4	
34	APPLIED CYBER SECURITY ENGINEERING	PEC1	25ACS3111E	OFFENSIVE SECURITY & ETHICAL HACKING	CNAS /OPS Y	2	0	0	4	3	6	NIL	
35	APPLIED CYBER SECURITY ENGINEERING	PEC2	25ACS3221E	VULNERABILITY ASSESSMENT & ADVANCED PENETRATION TESTING	ACS1	2	0	0	4	3	6	ACS1	
36	APPLIED CYBER SECURITY ENGINEERING	PEC3	25ACS3231E	DIGITAL FORENSICS & CYBER INCIDENT RESPONSE	ACS1 /OPS Y	2	0	0	4	3	6	ACS1	
37	APPLIED CYBER SECURITY ENGINEERING	PEC4	25ACS3341E	SOC ENGINEERING & CYBER THREAT INTELLIGENCE	ACS2 /ACS 3	2	0	0	4	3	6	ACS2 or ACS3	
38	APPLIED CYBER SECURITY ENGINEERING	PEC5	25ACS3351E	AI-DRIVEN SECURITY OPERATIONS & ZERO TRUST ARCHITECTURE	ACS3 /ACS 4	2	0	0	4	3	6	ACS3 or ACS4	

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39	CLOUD NATIVE PLATFORM ENGINEERING	PEC1	25CNP3111E	KUBERNETES ORCHESTRATION & CLOUD-NATIVE ARCHITECTURE	CDIS / OPSY / CNAS	2	0	0	4	3	6	NIL	
40	CLOUD NATIVE PLATFORM ENGINEERING	PEC2	25CNP3221E	ZERO TRUST SECURITY & CLOUD-NATIVE NETWORK ENGINEERING	CNP1	2	0	0	4	3	6	CNP1	
41	CLOUD NATIVE PLATFORM ENGINEERING	PEC3	25CNP3231E	PLATFORM ENGINEERING & INTERNAL DEVELOPER PLATFORMS	CNP1	2	0	0	4	3	6	CNP1	
42	CLOUD NATIVE PLATFORM ENGINEERING	PEC4	25CNP3341E	DISTRIBUTED SYSTEMS DESIGN & CLOUD-NATIVE DATA ENGINEERING	CNP2 /CNP 3	2	0	0	4	3	6	CNP2 or CNP3	
43	CLOUD NATIVE PLATFORM ENGINEERING	PEC5	25CNP3351E	HYPERSCALE CLOUD ARCHITECTURE & SITE RELIABILITY ENGINEERING	CNP3 /CNP 4	2	0	0	4	3	6	CNP3 or CNP4	
44	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC1	25GDI3111E	GAME ENGINE ARCHITECTURE & REAL-TIME RENDERING SYSTEMS	DSA1 /OOP /Linear Algebra	2	0	0	4	3	6	NIL	
45	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC2	25GDI3221E	GAMEPLAY SYSTEMS ENGINEERING & NETWORKED MULTIPLAYER ARCHITECTURE	GDI1	2	0	0	4	3	6	GDI1	

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Sl No	SPECIALIZATION	CAT	COURSE CODE	COURSE TITLE	ACR	L	T	P	S	Cr	CH	PRE-REQ	PBL
46	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC3	25GDI3231E	AI-DRIVEN GAME SYSTEMS: PROCEDURAL GENERATION & GENERATIVE CONTENT	GDI1	2	0	0	4	3	6	GDI1	
47	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC4	25GDI3341E	EXTENDED REALITY (XR) ENGINEERING: VR, AR & MIXED REALITY	GDI2 /GDI 3	2	0	0	4	3	6	GDI2 or GDI3	
48	GAME DEVELOPMENT & IMMERSIVE TECHNOLOGIES	PEC5	25GDI3351E	CLOUD-NATIVE GAME PLATFORM ENGINEERING & LIVE OPERATIONS	GDI3 /GDI 4	2	0	0	4	3	6	GDI3 or GDI4	
49	QUANTUM COMPUTING	PEC1	25QNC3111E	QUANTUM COMPUTING FOUNDATIONS: CIRCUITS, HARDWARE & QUBITS	Linea r algeb ra/Pr obabi lity	2	0	0	4	3	6	NIL	
50	QUANTUM COMPUTING	PEC2	25QNC3221E	QUANTUM ALGORITHMS & COMPUTATIONAL COMPLEXITY	QNC1	2	0	0	4	3	6	QNC1	
51	QUANTUM COMPUTING	PEC3	25QNC3231E	QUANTUM ERROR CORRECTION & FAULT-TOLERANT COMPUTING	QNC1	2	0	0	4	3	6	QNC1	
52	QUANTUM COMPUTING	PEC4	25QNC3341E	QUANTUM CRYPTOGRAPHY, SECURE COMMUNICATIONS & QUANTUM NETWORKS	QNC2 /QNC 3	2	0	0	4	3	6	QNC2 or QNC3	

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Sl No	SPECIALIZATION	CAT	COURSE CODE	COURSE TITLE	ACR	L	T	P	S	Cr	CH	PRE-REQ	PBL
53	QUANTUM COMPUTING	PEC5	25QNC3351E	QUANTUM MACHINE LEARNING & INDUSTRIAL QUANTUM APPLICATIONS	QNC3 /QNC 4	2	0	0	4	3	6	QNC3 or QNC4	

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Annexure - 7

M.TECH 2026-27 ADMITTED BATCH CATEGORY WISE COURSE STRUCTURE

S.NO	CAT	Course Code	Course Title	Short Name	L	T	P	S	CR	CH	Pre Req	New/ Revised/Retained	Stake Holder	Justification for considering the feedback	EES
1	AUDIT	26UC5101E	COMMUNICATION SKILLS AND TECHNICAL WRITING	CSTW	2	0	2	0	0	4	NIL	New	FACULTY	-	SKILL DEVELOPMENT
2	AUDIT	26UC5302E	PLACEMENT TRAINING AND PROFESSIONAL READINESS	PTPR	2	0	2	0	0	4	NIL	New	INDUSTRY PERSON	-	EMPLOYABILITY
3	CORE	26CS5101E	COMPUTATIONAL THINKING AND PROGRAMMING	CTPG	3	1	3	0	4	7	NIL	New	INDUSTRY PERSON	-	EMPLOYABILITY
4	CORE	26CS5102E	OS, CONCURRENCY AND DISTRIBUTED SYSTEMS	OSDS	3	1	3	0	4	7	NIL	New	FACULTY	-	SKILL DEVELOPMENT

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S.NO	CAT	Course Code	Course Title	Short Name	L	T	P	S	CR	CH	Pre Req	New/ Revised/Retained	Stake Holder	Justification for considering the feedback	EES
5	CORE	26CS5103E	DATACENTRE NETWORKS AND INTERNET PROTOCOLS	DCNP	3	1	3	0	4	7	NIL	New	ACADEMIC PEER	-	EMPLOYABILITY
6	CORE	26CS5104E	AI AND MACHINE LEARNING WITH APPLIED MATHEMATICS	AIML	3	1	3	0	4	7	NIL	New	ACADEMIC PEER	-	EMPLOYABILITY
7	CORE	26CS5205E	FULL-STACK WEB ENGINEERING	FSWE	3	1	3	0	4	7	NIL	New	INDUSTRY PERSON	-	EMPLOYABILITY
8	CORE	26CS5206E	ALGORITHM ENGINEERING FOR DATA SYSTEMS	ALGO	3	1	3	0	4	7	CTPG	New	ACADEMIC PEER	-	SKILL DEVELOPMENT
9	CORE	26CS5207E	DEEP LEARNING AND NATURAL LANGUAGE PROCESSING	DLNP	3	1	3	0	4	7	AIML	New	INDUSTRY PERSON	-	EMPLOYABILITY

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10	CORE	26IE5201E	RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS	RMIP	3	0	0	0	3	3	NIL	New	FACULTY	-	ENTREPRENEURSHIP
11	CORE	26CS5308E	GENERATIVE AI AND LLM APPLICATION ENGINEERING	LLME	3	1	3	0	4	7	FSWE	New	ACADEMIC PEER	-	EMPLOYABILITY
12	CORE	26CS5309E	CLOUD SERVICES AND DEVOPS ENGINEERING	CDVO	3	1	3	0	4	7	OSDS, DCNP	New	INDUSTRY PERSON	-	SKILL DEVELOPMENT
13	CORE	26CS5310E	DATA SCIENCE AND ANALYTICS ENGINEERING AT SCALE	DSAS	3	1	3	0	4	7	NIL	New	INDUSTRY PERSON	-	ENTREPRENEURSHIP
14	CORE	26CS6111E	AGENTIC AI, MCP AND MULTIMODAL ENGINEERING	AGAI	3	1	3	0	4	7	LLME	New	ACADEMIC PEER	-	EMPLOYABILITY

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15	CORE	26CS6112E	HIGH-PERFORMANCE COMPUTING SYSTEMS	HPCS	3	1	3	0	4	7	OSDS, DCNP	New	FACULTY	-	SKILL DEVELOPMENT
16	PE-1	26CS52A1E	PARALLEL AND CONCURRENT PROGRAMMING MODELS(PC&S)		3	1	3	0	4	7	CTPG, OSDS	New	FACULTY	-	ENTREPRENEURSHIP
17	PE-1	26CS52B1E	KUBERNETES AND CONTAINER ORCHESTRATION(CNE&D)		3	1	3	0	4	7	OSDS, DCNP	New	INDUSTRY PERSON	-	EMPLOYABILITY
18	PE-2	26CS53A2E	CUDA AND GPU PROGRAMMING (PC&S)		3	1	3	0	4	7	NIL	New	INDUSTRY PERSON	-	SKILL DEVELOPMENT
19	PE-2	26CS53B2E	SERVICE MESH AND MICROSERVICES		3	1	3	0	4	7	FSWE ,KUBE	New	INDUSTRY PERSON	-	ENTREPRENEURSHIP

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			ARCHITECTURE (CNE&D)												
20	PE-3	26CS61A3E	ML SYSTEMS: COMPILERS, TRAINING AND INFERENCE(PC &S)		3	1	3	0	4	7	DLNP, AIML	New	ACADEMIC PEER	-	EMPLOYABILITY
21	PE-3	26CS61B3E	SITE RELIABILITY ENGINEERING AND OBSERVABILITY (CNE&D)		3	1	3	0	4	7	OSDS, CDVO	New	INDUSTRY PERSON	-	SKILL DEVELOPMENT
22	PE-4	26CS61A4E	PROCESSOR ARCHITECTURE AND ISA DESIGN(PC&S)		3	1	3	0	4	7	OSDS	New	FACULTY	-	ENTREPRENEURSHIP
23	PE-4	26CS61B4E	CLOUD PLATFORM ENGINEERING AND IAC (CNE&D)		3	1	3	0	4	7	OSDS, DCNP	New	FACULTY	-	EMPLOYABILITY

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24	PRI	26IE6202E	CAPSTONE RESEARCH / INDUSTRY PROJECT – PHASE I	CAP1	0	0	36	0	12	32	NIL	New	INDUSTRY PERSON	-	SKILL DEVELOPMENT
25	PRI	26IE6303E	CAPSTONE RESEARCH / INDUSTRY PROJECT – PHASE II	CAP2	0	0	36	0	12	32	NIL	New	INDUSTRY PERSON	-	ENTREPRENEURSHIP
			TOTAL NO. OF COURSES AND CREDITS		**21**					**83**					

Total number of courses =25
Percentage of Syllabus Revision= (Total No. of courses revised + new courses) *100/Total Courses = ((0+25)*100)/25 = 100%
Percentage of Courses focusing on Employability= 11*100/25=44%
Percentage of Courses focusing on Entrepreneurship = 6*100/25=24%
Percentage of Courses focusing on Skill Development = 8*100/25=32%

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Annexure-8

COURSE PROFILE 1: COMMUNICATION SKILLS AND TECHNICAL WRITING

Course Overview

- **Course Code:** 26UC5101E **Course Name:** Communication Skills and Technical Writing
- **L-T-P-S Structure:** 0-0-0-3 **Credits:** 0 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Write clear, structured technical documents covering design docs, ADRs, and RFCs.	PO1(H), PO3(M), PO4(L)	PSO1	BTL3. Apply
CO2	Engineer technical presentations using narrative arc, slide composition, demo design and audience adaptation.	PO1(H), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO3	Communicate effectively in async-first professional channels.	PO1(M), PO3(H), PO4(L)	PSO1	BTL3. Apply
CO4	Produce professional technical content covering blog posts, video tutorials, and conference talks.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO5	Deliver high-stakes verbal communication covering public speaking, panel discussions, and conference Q&A.	PO1(L), PO2(M), PO3(H)	PSO1	BTL4. Analyze
CO6	Build a coherent professional engineering identity across resume, LinkedIn, GitHub, personal site, and public artifacts.	PO1(M), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Technical Writing — The Engineering Document Stack	Document types — design doc, architecture decision record (ADR), RFC, post-mortem, runbook, README, API docs, release notes; structured writing — TL;DR, executive summary, body, appendix; active versus passive voice; the inverted pyramid and the one-screen rule; the Diátaxis framework (tutorials, how-tos, reference, explanation); clarity, concision and editing for the reader.

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Module 2	Presentation Engineering	Narrative arc — situation, complication, resolution; slide composition — Tufte principles, signal versus noise, data-ink ratio; visualisation — when to chart, when to diagram, when to show code; live-demo design — fail-safes, recovery paths, recorded fallback; audience adaptation — engineer versus product manager versus executive versus investor; talk pacing, timing and rehearsal; handling nerves and stage presence.
Module 3	Async-First Professional Communication	Email — subject lines, structure, ask placement, reply discipline; Slack — channel etiquette, threaded versus main, async-friendly long-form; GitHub pull-request descriptions — context, change, test, screenshot; code-review etiquette — tone, specificity, action versus opinion; status updates — concise, ship-friendly format; documentation as communication; writing for a distributed, time-zone-spread team; and writing that is skimmable, unambiguous and decision-ready.
Module 4	Public Technical Content	Engineering blog posts — hook, problem, journey, lesson; video tutorials — script, screen recording, voice-over; conference talks — call-for-proposals writing, talk structure, storytelling; README engineering — installation, usage, contribution, badges; developer relations and community building; engagement metrics — read-throughs, claps, stars, conversions; building an audience and content cadence; and turning technical work into public, reusable knowledge.
Module 5	High-Stakes Verbal Communication	Public speaking — voice, body, pace, presence; panel discussions — preparation, listening, well-timed intervention; question-and-answer handling — bridging, redirecting, admitting the unknown; podcast interviews — talking points, soundbites, story arcs; crisis communication — incident updates, customer comms, executive briefings; storytelling for engineers; persuasion and influence without authority; and reading the room to adapt a message in real time.
Module 6	Engineering Identity & Personal Brand	Resume engineering — Context-Action-Result bullets, quantification, formatting, ATS-friendliness; LinkedIn — headline, about, experience, content cadence; GitHub — pinned repos, profile README, contribution-graph hygiene; personal site — landing, bio, projects, blog, contact; engineering presence on Twitter/X and Bluesky; portfolio strategy; managing an authentic, consistent professional identity online; and building a credible track record recruiters can find.

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Recommended Textbooks & Reference Literature

- *Style: Lessons in Clarity and Grace*, Joseph M. Williams & Joseph Bizup, Pearson, 2024 (12th ed.)
- *Presentation Zen*, Garr Reynolds, New Riders, 2023 (3rd ed.)
- *Better Data Visualizations*, Jonathan Schwabish, Columbia University Press, 2021
- *The Pyramid Principle*, Barbara Minto, Financial Times Prentice Hall, 2002
- *The Sense of Style*, Steven Pinker, Penguin Books, 2014

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Module 2	Network Programming — Sockets to eBPF	Network programming — BSD sockets (TCP, UDP, raw, Unix domain); scalable event notification (epoll, kqueue, io_uring); async networking (Tokio, asyncio, libuv); raw packet crafting (scapy); eBPF for packet processing (XDP for high performance, TC for traffic control); and an introduction to P4. **Indian context:** high-performance network programming foundational to Indian cloud, CDN and telecom infrastructure engineering teams.
Module 3	Datacentre Topologies & Traffic Patterns	Datacentre topologies — hierarchical (legacy) versus Clos and fat-tree (modern), and Dragonfly+ for HPC; spine-leaf design; ECMP load balancing; East-West versus North-South traffic; microbursts and incast; datacentre tail-latency; and network-aware ML-training topology. **Indian context:** datacentre network design foundational to Indian hyperscale, cloud and AI-compute datacentre buildouts by Reliance Jio, Tata Communications, Yotta and CtrlS.
Module 4	Routing Protocols & Overlays	Routing protocols and overlays — BGP (eBGP, iBGP, route reflectors, communities); OSPF basics; ECMP; overlays (VXLAN, GENEVE, NVGRE); EVPN; the service-mesh data plane (Envoy, Cilium); and network policy engines. **Indian context:** routing and overlay engineering foundational to Indian cloud, telecom (Reliance Jio, Airtel) and datacentre networking teams building large-scale multi-tenant infrastructure.
Module 5	Load Balancers, Proxies, API Gateways	Load balancers, proxies and API gateways — L4 versus L7 load balancing; hashing (consistent, Maglev); direct server return; Envoy proxy architecture; service mesh (Istio, Linkerd, Cilium Service Mesh); API gateways (Kong, Traefik, APISIX); circuit breakers, retries and hedged requests at the LB layer; and eBPF-accelerated load balancing. **Indian context:** load-balancing and API-gateway engineering foundational to Indian high-scale product, fintech and e-commerce platforms.
Module 6	Capstone — Mini-CDN / Edge Proxy	Capstone — a multi-PoP edge proxy with anycast routing simulation, TLS 1.3 termination, HTTP/3, content caching, origin shielding, rate limiting, and DDoS-resistance patterns (XDP filtering, SYN cookies), with full observability and metrics. **Indian context:** edge-proxy and CDN engineering foundational to Indian content delivery, streaming (JioCinema, Hotstar) and e-commerce platforms serving hundreds of millions of users.

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Recommended Textbooks & Reference Literature

- *Computer Networking: A Top-Down Approach*, James Kurose & Keith Ross, Pearson, 2021 (8th ed.)
- *TCP/IP Illustrated, Volume 1*, W. Richard Stevens, Addison-Wesley, 2011 (2nd ed.)
- *TCP/IP Illustrated, Volume 2*, Gary R. Wright & W. Richard Stevens, Addison-Wesley, 1995
- *Routing TCP/IP, Volume 1*, Jeff Doyle, Cisco Press, 2005 (2nd ed.)
- *Understanding Linux Network Internals*, Christian Benvenuti (Calcote), O'Reilly, 2005

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COURSE PROFILE 6: AI AND MACHINE LEARNING WITH APPLIED MATHEMATICS

Course Overview

- **Course Code:** 26CS5104E **Course Name:** AI and Machine Learning with Applied Mathematics
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Apply linear algebra, probability, and optimization mathematics to formulate machine learning problems and reason about algorithm behavior.	PO1(M), PO2(H), PO3(M)	PSO1	BTL4. Analyze
CO2	Implement supervised learning algorithms using scikit-learn and PyTorch.	PO1(H), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO3	Apply unsupervised learning covering clustering, dimensionality reduction, and embeddings.	PO1(H), PO3(M), PO4(L)	PSO1	BTL3. Apply
CO4	Engineer optimization and training procedures for stable convergence.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO5	Evaluate model performance using rigorous metrics, statistical tests, calibration analysis, and fairness audits beyond accuracy alone.	PO1(L), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Evaluate
CO6	Engineer production ML systems with reproducible training, model versioning, monitoring, and deployment using MLOps best practices.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Mathematical Foundations for ML	Mathematical foundations for ML — linear algebra (vectors, matrices, eigendecomposition, SVD, matrix calculus); probability (random variables, distributions, conditional/joint probability, Bayes rule, expectation, variance); statistics (estimators, confidence intervals, hypothesis testing, MLE, MAP); calculus (partial derivatives, chain rule, gradient, Hessian); and optimization (convexity, gradient methods, Lagrange multipliers, KKT conditions). **Indian context:** mathematical ML foundations underpinning Indian AI/ML engineering, research and the data-science industry.
Module 2	Supervised Learning	Supervised learning — regression (linear, polynomial, regularized Ridge/Lasso/ElasticNet); classification (logistic regression, naive Bayes, k-NN); tree ensembles (decision trees, random forests, gradient boosting via XGBoost, LightGBM, CatBoost); support vector machines and kernels; cross-validation strategies; hyperparameter tuning (grid, random, Bayesian); train/validation/test discipline; and the bias-variance trade-off. **Indian context:** supervised learning foundational to Indian analytics, fintech risk-scoring and data-science teams.
Module 3	Unsupervised Learning & Embeddings	Unsupervised learning and embeddings — clustering (k-means, DBSCAN, hierarchical, GMM); dimensionality reduction (PCA, t-SNE, UMAP) and manifold learning; anomaly/novelty detection (isolation forest, one-class SVM); embeddings (historical word2vec and GloVe, and modern transformer embeddings); self-supervised learning; and representation-learning principles. **Indian context:** unsupervised methods foundational to Indian fraud detection, customer analytics and recommendation systems.
Module 4	Optimization & Training	Optimization and training — gradient descent variants (SGD, momentum, Nesterov, Adagrad, RMSprop, Adam, AdamW, Lion); learning-rate schedules (step, cosine, warm restarts, one-cycle); regularization (L1/L2, dropout, batch norm, data augmentation, early stopping); initialization (Xavier, He); mini-batch training and gradient accumulation; mixed-precision training; and distributed-training basics (DDP). **Indian context:** training optimization foundational to Indian deep-learning research and production ML teams.
Module 5	Model Evaluation & Selection	Model evaluation and selection — beyond accuracy (precision, recall, F1, ROC-AUC, PR-AUC, MCC); calibration (reliability diagrams, Platt scaling, isotonic regression, expected calibration error); statistical significance testing

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		(paired t-test, McNemar's test, bootstrap); cross-validation done right (stratified, time-series, group-aware); fairness (demographic parity, equalized odds, equal opportunity); and an error-analysis taxonomy. **Indian context:** rigorous model evaluation foundational to Indian production ML and regulated fintech/healthcare AI.
Module 6	Production ML Engineering (MLOps)	Production ML engineering (MLOps) — reproducible training (DVC, seed management, environment pinning); model versioning (MLflow Model Registry, Hugging Face Hub); model serving (FastAPI, BentoML, TorchServe, Triton Inference); batch versus online inference; monitoring (model, data, concept and feature drift); continuous training and model A/B testing; model cards for documentation; and CI/CD for ML. **Indian context:** MLOps foundational to Indian AI product companies and enterprise ML platforms operating at scale.

Recommended Textbooks & Reference Literature

- *Mathematics for Machine Learning*, Marc Peter Deisenroth, A. Aldo Faisal & Cheng Soon Ong, Cambridge University Press, 2020
- *The Elements of Statistical Learning*, Trevor Hastie, Robert Tibshirani & Jerome Friedman, Springer, 2009 (2nd ed.)
- *Pattern Recognition and Machine Learning*, Christopher M. Bishop, Springer, 2006
- *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, Aurélien Géron, O'Reilly, 2022 (3rd ed.)
- *Designing Machine Learning Systems*, Chip Huyen, O'Reilly, 2022

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COURSE PROFILE 2: PLACEMENT TRAINING AND PROFESSIONAL READINESS

Course Overview

- **Course Code:** 26UC5302E **Course Name:** Placement Training and Professional Readiness
- **L-T-P-S Structure:** 0-0-0-3 **Credits:** 0 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Solve algorithmic problems at LeetCode Medium-Hard level under interview time pressure with optimal complexity analysis.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO2	Design distributed systems at scale covering capacity estimation, data partitioning, and caching.	PO1(H), PO2(M), PO3(M), PO4(M)	PSO1	BTL5. Create
CO3	Deliver structured behavioral interview responses using STAR/SBI/CAR frameworks with quantified outcomes and learning narratives.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO4	Negotiate compensation packages using market-data evidence and BATNA analysis.	PO1(H), PO2(M), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO5	Build and execute a placement strategy.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO6	Demonstrate domain-specific interview readiness in their M.Tech specialisation at hiring-bar quality.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL5. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	DSA Refresher & Coding Interview Engineering	Pattern-based data structures and algorithms — sliding window, two pointers, fast-slow, monotonic stack, prefix sums, intervals, BFS/DFS, topological sort, union-find, segment tree, binary indexed tree, and dynamic-programming patterns (knapsack, LIS, LCS, matrix-chain,

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		partition, state-machine); complexity analysis and edge cases; coding-interview communication — talk before code, clarifying questions, dry-run walkthrough, test before submit.
Module 2	System Design Interview Engineering	Capacity estimation (back-of-envelope); functional and non-functional requirements; API design and data modelling; scaling — load balancers, caches (Redis, Memcached), CDN, sharding, replication, message queues (Kafka, RabbitMQ); consistency trade-offs (CAP, PACELC); common designs — URL shortener, Twitter, Uber, WhatsApp, Netflix, Dropbox, payment gateway, stock exchange; observability and bottleneck analysis; and communicating design trade-offs clearly under time pressure.
Module 3	Behavioral Interviews	Frameworks — STAR (situation-task-action-result), SBI (situation-behavior-impact), CAR (context-action-result); a story bank of eight to ten polished stories covering leadership, conflict, failure, learning, ambiguity, deadlines, customers, ethics; company-specific behavioural patterns (Amazon Leadership Principles, Google Googleyness, Meta move-fast, Microsoft growth-mindset); reverse interviews — questions to ask the company; authenticity and reflection; and conveying impact with concrete, quantified outcomes.
Module 4	Compensation Negotiation	Compensation components — base, RSU/ESOP (vesting cliff and schedule), sign-on, relocation, performance bonus, retention; market-data sources — Levels.fyi, Blind, AmbitionBox, Glassdoor; BATNA and using multiple offers as leverage; the four-step playbook (delay, anchor, justify, mutual gain); recruiter dynamics; counter-offer scripts; common mistakes and how to avoid them; and knowing when to accept, counter or walk away.
Module 5	Career Strategy & Networking	Company prioritisation — tier mapping, role fit, growth trajectory; application sequencing — the interview-readiness curve, dry-run companies first; recruiter outreach — cold-email templates, LinkedIn DMs, alumni reach-out; networking — informational interviews, hackathons, meetups, open-source contributions for visibility; referrals — how to ask and how to give back; reading the market — labour-market data, Levels trends, hiring slow-downs; long-term career planning.
Module 6	Domain-Specific Interview Mastery	Specialisation-track interview prep — for CSE/AIDS/CYS: ML system design, RAG/LLM engineering, infrastructure deep-dives; for CTM/STR: project portfolio, drawings review, BIM/structural-design walkthrough; for MD/RA:

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		CAD portfolio, finite-element simulations, hands-on demos; for PEPS/VLSI/EMB: circuit walkthrough, simulation results, hardware demos; for BT: lab notebook, SOP defence, scientific reasoning; company-specific deep-dives on what each tier-1 firm actually asks; mock interviews and feedback.

Recommended Textbooks & Reference Literature

- *Cracking the Coding Interview*, Gayle Laakmann McDowell, CareerCup, 2015 (6th ed.)
- *System Design Interview – An Insider's Guide (Vol 1 & Vol 2)*, Alex Xu, Byte Byte Go LLC, 2020-2022
- *Designing Data-Intensive Applications*, Martin Kleppmann, O'Reilly, 2017
- *Work Rules! Insights from Inside Google*, Laszlo Bock, Twelve, 2015
- *Never Split the Difference*, Chris Voss, Random House, 2016

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COURSE PROFILE 3: COMPUTATIONAL THINKING AND PROGRAMMING

Course Overview

- **Course Code:** 26CS5101E **Course Name:** Computational Thinking and Programming
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Decompose computational problems into algorithmic solutions using systematic problem-solving frameworks.	PO1(M), PO2(L), PO3(M), PO4(H)	PSO1	BTL3. Apply
CO2	Implement efficient programs in Python with proper data structures, complexity analysis, and Pythonic idioms.	PO1(H), PO2(M), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO3	Design object-oriented systems using SOLID principles, design patterns, type hints, and dataclasses for maintainable code.	PO1(H), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO4	Apply functional programming patterns and concurrency primitives appropriately.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO5	Engineer software quality through unit/integration testing, type checking, linting, code coverage, and CI/CD pipelines at production standards.	PO1(M), PO3(M), PO4(H)	PSO1	BTL4. Analyze
CO6	Develop production code using AI-pair programming as a force multiplier.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Problem Decomposition & Algorithmic Thinking	Computational thinking — decomposition, abstraction, pattern recognition, algorithm design; the core algorithmic patterns (divide-and-conquer, dynamic programming, greedy, backtracking, branch-and-bound); complexity analysis (Big-O, amortized, expected); problem-solving heuristics; and understanding when to apply which pattern. **Indian context:** foundational algorithmic problem-solving for Indian software engineering, competitive programming (CodeChef, IIT/IIIT contests) and product-company technical interviews.
Module 2	Pythonic Programming & Data Structures	The Python data model — sequences, mappings, sets; comprehensions versus loops; generators and iterators; context managers (the with-statement); decorators; the built-in modules (collections, itertools, functools, heapq, bisect); and Pythonic idioms (duck typing, EAFP versus LBYL) with performance considerations from CPython internals. **Indian context:** Python is the dominant language across Indian software services, product companies, data science and the AI industry.
Module 3	Object-Oriented Engineering	Object-oriented engineering — classes, inheritance, composition and mixins; type hints (PEP 484, 604, 695) and generic types; dataclasses, attrs and Pydantic; the SOLID principles in Python; design patterns (Strategy, Factory, Observer, Singleton, Adapter, Decorator, Iterator, Command); ABCs and protocols (PEP 544); and domain-driven design basics. **Indian context:** object-oriented design foundational to Indian enterprise software and product engineering.
Module 4	Functional Patterns & Concurrency	Functional programming in Python — pure functions, higher-order functions, immutability, map/filter/reduce, partial application and currying; concurrency primitives (threading, multiprocessing, and asyncio event loops, coroutines and async/await); concurrency patterns (producer-consumer, futures, async generators); GIL implications; and choosing between them for CPU-bound versus I/O-bound work. **Indian context:** concurrency engineering foundational to Indian backend, data-pipeline and high-scale product teams.
Module 5	Software Quality Engineering	Software quality engineering — the testing pyramid (unit, integration, end-to-end); Pytest (fixtures, parametrize, marks, plugins); property-based testing (Hypothesis); mocking (unittest.mock, pytest-mock); coverage (pytest-cov); type checking (mypy strict); linting (ruff, pylint);

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		formatting (black); pre-commit hooks; CI/CD (GitHub Actions, GitLab CI); and containerisation basics (Dockerfile). **Indian context:** quality-engineering practices standard across Indian software services and product companies.
Module 6	AI-Pair Programming Engineering	Engineering with AI as a force multiplier, not a substitute — effective prompting for code generation; context management (relevant files, codebase navigation); specification-first development; code review of AI output; refactoring AI-generated code to project conventions; type-driven and test-first development with AI; tool selection (Claude Code, Cursor, Windsurf, Copilot, Continue.dev); and honest disclosure of AI assistance. **Indian context:** AI-pair programming reshaping Indian software-engineering productivity across services and product firms.

Recommended Textbooks & Reference Literature

- *Fluent Python*, Luciano Ramalho, O'Reilly, 2022 (2nd ed.)
- *Introduction to Algorithms*, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest & Clifford Stein, MIT Press, 2022 (4th ed.)
- *Python Cookbook*, David Beazley, O'Reilly, 2013 (3rd ed.)
- *Effective Python*, Brett Slatkin, Addison-Wesley, 2024 (3rd ed.)
- *Clean Code: A Handbook of Agile Software Craftsmanship*, Robert C. Martin, Prentice Hall, 2008

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COURSE PROFILE 4: OS, CONCURRENCY AND DISTRIBUTED SYSTEMS

Course Overview

- **Course Code:** 26CS5102E **Course Name:** OS, Concurrency and Distributed Systems
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse process and memory management in modern operating systems including scheduling, virtual memory, and address-space layouts.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO2	Analyse filesystem and storage internals covering inodes, journaling, and page cache.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO3	Engineer concurrent programs using locks, atomics, channels, and lock-free patterns.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Apply distributed systems primitives covering replication and sharding.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO5	Evaluate consensus algorithms and consistency models for system requirements.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL5. Evaluate
CO6	Build and operate cloud-native systems using containers, orchestration, service mesh, and observability at SRE production standards.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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Mo+dule-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Process & Memory Management	The process model — fork, exec, signals, namespaces and cgroups; threads versus processes; the Linux scheduler (CFS, EEVDF in kernel 6.6+); virtual memory (paging, TLB, MMU); memory mappings (anonymous, file-backed, shared); address-space layout (text, data, BSS, heap, stack, mmap region); the Linux memory allocator (jemalloc, glibc malloc); and performance (page faults, NUMA effects). **Indian context:** OS-internals engineering foundational to Indian systems, cloud-infrastructure and performance teams.
Module 2	Filesystems & Storage Engineering	Filesystem and storage engineering — filesystem internals (inodes, dentries, page cache, write-back); journaling versus copy-on-write (ext4, ZFS, btrfs); the storage hierarchy (NVMe, SSD, HDD, network-attached); fsync semantics and data integrity; I/O models (blocking, non-blocking, async io_uring); object storage (S3 semantics); and storage-aware data structures (LSM trees versus B+ trees). **Indian context:** storage engineering foundational to Indian cloud, database and data-platform teams.
Module 3	Concurrency Engineering	Concurrency engineering — concurrency versus parallelism; mutexes, semaphores and condition variables; atomic operations and memory models (sequential consistency, acquire-release, relaxed); lock-free data structures (queues, stacks, hash maps); channel-based concurrency (Go, Rust); the actor model (Erlang, Akka); common pitfalls (deadlock, livelock, priority inversion, false sharing); and concurrent data-race detection. **Indian context:** concurrency engineering foundational to Indian high-scale backend and systems teams.
Module 4	Distributed Systems Primitives	Distributed-systems primitives — network programming (sockets, gRPC, REST, WebSockets); RPC (Protobuf, Cap'n Proto, gRPC, Apache Thrift); replication strategies (leader-follower, multi-leader, leaderless); sharding strategies (range, hash, geographic); load balancing (round-robin, consistent hashing, power of two choices); failure detection (heartbeats, gossip, SWIM); and service discovery (DNS, Consul, etcd). **Indian context:** distributed-systems engineering foundational to Indian hyperscale product, fintech and e-commerce platforms.
Module 5	Consensus & Consistency	Consensus and consistency — the CAP theorem (what it actually says and does not) and PACELC's latency-versus-consistency trade-off; consistency models (linearizable, sequential, causal, eventual, monotonic); consensus (Lamport's Paxos, Raft, Viewstamped Replication);

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		distributed transactions (2PC, 3PC, Saga); logical clocks (Lamport, vector, version vectors); and CRDTs. **Indian context:** consensus and consistency engineering foundational to Indian distributed-database and high-availability platform teams building UPI-scale systems.
Module 6	Cloud-Native Operating Models	Cloud-native operating models — containers (Docker, OCI runtime, image layers, namespaces, cgroups); orchestration (Kubernetes pods, services, deployments, StatefulSets, controllers); service mesh (Istio, Linkerd); configuration (Helm, Kustomize, ConfigMaps, Secrets); observability (Prometheus, Grafana, Loki, Tempo, OpenTelemetry); and SRE practice (SLO/SLI, error budgets, postmortems, runbooks). **Indian context:** cloud-native and SRE practice foundational to Indian product, SaaS and platform-engineering teams.

Recommended Textbooks & Reference Literature

- *Designing Data-Intensive Applications*, Martin Kleppmann, O'Reilly, 2017
- *Modern Operating Systems*, Andrew S. Tanenbaum & Herbert Bos, Pearson, 2022 (5th ed.)
- *Systems Performance: Enterprise and the Cloud*, Brendan Gregg, Addison-Wesley, 2020 (2nd ed.)
- *Site Reliability Engineering*, Betsy Beyer et al., O'Reilly, 2016
- *Rust Atomics and Locks*, Mara Bos, O'Reilly, 2023

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COURSE PROFILE 5: DATACENTRE NETWORKS AND INTERNET PROTOCOLS

Course Overview

- **Course Code:** 26CS5103E **Course Name:** Datacentre Networks and Internet Protocols
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse Internet protocol stack covering Ethernet, IPv4/IPv6, and QUIC.	PO1(L), PO2(M), PO3(M), PO4(H)	PSO1	BTL4. Analyze
CO2	Implement and debug network applications using sockets, raw packets, and protocol-aware tooling.	PO1(H), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO3	Analyse datacentre topologies covering Clos and fat-tree.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO4	Configure and operate BGP, OSPF, ECMP, and overlay networks in a simulated multi-region datacentre.	PO1(M), PO3(M), PO4(H)	PSO1	BTL3. Apply
CO5	Analyse and engineer load balancers, proxies, service meshes, and API gateways with eBPF/XDP acceleration.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO6	Build a small CDN / edge proxy with anycast routing, TLS termination, observability, and DDoS-resistance patterns.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Internet Protocol Stack — Packet Engineering	The internet protocol stack — Ethernet, ARP, and IPv4/IPv6 forwarding; TCP (three-way handshake, congestion control via CUBIC, BBR and BBRv3, retransmission); UDP and QUIC; HTTP/2 multiplexing and HTTP/3 over QUIC; the TLS 1.3 handshake; and DNS with DoH/DoT. **Indian context:** packet engineering foundational to Indian telecom (Reliance Jio, Airtel), cloud and CDN infrastructure teams building nationwide networks.

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COURSE PROFILE 7: FULL-STACK WEB ENGINEERING

Course Overview

- **Course Code:** 26CS5205E **Course Name:** Full-Stack Web Engineering
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Engineer modern frontend applications using TypeScript, React, and Next.js with proper component architecture, state management, and accessibility.	PO1(H), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO2	Build production backend services using FastAPI / Hono / Express with REST and tRPC, including request validation, error handling, and OpenAPI documentation.	PO1(H), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO3	Design and operate database layers with proper schema design, indexing, transactions, migrations, and Redis caching.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO4	Implement authentication, authorization, payments, and webhook integrations to production-grade security and reliability standards.	PO1(H), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO5	Engineer real-time and async features covering WebSockets, server-sent events, and background jobs.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO6	Deploy and operate full-stack applications with proper CI/CD, observability, performance optimization, and SEO at production-engineer standard.	PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	TypeScript & Modern Frontend (React, Next.js)	TypeScript essentials — types, generics, discriminated unions, conditional types, type guards; React fundamentals (components and hooks: useState, useEffect, useReducer, useMemo, useCallback, custom hooks); React 19 features (use, server components, actions); Next.js 15 (App Router, Server Components, Server Actions, streaming, partial prerendering); state management (Zustand, Jotai, TanStack Query); styling (Tailwind CSS, CSS modules, Vanilla Extract); forms (react-hook-form plus Zod); and accessibility (WCAG 2.2, semantic HTML, ARIA). **Indian context:** modern frontend engineering foundational to Indian product and SaaS companies.
Module 2	Backend Engineering (FastAPI / Hono / Express)	Backend engineering — frameworks (FastAPI in Python as primary, Hono for TypeScript edge, Express/Fastify for Node); REST API design (resource modeling, status codes, error formats, versioning); tRPC for type-safe RPC; request validation (Pydantic, Zod); auto-generated OpenAPI/Swagger docs; middleware patterns; error handling and logging; rate limiting; and CORS. **Indian context:** backend API engineering foundational to Indian product, fintech and SaaS platforms.
Module 3	Databases & Caching	Databases and caching — PostgreSQL deep-dive (schema design, normalization, indexes B-tree/GIN/GiST/BRIN, transactions, isolation levels, JSON columns, full-text search); migrations (Alembic, Prisma, Drizzle); ORMs versus raw SQL (SQLAlchemy 2, Prisma, Drizzle, sqlc); connection pooling (PgBouncer, Supavisor); Redis (cache-aside, write-through, write-behind, pub/sub, rate limiting, sorted-set leaderboards); and NoSQL options (MongoDB, DynamoDB) with their tradeoffs. **Indian context:** database engineering foundational to Indian high-scale product and fintech platforms.
Module 4	Auth, Payments & Webhooks	Authentication, payments and webhooks — authentication (sessions versus JWT, OAuth 2.0/OIDC, social login, magic links, WebAuthn passkeys); authorization (RBAC, ABAC, Postgres row-level security); auth services (NextAuth/Auth.js, Clerk, Supabase Auth, BetterAuth); payments (Stripe globally, Razorpay in India); subscription and one-time billing with payment webhooks; and webhook reliability (idempotency, retries, signature verification). **Indian context:** payments and auth engineering foundational to Indian fintech and e-commerce (Razorpay, UPI).

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Module 5	Real-Time & Async (WebSockets, Queues, Background Jobs)	Real-time and async — real-time transports (WebSockets, server-sent events, polling); the real-time stack (Pusher, Ably, Soketi, Socket.io, collaborative Liveblocks); background jobs (RQ, Celery, BullMQ, Inngest, Trigger.dev); job patterns (at-least-once delivery, idempotency, exponential-backoff retries, dead-letter queues); and message brokers (Redis Streams, Kafka, NATS). **Indian context:** real-time and async engineering foundational to Indian high-scale product, gaming and fintech platforms.
Module 6	Production Deploy, Observability & Performance	Production deployment, observability and performance — deployment (Vercel, Render, Railway, Fly.io, Cloudflare Workers, AWS Amplify, self-hosted Docker); CI/CD (GitHub Actions); observability (Sentry, PostHog, Vercel Analytics, Plausible); logging and traces (Axiom, Better Stack, OpenTelemetry); performance (Core Web Vitals, lazy loading, image optimization, edge caching); and SEO (meta tags, structured data, sitemaps, Lighthouse). **Indian context:** production web engineering foundational to Indian product and SaaS companies.

Recommended Textbooks & Reference Literature

- *The Road to React*, Robin Wieruch, Independently Published, 2023
- *Modern Frontend Development with Node.js*, Thomas Erickson, Packt Publishing, 2024
- *Fluent Python*, Luciano Ramalho, O'Reilly, 2022 (2nd ed.)
- *HTTP/3 Explained*, Daniel Stenberg, Open Source Online Documentation
- *The Algorithm Design Manual*, Steven S. Skiena, Springer, 2020 (3rd ed.)

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Guntur District. Andhra Pradesh

COURSE PROFILE 8: ALGORITHM ENGINEERING FOR DATA SYSTEMS

Course Overview

- **Course Code:** 26CS5206E **Course Name:** Algorithm Engineering for Data Systems
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** CTPG

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse algorithm performance using amortised, expected, and worst-case complexity models, with hardware-aware reasoning.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO2	Apply advanced data structures covering segment trees, BITs, and persistent structures.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO3	Engineer probabilistic data structures for approximate query systems with bounded error guarantees.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO4	Design and implement vector search systems using LSH, HNSW, IVF, and product quantization for high-dimensional similarity at scale.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Apply streaming and sketching algorithms to bounded-memory analytics over unbounded data streams.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO6	Engineer end-to-end production search/retrieval systems combining inverted indexes, vector search, ranking, and caching.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Algorithm Engineering & Hardware-Aware Analysis	Algorithm engineering and hardware-aware analysis — theoretical models (RAM, cache-oblivious external-memory, parallel PRAM and work-span); real-world bottlenecks (cache hierarchy, branch prediction, SIMD, NUMA, GPU memory hierarchy); amortised analysis (accounting, potential method); expected complexity (randomization, fingerprints); profiling-driven optimization; algorithmic complexity versus constant factors; and choosing the right model. **Indian context:** algorithm engineering foundational to Indian high-performance systems, quant and product teams.
Module 2	Advanced Data Structures	Advanced data structures — segment trees with lazy propagation; binary indexed (Fenwick) trees; persistent structures (copy-on-write trees, fat-node, path-copying); suffix arrays with LCP (DC3 construction) and suffix automata; heavy-light decomposition; link-cut trees; sqrt decomposition; Mo's algorithm and offline query processing; applied to range-query systems, version control and full-text search. **Indian context:** advanced data structures foundational to Indian competitive programming and systems engineering.
Module 3	Probabilistic Data Structures	Probabilistic data structures — Bloom filters (design, false-positive analysis, scalable/cuckoo/counting variants); HyperLogLog for cardinality estimation; Count-Min sketch for frequency; t-digest for percentiles; MinHash and LSH for set similarity; SimHash for near-duplicate detection; top-k heavy hitters (Misra-Gries, space-saving); and when approximation is acceptable with its mathematical error bounds. **Indian context:** probabilistic structures foundational to Indian large-scale analytics, ad-tech and streaming systems.
Module 4	Vector Search & High-Dimensional Similarity	Vector search and high-dimensional similarity — the curse of dimensionality; distance metrics (Euclidean, cosine, dot, Manhattan, Hamming); locality-sensitive hashing (random projections, p-stable); tree-based methods (KD trees, ball trees, and their high-D limitations); graph-based HNSW and NSG; inverted-file IVF with product quantization (PQ, OPQ, residual); disk-based DiskANN; hybrid BM25-plus-dense retrieval; and production trade-offs (recall, latency, memory, build time). **Indian context:** vector search foundational to Indian GenAI, RAG and recommendation systems.

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Module 5	Streaming & Online Algorithms	Streaming and online algorithms — the streaming model (bounded memory, single-pass, sub-linear); sliding-window analytics; reservoir sampling; Misra-Gries heavy hitters; distinct counting (Flajolet-Martin to HyperLogLog); frequency estimation (Count-Min); sketches for joins and set operations; online algorithms with competitive-ratio analysis; concept-drift detection; and real-time aggregation pipelines. **Indian context:** streaming algorithms foundational to Indian real-time analytics, fraud detection and ad-tech platforms.
Module 6	Production Search & Retrieval Systems	Production search and retrieval systems — the inverted index (postings lists, gap encoding, skip lists); BM25 ranking; query parsing (tokenization, stemming, lemmatization, synonym expansion); hybrid retrieval fusing sparse BM25 and dense vectors via Reciprocal Rank Fusion; cross-encoder re-ranking; caching (query, document, fragment); the distributed index (sharding, replication, fan-out); and relevance metrics (MRR, NDCG) with A/B testing. **Indian context:** search engineering foundational to Indian e-commerce, marketplace and content platforms.

Recommended Textbooks & Reference Literature

- *Sequential and Parallel Algorithms and Data Structures*, Peter Sanders, Kurt Mehlhorn, Martin Dietzfelbinger & Roman Dementiev, Springer, 2019
- *Introduction to Algorithms*, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest & Clifford Stein, MIT Press, 2022 (4th ed.)
- *The Algorithm Design Manual*, Steven S. Skiena, Springer, 2020 (3rd ed.)
- *Data Mining: The Textbook*, Charu C. Aggarwal, Springer, 2024 (2nd ed.)
- *Search Engines: Information Retrieval in Practice*, W. Bruce Croft, Donald Metzler & Trevor Strohman, Pearson, 2015

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COURSE PROFILE 9: DEEP LEARNING AND NATURAL LANGUAGE PROCESSING

Course Overview

- **Course Code:** 26CS5207E **Course Name:** Deep Learning and Natural Language Processing
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** AIML

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse and engineer feedforward and convolutional neural networks with proper architectures, loss functions, and training strategies for vision and tabular tasks.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO2	Apply RNN, LSTM, GRU architectures to sequence modeling tasks.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO3	Implement the Transformer architecture from scratch.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Engineer pre-trained language models for downstream tasks via fine-tuning and PEFT.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Build NLP pipelines using modern frameworks.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO6	Apply multimodal and vision-language models and optimize inference.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Neural Network Foundations & Computer Vision	Neural-network foundations and computer vision — feedforward networks (perceptron, MLP, universal approximation); activation functions (ReLU, GeLU, SiLU); initialization (He, Xavier); backpropagation from the chain rule; loss functions (cross-entropy, MSE, focal, contrastive); convolutional networks (convolution, pooling, padding, strides); modern CNN architectures (ResNet, EfficientNet, ConvNeXt); Vision Transformers; and data augmentation. **Indian context:** deep-learning foundations underpinning Indian AI/ML research and the computer-vision industry.
Module 2	Sequence Modeling — RNN, LSTM, GRU	Sequence modeling — sequential data (language, time series, audio); RNNs (structure, BPTT, vanishing/exploding gradients); LSTMs (forget, input and output gates, cell state); GRUs with simpler gating; bidirectional and stacked variants; the limitations (sequential bottleneck without parallelism, long-range dependency challenges) that attention solved; and the historical context. **Indian context:** sequence-modeling lineage foundational to understanding modern Indian NLP and speech systems.
Module 3	The Transformer — From Scratch	The Transformer from scratch — self-attention (query, key, value, scaled dot-product); multi-head attention; positional encoding (sinusoidal, learned, ALiBi, and the modern-default RoPE); layer normalization (pre-LN versus post-LN); residual connections; the feed-forward block (with modern SwiGLU); encoder versus decoder versus encoder-decoder; causal masking; and KV caching for inference. **Indian context:** transformer engineering foundational to Indian LLM and foundation-model builders (Sarvam, Krutrim, AI4Bharat).
Module 4	Pre-trained Language Models & Fine-tuning	Pre-trained language models and fine-tuning — pre-training paradigms (masked LM in BERT, causal LM in GPT, span corruption in T5, prefix LM); tokenization (BPE, WordPiece, SentencePiece, tiktoken); encoder models (BERT, RoBERTa, DeBERTa for classification/NER/extractive QA); decoder models (GPT-2, LLaMA, Mistral, Qwen for generation); encoder-decoder (T5, BART for summarisation/translation); full fine-tuning; PEFT (LoRA, QLoRA, adapters, prefix tuning); instruction tuning; and the Hugging Face Trainer. **Indian context:** LM fine-tuning foundational to Indian Indic-language model builders (AI4Bharat, Sarvam).
Module 5	NLP Tasks & Pipelines	NLP tasks and pipelines — text classification (sentiment, intent, topic); named-entity recognition (BIO/BIOES tagging); token classification and sequence labeling; extractive versus

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		generative QA; summarisation (abstractive versus extractive); machine translation; semantic similarity via sentence embeddings; information retrieval (intro to RAG); cross-lingual NLP; and Indian-language NLP (AI4Bharat resources). **Indian context:** Indic NLP foundational to India's 22-language digital-inclusion and Bhashini programs.
Module 6	Multimodal Models & Inference Optimization	Multimodal models and inference optimization — vision-language models (CLIP, SigLIP, contrastive learning); multimodal LLMs (LLaVA, Qwen-VL, GPT-4V); audio-language (Whisper, AudioPaLM); inference optimization (INT8/INT4 quantization via GPTQ/AWQ/SmoothQuant, pruning, distillation); KV-cache optimization; speculative decoding; production serving (vLLM, TensorRT-LLM, SGLang); ONNX export; and mobile/edge model compression. **Indian context:** multimodal and inference engineering foundational to Indian GenAI and edge-AI product teams.

Recommended Textbooks & Reference Literature

- *Deep Learning*, Ian Goodfellow, Yoshua Bengio & Aaron Courville, MIT Press, 2016
- *Dive into Deep Learning*, Aston Zhang et al., Cambridge University Press, 2023
- *Speech and Language Processing*, Daniel Jurafsky & James H. Martin, Pearson, 2024 (3rd ed. draft)
- *Introduction to Natural Language Processing*, Jacob Eisenstein, MIT Press, 2019
- *Natural Language Processing with Transformers*, Lewis Tunstall, Leandro von Werra & Thomas Wolf, O'Reilly, 2022

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COURSE PROFILE 10: RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS

Course Overview

- **Course Code:** 26IE5201E **Course Name:** Research Methodology and Intellectual Property Rights
- **L-T-P-S Structure:** 3-0-0-0 **Credits:** 2 **Prerequisite:** None

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Formulate research questions and develop hypotheses using systematic literature review and gap analysis.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL3. Apply
CO2	Design experiments using quantitative, qualitative and computational methodologies appropriate to engineering research.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL3. Apply
CO3	Conduct literature search across academic databases and manage references using Zotero/Mendeley with PRISMA discipline.	PO1(H), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO4	Write technical papers, theses and research reports in IEEE/ACM/Springer formats using LaTeX with proper citation.	PO2(M), PO3(M), PO4(H)	PSO1	BTL3. Apply
CO5	Analyse patent landscapes, conduct freedom-to-operate searches and draft patent specifications for engineering inventions.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO6	Evaluate research integrity issues covering plagiarism, AI-disclosure, and replication.	PO1(L), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Evaluate

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Research Foundations & Question Formulation	Research types — basic, applied, design-based, action research; engineering research versus scientific research and the distinction between problem-solving and knowledge-generation; research questions versus hypotheses — formulating, refining and operationalising them; inductive versus deductive reasoning; research design frameworks (exploratory, descriptive, explanatory); gap analysis from a systematic literature review; theory building and conceptual frameworks in engineering.
Module 2	Experimental Design & Methodology	Quantitative methods — experimental, quasi-experimental, survey, computational/simulation; qualitative methods — case study, interview, ethnography, grounded theory; mixed-methods designs and triangulation; design of experiments — full-factorial, fractional-factorial, Taguchi orthogonal arrays, response-surface methodology; randomisation, blocking and replication; sample-size determination and power analysis; validity — internal, external, construct, statistical-conclusion; reliability and reproducibility of measurements.
Module 3	Literature Review & Reference Management	Systematic literature review following PRISMA 2020 — protocol, search strategy, inclusion/exclusion, screening, synthesis; snowballing by forward and backward citation tracking; databases — Scopus, Web of Science, IEEE Xplore, ACM Digital Library, SpringerLink, ScienceDirect; reference managers (Zotero, Mendeley, JabRef); predatory journals (Beall's list) and journal metrics (impact factor, h-index, CiteScore); open access — green, gold, hybrid, diamond; preprint servers (arXiv, bioRxiv, ChemRxiv).
Module 4	Scientific Writing & LaTeX	IMRaD structure (introduction, methods, results, discussion); abstract writing — informative versus descriptive; figures and tables — design principles, captioning, self-containment; citation styles — IEEE, ACM, APA, Vancouver; the peer-review process — editorial workflow, reviewer roles, response to reviewers; LaTeX fundamentals — TeX Live, document classes, math mode, BibTeX/biblatex; journal and conference templates — IEEEtran, ACM, Springer LNCS, Elsevier elsarticle; version control for manuscripts (Git, Overleaf).
Module 5	IPR & Patent Engineering	Types of intellectual property — patents, copyrights, trademarks, trade secrets, geographical indications, industrial designs; patentability — novelty, non-obviousness (inventive step), industrial applicability, and statutory exclusions (Section 3, Indian Patents Act 1970); patent specification — claims (independent, dependent),

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		description, drawings, abstract; freedom-to-operate analysis; filing routes — provisional, complete, PCT; patent-landscape and prior-art search; software patentability — Section 3(k), Indian guidelines versus the USPTO Alice test.
Module 6	Research Ethics & Integrity	Plagiarism — text, idea and self-plagiarism, and detection tools; authorship norms — Vancouver, COPE, ICMJE, contributorship and gift/ghost authorship; conflicts of interest — financial, intellectual, personal; data fabrication and falsification; AI-assisted writing and disclosure norms (Nature, Springer, ACM, IEEE policies); the replication crisis; questionable research practices — p-hacking, HARKing, the garden of forking paths; open science — preregistration, open data, open code; ethics review (IRB, animal ethics, IBC).

Recommended Textbooks & Reference Literature

- *Research Methodology: Methods and Techniques*, C. R. Kothari & Gaurav Garg, New Age International, 2024 (4th ed.)
- *Engineering Research Methodology*, Dipankar Deb et al., Springer, 2019
- *The Craft of Research*, Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, Joseph Bizup & William T. FitzGerald, University of Chicago Press, 2024 (5th ed.)
- *Patent It Yourself*, David Pressman, Nolo, 2024 (22nd ed.)
- *How to Write and Publish a Scientific Paper*, Robert A. Day & Barbara Gastel, Greenwood, 2022 (9th ed.)

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COURSE PROFILE 11: GENERATIVE AI AND LLM APPLICATION ENGINEERING

Course Overview

- **Course Code:** 26CS5308E **Course Name:** Generative AI and LLM Application Engineering
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** AIML

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Engineer multi-provider LLM applications using current SDKs with structured-output enforcement, prompt patterns, and provider abstraction.	PO1(H), PO3(M), PO4(M)	PSO1	BTL3. Apply
CO2	Construct production-grade Retrieval-Augmented Generation pipelines from chunking through hybrid search and reranking, with measurable answer faithfulness.	PO1(M), PO3(M), PO4(H)	PSO1	BTL3. Apply
CO3	Evaluate LLM systems using offline benchmarks, online A/B tests, and LLM-as-judge harnesses.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO4	Fine-tune open-weight models with PEFT and align them with SFT and DPO/ORPO for domain-specific tasks under resource constraints.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL3. Apply
CO5	Architect agentic systems with tool calling, function routing, MCP integration, and multi-agent coordination.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO6	Engineer for cost, latency, safety, and security.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Evaluate

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	LLM Foundations & Prompt Engineering	LLM foundations and prompt engineering — tokenization, sampling parameters, context windows and multi-modality; system/user/assistant message roles; prompt patterns (few-shot, chain-of-thought, tree-of-thought, ReAct, self-

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		consistency); pricing models (input versus output tokens, prompt caching); and structured outputs (JSON mode, tool/function calling, schema-enforced generation). **Indian context:** LLM application engineering foundational to Indian AI startups (Sarvam, Krutrim) and the GenAI services industry.
Module 2	Retrieval-Augmented Generation Engineering	Retrieval-augmented generation engineering — embeddings (BGE-M3, OpenAI text-embedding-3, Cohere embed-v3, Voyage); chunking (token, semantic, hierarchical, contextual); vector databases (Qdrant, Weaviate, pgvector, Pinecone, Milvus); hybrid retrieval (BM25 plus dense); rerankers (Cohere, BGE-reranker); and query rewriting, HyDE, contextual retrieval and citation-grounded answers. **Indian context:** RAG engineering foundational to Indian enterprise GenAI, legal-tech and Indian-language knowledge systems (AI4Bharat).
Module 3	Evaluation, Telemetry & Observability	LLM evaluation, telemetry and observability — eval harnesses (lm-eval-harness, HELM, MTEB); task-specific evals (faithfulness, answer relevance, context precision and recall); LLM-as-judge (G-Eval, pairwise comparison); online A/B testing for LLM features; tracing, span analysis, regression detection and drift monitoring; and golden datasets with synthetic eval generation. **Indian context:** LLM evaluation foundational to Indian GenAI product teams shipping reliable production systems.
Module 4	Fine-Tuning & Alignment	Fine-tuning and alignment — pre-training versus SFT versus preference alignment; PEFT methods (LoRA, QLoRA, prefix tuning, prompt tuning); synthetic data generation with stronger models; dataset curation and deduplication; alignment methods (RLHF, DPO, IPO, KTO, ORPO); evaluation of fine-tuned models (MT-Bench, AlpacaEval, domain-specific benchmarks); and cost-efficient single- and multi-GPU training. **Indian context:** model fine-tuning foundational to Indian foundation-model builders (Sarvam, Krutrim, AI4Bharat) and Indic-language alignment.
Module 5	Agents, Tool Use & MCP	Agents, tool use and MCP — the ReAct loop, function calling, planning agents and multi-agent frameworks (CrewAI, AutoGen, LangGraph); the Model Context Protocol (server design, tool exposure, schema validation); Anthropic Computer Use and browser automation; agent memory (short-term, long-term, vector); tool-selection routing; and failure modes (looping, hallucinated tool calls, infinite recursion) with recovery patterns. **Indian context:** agentic AI engineering foundational to Indian GenAI startups and enterprise automation.

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Module 6	Production Engineering: Cost, Latency, Safety, Security	Production LLM engineering — caching (exact and semantic); batching, streaming, model routing and distillation; quantization (AWQ, GPTQ, GGUF, FP8); serving (vLLM, TGI, llama.cpp, SGLang, TensorRT-LLM); safety (Llama Guard, NeMo Guardrails, output moderation); security (prompt-injection defense, jailbreak hardening, PII redaction, data-exfiltration prevention); and SLO design (p50/p99 latency, cost-per-query, availability). **Indian context:** production LLM serving foundational to Indian GenAI platforms operating at scale.

Recommended Textbooks & Reference Literature

- *Hands-On Large Language Models*, Jay Alammar & Maarten Grootendorst, O'Reilly, 2024
- *AI Engineering*, Chip Huyen, O'Reilly, 2024
- *Generative AI on AWS*, Chris Fregly, Antje Barth & Shelbee Eigenbrode, O'Reilly, 2024
- *Building LLM Powered Applications*, Valentina Alto, Packt Publishing, 2024
- *Speech and Language Processing*, Daniel Jurafsky & James H. Martin, Pearson, 2024 (3rd ed. draft)

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COURSE PROFILE 12: CLOUD SERVICES AND DEVOPS ENGINEERING

Course Overview

- **Course Code:** 26CS5309E **Course Name:** Cloud Services and DevOps Engineering
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** OSDS

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Architect cloud-native applications across AWS / GCP / Azure using compute, storage, network, and managed services with cost-aware decisions.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO2	Engineer infrastructure-as-code using Terraform / Pulumi with module composition, state management, multi-environment, and policy-as-code.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO3	Deploy and operate Kubernetes-based platforms including service mesh, ingress, autoscaling, and storage at production-grade reliability.	PO1(L), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Implement GitOps-driven CI/CD pipelines with progressive delivery, secret management, and supply chain security.	PO1(M), PO2(L), PO3(M), PO4(H)	PSO1	BTL4. Analyze
CO5	Engineer SRE practice covering SLO/SLI definition, error budgets, and chaos engineering.	PO1(M), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Evaluate
CO6	Build internal developer platforms using Backstage / Port / Humanitec to provide self-service developer experience at production teams.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Cloud Architecture (AWS / GCP / Azure)	Cloud architecture across hyperscalers — compute (EC2, GCE, Azure VM), serverless (Lambda, Cloud Functions, Azure Functions), containers (ECS, Cloud Run, ACI) and managed Kubernetes (EKS, GKE, AKS); storage (object S3/GCS/Blob, block, file, archive); networking (VPC, subnets, security groups, IAM, peering, transit gateway); managed services (RDS, CloudSQL, BigQuery, Step Functions); edge (CloudFront, Cloudflare, Fastly); and cost (pricing models, savings plans, FinOps). **Indian context:** cloud architecture foundational to Indian product, SaaS and enterprise-migration teams.
Module 2	Infrastructure as Code (Terraform, Pulumi)	Infrastructure as Code — Terraform fundamentals (providers, resources, modules, variables, outputs, state); remote state (S3+DynamoDB, GCS, Terraform Cloud) with drift, imports and refactoring; modules (composition, versioning, registry); multi-environment (workspaces, Terragrunt, Atlantis); policy as code (OPA, Sentinel, Conftest); Pulumi (IaC in TypeScript, Python, Go); and Crossplane (Kubernetes-native control planes). **Indian context:** IaC foundational to Indian cloud-platform and DevOps teams building reproducible infrastructure.
Module 3	Kubernetes Production Operations	Kubernetes production operations — the architecture (control plane, kubelet, kube-proxy, CNI); workload types (Deployment, StatefulSet, DaemonSet, Job, CronJob); storage (PV, PVC, StorageClass, CSI); networking (Service, Ingress, Gateway API); service mesh (Istio, Linkerd, Cilium); autoscaling (HPA, VPA, KEDA, Cluster Autoscaler, Karpenter); operators and CRDs; Helm versus Kustomize; and multi-cluster (Karmada, Cluster API). **Indian context:** Kubernetes operations foundational to Indian cloud-native product and platform teams.
Module 4	GitOps CI/CD & Supply Chain Security	GitOps CI/CD and supply-chain security — GitOps principles (declarative, versioned, automated) with ArgoCD versus Flux; progressive delivery (canary, blue/green, feature flags); CI (GitHub Actions, GitLab CI, CircleCI, Jenkins); build (Buildkit, Bazel, ko, nixpacks); container security (image scanning via Trivy/Snyk/Grype, admission controllers, pod security standards); supply chain (SBOM, Sigstore cosign/fulcio, SLSA); and secret management (Vault, SOPS, External Secrets, sealed-secrets). **Indian context:** GitOps and supply-chain security foundational to Indian DevSecOps teams.

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Module 5	SRE Practice & Observability	SRE practice and observability — SRE foundations (SLO, SLI, error budget, toil, blameless postmortems); the three observability pillars (metrics, logs, traces); Prometheus (exporters, recording and alerting rules, federation, Thanos/Mimir); Grafana (dashboards, alerts, On-Call); logging (Loki, ELK/OpenSearch, Splunk); tracing (OpenTelemetry, Jaeger, Tempo, Honeycomb); continuous profiling (Pyroscope, Parca); chaos engineering (Chaos Mesh, Litmus, Gremlin); and incident response (PagerDuty, Opsgenie, Incident.io). **Indian context:** SRE practice foundational to Indian high-availability product teams.
Module 6	Internal Developer Platforms (IDP)	Internal developer platforms — the rationale (developer experience, cognitive load, golden paths); Backstage architecture (Software Catalog, Templates, TechDocs, Plugins); Port and Humanitec alternatives; self-service patterns (paved roads, golden templates, environment vending); platform engineering as a discipline; Team Topologies and platform-team interaction modes; and internal Kubernetes platforms (Cluster API, vCluster, Crossplane, Kratix). **Indian context:** internal developer platforms foundational to Indian scale-up and enterprise platform-engineering teams.

Recommended Textbooks & Reference Literature

- *Site Reliability Engineering*, Betsy Beyer, Chris Jones, Jennifer Petoff & Niall Richard Murphy, O'Reilly, 2016
- *The Site Reliability Workbook*, Betsy Beyer et al., O'Reilly, 2018
- *Implementing Service Level Objectives*, Alex Hidalgo, O'Reilly, 2020
- *Team Topologies*, Matthew Skelton & Manuel Pais, IT Revolution Press, 2019
- *Accelerate: The Science of Lean Software and DevOps*, Nicole Forsgren, Jez Humble & Gene Kim, IT Revolution Press, 2018
- *Terraform: Up and Running*, Yevgeniy Brikman, O'Reilly, 2022 (3rd ed.)
- *Kubernetes Up and Running*, Brendan Burns, Joe Beda, Kelsey Hightower & Lachlan Evenson, O'Reilly, 2022 (3rd ed.)

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COURSE PROFILE 13: DATA SCIENCE AND ANALYTICS ENGINEERING AT SCALE

Course Overview

- **Course Code:** 26CS5310E **Course Name:** Data Science and Analytics Engineering at Scale
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** ALGO

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Architect modern data platforms covering lakehouse and warehouse.	PO1(M), PO2(L), PO3(M), PO4(H)	PSO1	BTL4. Analyze
CO2	Engineer production data pipelines using Airflow / Dagster / Prefect with proper testing, lineage, observability, and dependency management.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO3	Build analytics-engineering workflows in dbt with proper modeling, tests, documentation, and dbt-mesh.	PO1(M), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Create
CO4	Engineer real-time streaming pipelines using Kafka and Flink / Spark Streaming / Materialize for sub-second analytics over event streams.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Apply reverse-ETL and operational analytics via Hightouch / Census.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO6	Build BI and self-service analytics with Looker / Metabase / Superset.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Modern Data Platform Architecture	Modern data platform architecture — data warehouse versus data lake versus lakehouse; cloud DW comparison (Snowflake with separated storage/compute, serverless slot-based BigQuery, Databricks lakehouse with Photon, plus Redshift/Synapse/Firebolt); open table formats (Netflix's Apache Iceberg, Databricks' Delta Lake, Uber's Hudi); the lakehouse rationale (open format, compute portability, ACID on object storage); storage tiers (hot, warm, cold, archive); and cost models. **Indian context:** data-platform engineering foundational to Indian analytics, fintech and e-commerce data teams.
Module 2	Production Data Pipelines (Airflow, Dagster, Prefect)	Production data pipelines — the orchestration evolution (cron to Airflow to asset-based Dagster to dynamic Prefect); Airflow (DAGs, operators, sensors, XCom, scheduler, Celery/Kubernetes executors); Dagster (software-defined assets, asset checks, lineage); Prefect (dynamic flows, deployments); data quality (Great Expectations, Soda, dbt tests); pipeline observability (Datafold, Monte Carlo, Bigeye); and lineage (OpenLineage, Marquez). **Indian context:** data-pipeline engineering foundational to Indian data-platform, analytics and fintech teams.
Module 3	Analytics Engineering with dbt	Analytics engineering with dbt — analytics engineering as a discipline; dbt project structure (staging, intermediate, marts); model materializations (view, table, incremental, materialized view); testing (generic, singular, dbt_utils, data contracts); documentation (dbt docs, exposures); macros and Jinja; snapshots for slowly-changing dimensions; sources and freshness; dbt-mesh cross-project references; the semantic layer (dbt Semantic Layer, Cube, MetricFlow); and performance (partition pruning, clustering). **Indian context:** analytics engineering foundational to Indian data and BI teams.
Module 4	Real-Time Streaming Analytics	Real-time streaming analytics — the streaming model (at-least-once versus exactly-once, watermarks, late data); Apache Kafka (producers, consumers, partitions, topics, retention); stream processing (stateful exactly-once Flink, Spark Structured Streaming, Kafka Streams); incremental-view Materialize and streaming-database RisingWave; Apache Pulsar; time-series databases (InfluxDB, TimescaleDB, QuestDB, Apache Druid, ClickHouse); and real-time dashboards. **Indian context:** streaming analytics foundational to Indian real-time fintech, gaming and ad-tech platforms.

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Module 5	Reverse-ETL & Operational Analytics	Reverse-ETL and operational analytics — reverse-ETL (pushing warehouse data into operational systems like Salesforce, HubSpot, Slack, Stripe via Hightouch, Census, Polytomic); embedded operational analytics; customer data platforms (Segment, RudderStack); feature stores for ML (Feast, Tecton, Hopsworks); activation use cases (personalisation, churn intervention, upsell); and data products versus dashboards with data contracts and APIs. **Indian context:** operational analytics foundational to Indian SaaS, fintech and e-commerce growth teams.
Module 6	Self-Service BI & Semantic Layer	Self-service BI and the semantic layer — the BI evolution (legacy Tableau/Power BI, Looker's LookML, open-source Metabase/Superset, modern Hex/Mode/Sigma); the semantic layer defining metrics once (dbt Semantic Layer/MetricFlow, Cube); data governance (column-level lineage, masking, fine-grained access); self-service empowering non-technical users; embedded analytics; and LLM text-to-SQL analytics chatbots. **Indian context:** self-service BI foundational to Indian data-driven product and enterprise decision-making.

Recommended Textbooks & Reference Literature

- *Fundamentals of Data Engineering*, Joe Reis & Matt Housley, O'Reilly, 2022
- *The Data Warehouse Toolkit*, Ralph Kimball & Margy Ross, Wiley, 2013 (3rd ed.)
- *Designing Event-Driven Systems*, Ben Stopford, O'Reilly, 2018
- *Streaming Systems*, Tyler Akidau, Slava Chernyak & Reuven Lax, O'Reilly, 2018
- *Data Engineering with Apache Spark*, Paul Crickard, Packt Publishing, 2024
- *The Cloud Data Lake*, Nkosanan Mahlangu, Packt Publishing, 2024

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COURSE PROFILE 14: AGENTIC AI, MCP AND MULTIMODAL ENGINEERING

Course Overview

- **Course Code:** 26CS6111E **Course Name:** Agentic AI, MCP and Multimodal Engineering
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** GLLM

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse agentic AI architectures covering ReAct, plan-and-execute, and reflection.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO2	Engineer tool-using agents with proper tool definition, calling, error recovery, and safety constraints using Anthropic Tool Use / OpenAI Functions / native model APIs.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO3	Build and integrate Model Context Protocol servers exposing tools, resources, and prompts to agentic clients in a standards-compliant way.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Engineer multi-agent systems using LangGraph / AutoGen / CrewAI / Anthropic Agent SDK with proper state management, communication, and orchestration.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Build computer-use and browser-automation agents using Anthropic Computer Use / Playwright / Browser Use with proper safety and human-in-the-loop checkpoints.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO6	Engineer multimodal applications covering voice and vision.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Agentic AI Architectures & Patterns	Agentic AI architectures and patterns — what makes a system agentic (autonomy, tool use, environment interaction, goal-directed behavior); agent architectures (ReAct, Plan-and-

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		Execute, Reflection, Tree of Thoughts, Self-consistency); the agent loop (perception, planning, action, evaluation); memory (short-term context, long-term retrieval, episodic, semantic); goal decomposition; failure modes (hallucination, infinite loops, harmful actions); and Anthropic's building-effective-agents principles versus over-engineered chains. **Indian context:** agentic AI foundational to Indian GenAI startups and enterprise automation.
Module 2	Tool Use & Function Calling	Tool use and function calling — tool definition (JSON Schema, Pydantic models, type-safe interfaces); native APIs (Anthropic Tool Use, OpenAI Functions, Gemini function calling); execution patterns (synchronous, async, parallel, streaming); error handling (retries, timeouts, fallbacks, malformed calls); tool-design principles (clear names, focused scope, concrete errors); security (capability constraints, sandboxing, least privilege); human-in-the-loop confirmations; and cost management. **Indian context:** tool-use engineering foundational to Indian agentic-AI and enterprise-automation product teams.
Module 3	Model Context Protocol (MCP)	The Model Context Protocol — its rationale (an open standard connecting AI to tools, resources and data sources); the architecture (clients like Claude Desktop and IDEs, and servers for data, tools and prompts); the three primitives (callable Tools, file-like Resources, template Prompts); transports (stdio, SSE, HTTP); building MCP servers (Python and TypeScript SDKs); server discovery and registry; security (capabilities, sandboxing, audit trails); and real-world servers (file systems, GitHub, Notion, Postgres, Slack). **Indian context:** MCP integration foundational to Indian agentic-AI and enterprise-tool ecosystems.
Module 4	Multi-Agent Systems & Orchestration	Multi-agent systems and orchestration — when multi-agent helps versus single-agent-plus-tools (Anthropic's pragmatic stance); multi-agent patterns (supervisor, hierarchical, parallel-execution, debate); state management (agent state, shared state, message passing); frameworks (LangGraph state machines, Microsoft AutoGen, role-based CrewAI, Anthropic Agent SDK, Mastra); communication protocols (Agent2Agent); and observability (LangSmith, Helicone, Langfuse for distributed agent traces). **Indian context:** multi-agent orchestration foundational to Indian complex-workflow automation startups.
Module 5	Computer Use & Browser Agents	Computer-use and browser agents — computer-use agents (Anthropic Computer Use, OpenAI Operator, Google Gemini computer use); vision-grounded screenshot-to-action loops; browser agents (Playwright-driven, Browser Use, Anchor

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		Browser, MultiOn); action grounding (click coordinates, keyboard input, scroll); safety (sandboxed VMs, restricted accounts, human checkpoints); long-running task management; failure recovery when agents get lost; cost considerations (vision tokens, action steps); and production patterns (RPA replacement, automated QA, task automation). **Indian context:** computer-use agents foundational to Indian RPA-replacement and automation product teams.
Module 6	Multimodal Agents — Voice + Vision	Multimodal voice and vision agents — voice agents (ASR via Whisper/Deepgram/Sarvam Saaras, then LLM, then TTS via ElevenLabs/Cartesia/Sarvam Bulbul) with low-latency streaming pipelines (Vapi, Retell, LiveKit Agents), interrupt handling, turn and silence detection; vision agents (VLM-driven UIs via Claude vision, GPT-4V, Gemini, LLaVA); multimodal RAG (text plus image retrieval); voice-cloning ethics and consent; and production uses (Sarvam-backed Indian-language support bots, vision AI tutors, accessibility agents). **Indian context:** multimodal agents foundational to India's 22-language voice-AI and accessibility ecosystems.

Recommended Textbooks & Reference Literature

- *Pattern Recognition and Machine Learning*, Christopher M. Bishop, Springer, 2006
- *Artificial Intelligence: A Modern Approach*, Stuart Russell & Peter Norvig, Pearson, 2020 (4th ed.)
- *Deep Learning*, Ian Goodfellow, Yoshua Bengio & Aaron Courville, MIT Press, 2016
- *Natural Language Processing with Transformers*, Lewis Tunstall, Leandro von Werra & Thomas Wolf, O'Reilly, 2022
- *Reinforcement Learning: An Introduction*, Richard S. Sutton & Andrew G. Barto, MIT Press, 2018 (2nd ed.)

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COURSE PROFILE 15: HIGH-PERFORMANCE COMPUTING SYSTEMS

Course Overview

- **Course Code:** 26CS6112E **Course Name:** High-Performance Computing Systems
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** OSDS

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse modern computing architectures using roofline analysis and arithmetic intensity.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO2	Engineer GPU kernels using CUDA C++ and Triton with proper memory access patterns, occupancy, and tensor-core utilization.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO3	Implement parallel programs using OpenMP, MPI, and oneAPI for multi-core CPU and multi-node distributed memory systems.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Engineer distributed training of large models using DDP, FSDP, ZeRO, pipeline parallelism, and tensor parallelism with proper communication optimization.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Apply ML compilers to optimize neural network execution.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL5. Evaluate
CO6	Engineer high-performance inference systems using vLLM, TensorRT-LLM, SGLang with continuous batching, paged attention, and quantization.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Modern Computing Architectures & Performance Analysis	Modern computing architectures and performance analysis — CPU architectures (superscalar, out-of-order execution, SIMD via AVX-512/NEON/SVE2, branch prediction, prefetching, NUMA); GPU architectures (SM/CUDA cores, warps, tensor cores, HBM3/GDDR/L1/L2/shared-memory/register hierarchy); specialized AI hardware (systolic-array TPU v5/v6, Trainium, Groq LPU, Cerebras WSE); the roofline model (peak FLOPS versus memory bandwidth, arithmetic intensity); and performance metrics (TFLOPS, throughput, latency, bandwidth utilization). **Indian context:** performance engineering foundational to Indian HPC and AI-systems teams.
Module 2	GPU Programming (CUDA, Triton)	GPU programming — the CUDA model (threads, warps, blocks, grids); the memory hierarchy (global, shared, constant, texture, registers) with coalescing, bank conflicts and occupancy; tensor cores (WMMA, CUTLASS, cuBLAS, cuDNN); Triton (OpenAI's Python-like kernels) versus raw CUDA; profile-driven optimization; FlashAttention as a kernel-fusion IO-aware case study; and multi-GPU programming (peer-to-peer, NVLink, NCCL). **Indian context:** GPU programming among the scarcest, highest-value skills in Indian AI-systems and semicon engineering.
Module 3	Parallel CPU Programming (OpenMP, MPI, SIMD)	Parallel CPU programming — shared-memory parallelism (OpenMP directives, parallel-for, sections, tasks, reductions, atomics) with false sharing, MESI/MOESI cache coherence, NUMA-aware placement and thread affinity; distributed-memory MPI (Send/Recv/Bcast/Reduce/Scatter/Gather/AllReduce/AllGather and collective algorithms); SIMD intrinsics (AVX-512, NEON, SVE2) and auto-vectorization; and heterogeneous oneAPI/SYCL (CPU+GPU+FPGA). **Indian context:** parallel programming foundational to Indian HPC, scientific-computing and AI-systems teams.
Module 4	Distributed Training of Large Models	Distributed training of large models — data parallelism (DDP, FSDP, and DeepSpeed ZeRO stages 1-3) with AllReduce/ReduceScatter/AllGather; tensor parallelism (Megatron-LM column/row); pipeline parallelism (GPipe, PipeDream, 1F1B); expert parallelism for MoE; sequence parallelism; 3D parallelism; mixed precision (FP16, BF16, FP8 on H100/B200); gradient accumulation; activation recomputation; and communication-computation overlap. **Indian context:** distributed training foundational to Indian

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		foundation-model builders (Sarvam, Krutrim) and AI-compute teams.
Module 5	ML Compilers & Graph Optimization	ML compilers and graph optimization — computational graphs (eager versus graph mode); the compiler stack (frontend PyTorch/JAX/ONNX, middle-end XLA HLO/MLIR/TVM Relay, backend LLVM/NVPTX/ROCm/OpenCL); optimizations (operator fusion, layout transformation NCHW/NHWC, kernel scheduling, polyhedral); JAX+XLA; Torch Compile (TorchDynamo, AOTAutograd, TorchInductor); Apache TVM; MLIR; quantization-aware compilation; and Triton as a compiler target. **Indian context:** ML-compiler engineering foundational to Indian AI-systems and semicon toolchain teams.
Module 6	High-Performance Inference Engines	High-performance inference engines — the LLM inference challenges (KV-cache memory, autoregressive decoding, batch heterogeneity); continuous versus static batching; paged attention (vLLM); speculative decoding; prefix caching; inference quantization (INT8 W8A8/SmoothQuant, INT4 GPTQ/AWQ, FP8, 1-bit BitNet); serving systems (vLLM, TensorRT-LLM, SGLang, llama.cpp, MLC LLM); multi-LoRA serving; and edge deployment (CoreML, ONNX Runtime Mobile, llama.cpp on Apple silicon). **Indian context:** inference engineering foundational to Indian GenAI platforms and edge-AI teams.

Recommended Textbooks & Reference Literature

- *Computer Architecture: A Quantitative Approach*, John L. Hennessy & David A. Patterson, Morgan Kaufmann, 2017 (6th ed.)
- *Programming Massively Parallel Processors: A Hands-on Approach*, David B. Kirk & Wen-mei W. Hwu, Morgan Kaufmann, 2022 (4th ed.)
- *An Introduction to Parallel Programming*, Peter Pacheco, Morgan Kaufmann, 2021 (2nd ed.)
- *CUDA for Engineers: An Introduction to High-Performance Parallel Computing*, Duane Storti & Mete Yurtoglu, Addison-Wesley, 2015

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COURSE PROFILE 16: PARALLEL AND CONCURRENT PROGRAMMING MODELS

Course Overview

- **Course Code:** 26CS52A1E **Course Name:** Parallel and Concurrent Programming Models
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** CTPG, OSDS

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse concurrency theory for a given problem.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO2	Engineer Go programs using goroutines, channels, select, sync primitives, and context propagation at production patterns scale.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO3	Build async Rust services using Tokio, async/await, Send/Sync, ownership-based concurrency, and lock-free data structures.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Implement actor-based systems using Erlang/Elixir and OTP with GenServer, supervision trees, and let-it-crash discipline.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Apply functional concurrency covering Software Transactional Memory and reactive streams.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO6	Engineer lock-free and wait-free data structures using atomics, memory ordering, hazard pointers, and RCU for high-contention scenarios.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Concurrency Theory & Programming Models	Concurrency theory and models — concurrency versus parallelism (Pike's distinction); concurrency models (shared memory with locks, CSP message passing, actor model, futures/promises, dataflow, transactional memory, structured concurrency); theory (happens-before, sequential consistency, linearizability); memory models (x86 TSO, weak ARM/Power, Java and C++ memory models);

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		bug taxonomies (data race, deadlock, livelock, starvation, priority inversion); and the historical lineage (Hoare's CSP, Hewitt's actors, Dijkstra's semaphores). **Indian context:** concurrency foundations for Indian high-scale systems engineering.
Module 2	Go Concurrency Patterns (Beyond the Basics)	Go concurrency patterns beyond the basics — goroutines (creation cost, the M:N GMP scheduler, Go 1.14+ preemption); channels (buffered versus unbuffered, close idioms, range-over-channel); select (fan-in, fan-out, timeout, cancellation); sync primitives (Mutex, RWMutex, Once, WaitGroup, Cond); context propagation (cancellation, deadlines, values); patterns (worker pool, pipeline, generator, channel semaphore, errgroup, singleflight); and antipatterns (goroutine leaks, channel-closure pitfalls). **Indian context:** Go concurrency foundational to Indian backend and cloud-infrastructure teams.
Module 3	Async Rust & Lock-Free Engineering	Async Rust and lock-free engineering — Rust ownership and Send/Sync compile-time concurrency safety; async/await (the Future trait, Poll, Wakers); the Tokio runtime (multi-threaded executor, task scheduler, I/O reactor) and async-std/smol; async traits and Pin; channels (std mpsc, tokio mpsc/oneshot/broadcast, crossbeam, flume); lock-free primitives (Arc, atomics, parking_lot, dashmap, evmap); Loom concurrency testing; and production stacks (Tower, Hyper, Axum, Actix Web). **Indian context:** async Rust foundational to Indian high-performance systems and fintech teams.
Module 4	Erlang/OTP & Actor-Based Systems	Erlang/OTP and actor-based systems — why BEAM matters (soft real-time, fault tolerance, hot code reload, billions of lightweight processes); Erlang fundamentals (pattern matching, immutable data, message passing); OTP behaviors (GenServer, GenStateMachine, Supervisor, Application) and supervision trees with let-it-crash discipline; distributed Erlang; Elixir (modern BEAM syntax, macros, Phoenix LiveView); and ETS/DETS/Mnesia state. **Indian context:** actor-based systems foundational to Indian real-time messaging and telecom platforms.
Module 5	Functional Concurrency — STM, Reactive Streams, Akka	Functional concurrency — Software Transactional Memory (Haskell STM, Clojure refs/atoms/agents) and its deadlock-avoidance versus retry costs; reactive streams (Reactor, RxJava/RxJS, Akka Streams) with backpressure as a first-class concept; Akka actors (JVM actor model, Cluster, Persistence event sourcing); functional reactive programming; Java Project Loom virtual threads; the capability-secure Pony language; and comparing models on

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		a single workload. **Indian context:** functional-concurrency approaches foundational to Indian reactive-systems and JVM-platform teams.
Module 6	Lock-Free & Wait-Free Engineering	Lock-free and wait-free engineering — the motivation (eliminating priority inversion, deadlock, and sometimes contention); compare-and-swap and LL/SC; the ABA problem and solutions (tagged pointers, hazard pointers, epoch-based reclamation, RCU); lock-free queues (Michael-Scott), stacks (Treiber) and hash maps; the wait-free/lock-free/obstruction-free distinctions; concurrent reclamation (hazard pointers, Linux-kernel RCU); memory ordering (relaxed to SeqCst); false sharing and cache-line padding; and real production code. **Indian context:** lock-free engineering among the scarcest Indian systems skills.

Recommended Textbooks & Reference Literature

- *Rust Atomics and Locks*, Mara Bos, O'Reilly, 2023
- *The Go Programming Language*, Alan A. A. Donovan & Brian W. Kernighan, Addison-Wesley, 2015
- *Designing for Scalability with Erlang/OTP*, Francesco Cesarini & Steve Vinoski, O'Reilly, 2016
- *Java Concurrency in Practice*, Brian Goetz et al., Addison-Wesley, 2006
- *The Art of Multiprocessor Programming*, Maurice Herlihy & Nir Shavit, Morgan Kaufmann, 2020 (2nd ed.)
- *Is Parallel Programming Hard, And, If So, What Can You Do About It?*, Paul E. McKenney, Kernel.org, 2021

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COURSE PROFILE 17: KUBERNETES AND CONTAINER ORCHESTRATION

Course Overview

- **Course Code:** 26CS52B1E **Course Name:** Kubernetes and Container Orchestration
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** OSDS, DCNP

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse Kubernetes internals covering controller manager, kubelet, and scheduler.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO2	Engineer custom Kubernetes operators using controller runtime, Kubebuilder, and Operator SDK with proper reconciliation, status management, finalizers, and webhook patterns.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO3	Design and deploy Custom Resource Definitions (CRDs) with comprehensive schema validation, conversion webhooks, API versioning, and OpenAPI documentation.	PO1(H), PO2(M), PO3(M), PO4(M)	PSO1	BTL5. Create
CO4	Apply multi-cluster Kubernetes patterns covering Cluster API for cluster lifecycle, Karmada for federation, and vCluster for virtual clusters.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO5	Engineer production Kubernetes platforms using Crossplane and Kratix for Infrastructure-as-Data, Karpenter for node autoscaling, and KEDA for event-driven scaling.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Evaluate
CO6	Build complete Internal Developer Platforms (IDPs) on Kubernetes using Backstage,	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

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	Port, or Humanitec with self-service developer workflows.			

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Kubernetes Internals – Source-Level Deep Dive	Kubernetes internals at source level—architecture of the control plane (API Server, etcd, Controller Manager, Scheduler) and data plane (Kubelet, Kube-Proxy, Container Runtime); watch-list mechanisms (Informers, Listers, Work Queues); reconciliation pattern (desired versus observed state, control loops); etcd as the source of truth (watch streams, optimistic concurrency); admission controllers (validating and mutating webhooks); scheduler internals (predicates, priorities, scoring framework); kubelet's Pod Lifecycle Event Generator (PLEG); CNI, CSI, and CRI plugin interfaces; and effective navigation of the Kubernetes Go codebase. **Indian context:** Kubernetes internals form the foundation of cloud-native platform engineering across Indian enterprises and hyperscale cloud teams.
Module 2	Kubernetes Operators with controller-runtime & Kubebuilder	Kubernetes operators and controller development—the Operator Pattern; Operator SDK and Kubebuilder scaffolding; controller-runtime architecture (Manager, Cache, Client, Reconciler); reconciliation best practices (idempotency, observe-then-act, requeue strategies); Status subresource; Finalizers for safe deletion; Owner References and garbage collection; operator metrics; webhook patterns (defaulting, validation, conversion); Operator Lifecycle Manager (OLM); Helm-based versus Go-based operators; and OperatorHub ecosystem. **Indian context:** Operator engineering is foundational to cloud-native automation and platform teams across Indian technology organizations.
Module 3	CRDs, API Design & Schema Engineering	Custom Resource Definitions (CRDs) and Kubernetes API engineering—declarative API philosophy; Spec and Status separation; OpenAPI v3 schema validation; admission webhook defaulting; conversion webhooks for API version evolution; Status and Scale subresources; Kubernetes API conventions (naming, labels, annotations); deletion-order finalizers; aggregated APIs using APIService; Alpha, Beta, and GA versioning strategies; schema

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		evolution; and production CRDs including Argo CD Application, Knative Service, and Tekton Pipeline. **Indian context:** CRD and API engineering skills are increasingly important in Indian Kubernetes platform development teams.
Module 4	Multi-Cluster Kubernetes Patterns	Multi-cluster Kubernetes architecture—drivers including multi-region deployment, multi-cloud strategy, multi-tenancy, blast-radius isolation, and regulatory compliance; Cluster API declarative cluster lifecycle management across AWS, Azure, GCP, and vSphere; Karmada federation with propagation and override policies; Open Cluster Management; vCluster for virtual clusters; Submariner networking; Cilium Cluster Mesh; service migration strategies; and federated observability using Mimir, Thanos, and Loki. **Indian context:** Multi-cluster architectures support geographically distributed cloud deployments and regulated industries in India.
Module 5	Crossplane, Kratix & Cluster Autoscaling	Infrastructure-as-Data and production platform engineering—Crossplane architecture and cloud providers (AWS, Azure, GCP, Terraform); Composite Resources and Compositions; Kratix promises and Platform-as-a-Product philosophy; Cluster API integration; Karpenter just-in-time node provisioning versus Cluster Autoscaler; KEDA event-driven autoscaling with Kafka, RabbitMQ, and SQS triggers; Horizontal and Vertical Pod Autoscaling (HPA/VPA); Pod Priority, Preemption, Topology Spread Constraints; and Spot-aware scheduling. **Indian context:** Declarative infrastructure and intelligent autoscaling are foundational to cost-efficient cloud-native platforms in Indian enterprises.
Module 6	Internal Developer Platforms (IDPs) on Kubernetes	Internal Developer Platforms (IDPs)—platform engineering philosophy (golden paths, paved roads, cognitive-load reduction); Backstage architecture (Software Catalog, Templates, TechDocs, Plugins, Permissions); custom Backstage plugin development; Port and Humanitec alternatives; self-service platform capabilities including ephemeral environments, environment vending, and golden-path templates; Team Topologies interaction models; Crossplane-integrated self-service platforms; and measuring platform success using DORA metrics, SPACE framework, and Developer Experience (DX) surveys. **Indian context:** Internal Developer

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		Platforms are becoming a core capability for enterprise platform engineering and cloud-native software delivery in Indian organizations.

Recommended Textbooks & Reference Literature

- *Kubernetes Up & Running (3rd Edition), Brendan Burns, Joe Beda & Kelsey Hightower, O'Reilly, 2022.*
- *Kubernetes Operators, Jason Dobies & Joshua Wood, O'Reilly, 2020.*
- *Cloud Native Spring in Action, Kamesh Vetal, Manning Publications, 2023.*
- *Team Topologies, Matthew Skelton & Manuel Pais, IT Revolution Press, 2019.*
- *Cloud Native Architectures, Yasir Bashir, Packt Publishing, 2018.*
- *The Kubebuilder Book, Kubernetes SIG API Machinery, Kubebuilder Project (Online Documentation).*

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COURSE PROFILE 18: CUDA AND GPU PROGRAMMING

Course Overview

- **Course Code:** 26CS53A2E **Course Name:** CUDA and GPU Programming
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** CTPG

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse GPU microarchitecture via roofline and Nsight Compute.	PO1(M), PO2(L), PO3(M), PO4(H)	PSO1	BTL4. Analyze
CO2	Engineer high-performance CUDA kernels using shared memory tiling, warp-level primitives, async copy, and multi-stage pipelining for production workloads.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO3	Implement tensor-core programming using WMMA / MMA APIs and CUTLASS templates.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Reproduce IO-aware kernel design for memory bandwidth optimization.	PO1(H), PO2(M), PO3(M), PO4(M)	PSO1	BTL5. Create
CO5	Engineer multi-GPU programs with NCCL collectives, NVLink topology awareness, peer-to-peer access, and cooperative groups.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO6	Apply Triton for compiler-driven kernel authoring.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	GPU Microarchitecture & Performance Analysis	GPU microarchitecture and performance analysis — the evolution (Volta, Turing, Ampere, Hopper, Blackwell B100/B200); the streaming multiprocessor (CUDA cores, tensor cores, RT cores, special-function units); warp execution (32-thread SIMD lanes, scoreboarding, instruction issue); the memory hierarchy (registers, banked shared memory, L1/L2 cache, HBM3, Hopper

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		TMA async copy); instruction pipelines (FMA, tensor-core MMA, transcendentals); occupancy limiters (registers, shared memory, blocks per SM); performance metrics (achieved occupancy, SM efficiency, memory throughput); and GPU-level roofline analysis. **Indian context:** GPU microarchitecture foundational to Indian AI-systems and semicon teams.
Module 2	CUDA Kernel Engineering Patterns	CUDA kernel engineering patterns — kernel design (block/grid configuration, shared-memory and register tiling); memory access patterns (coalescing, broadcasts, vectorized LDG.E.128 loads); bank conflicts and avoidance (padding, swizzling); warp-level primitives (__shfl_sync, __ballot_sync, cooperative-group reductions); async copy via TMA/cp.async with multi-stage software pipelining; PTX inline assembly; kernel-launch overhead and CUDA Graphs; dynamic parallelism; and debugging (cuda-gdb, compute-sanitizer). **Indian context:** CUDA kernel engineering among the highest-value Indian AI-systems skills.
Module 3	Tensor Cores & CUTLASS	Tensor cores and CUTLASS — tensor cores (matrix-multiply-accumulate units across Volta FP16, Ampere TF32/BF16, Hopper FP8, Blackwell FP4/MXFP generations); the WMMA API (fragment, load, store, mma_sync) and modern PTX mma.sync; CUTLASS (the header-only template library for tensor-core GEMMs and convolutions) with its shape/layout abstractions and block/warp/thread kernel hierarchies; CuTe's tensor-layout DSL; and cuBLAS-LT runtime kernel selection. **Indian context:** tensor-core programming foundational to Indian AI-accelerator and model-training teams.
Module 4	IO-Aware Kernel Design (FlashAttention)	IO-aware kernel design via FlashAttention — why standard attention is memory-bound; the online-softmax derivation (incremental max, log-sum-exp tricks); tiling from HBM to SRAM to keep the working set on-chip; backward-pass recomputation avoiding the full attention matrix; the FlashAttention v1/v2/v3 deltas (split-K, Hopper warpgroup MMA, FP8); causal versus non-causal masking efficiency; sliding-window attention (Mistral); paged attention (vLLM block-allocated KV cache); and custom fused kernels beyond attention. **Indian context:** IO-aware kernel design foundational to Indian LLM-serving and AI-systems teams.

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Module 5	Multi-GPU Programming	Multi-GPU programming — topologies (PCIe, NVLink, NVSwitch, fully-connected, ring, hierarchical multi-node); peer-to-peer memory access; NCCL primitives (ring/tree AllReduce, ReduceScatter, AllGather, Broadcast, Reduce) and their alpha-beta complexity; cooperative groups across blocks; multi-stream concurrency and stream priorities; H100/B100 SuperPOD NVLink/NVSwitch topologies; communication-computation overlap; and multi-node via MPI+NCCL or RDMA/GPUDirect. **Indian context:** multi-GPU programming foundational to Indian large-model training and AI-compute buildouts.
Module 6	Triton — Compiler-Driven Kernel Authoring	Triton compiler-driven kernel authoring — its rationale (Python-like syntax, compiler-driven optimization, auto-tuning); the programming model (block-level abstractions, automatic memory-hierarchy management, automatic vectorization); the productivity-versus-control comparison with raw CUDA; Triton internals (the MLIR-based compiler generating PTX); Triton kernels for matmul, attention and convolution; auto-tuning configurations; the performance ceiling relative to hand-tuned CUDA and when to drop to CUDA; and Triton in PyTorch TorchInductor. **Indian context:** Triton authoring foundational to Indian ML-systems and kernel-engineering teams.

Recommended Textbooks & Reference Literature

- *Programming Massively Parallel Processors: A Hands-on Approach*, David B. Kirk & Wen-mei W. Hwu, Morgan Kaufmann, 2022 (4th ed.)
- *Professional CUDA C Programming*, John Cheng, Max Grossman & Ty McKercher, Wrox, 2014
- *CUDA for Engineers: An Introduction to High-Performance Parallel Computing*, Duane Storti & Mete Yurtoglu, Addison-Wesley, 2015
- *NVIDIA CUDA C Programming Guide*, NVIDIA Corporation, Online Technical Documentation
- *NVIDIA CUDA Best Practices Guide*, NVIDIA Corporation, Online Technical Documentation

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COURSE PROFILE 19: SERVICE MESH AND MICROSERVICES ARCHITECTURE

Course Overview

- **Course Code:** 26CS53B2E **Course Name:** Service Mesh and Microservices Architecture
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** FSWE, KUBE

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Apply Domain-Driven Design (DDD) principles including bounded contexts, aggregates, entities, value objects, repositories, and domain events to engineer scalable microservices.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4 – Analyze
CO2	Engineer event-driven architectures using Event Sourcing, CQRS, Saga patterns, Outbox/Inbox patterns, and eventual consistency for distributed applications.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5 – Create
CO3	Analyze service mesh architectures including Istio, Linkerd, and Cilium, and evaluate their suitability for production cloud-native deployments.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4 – Analyze
CO4	Engineer production-ready service mesh deployments using mTLS, traffic policies, resilience mechanisms, observability, RBAC, and progressive traffic shifting techniques.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5 – Create
CO5	Build modern API gateway solutions supporting authentication, rate limiting, protocol translation, GraphQL federation, gRPC, and real-time communication protocols.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5 – Create
CO6	Evaluate distributed-system anti-patterns and design properly bounded service decompositions using industry best practices for enterprise-scale systems.	PO1(H), PO2(M), PO3(M), PO4(M)	PSO1	BTL5 – Evaluate

Module-wise Syllabus Structure:

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Domain-Driven Design (DDD) for Microservices	Strategic Domain-Driven Design—bounded contexts, context mapping (anti-corruption layer, customer-supplier, conformist), ubiquitous language, domain vision; Tactical DDD—aggregates, entities, value objects,

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		repositories, domain events; Hexagonal (Ports-and-Adapters) Architecture; microservice decomposition strategies based on business domains, data ownership, and team boundaries; distributed monolith anti-pattern; Conway's Law, inverse Conway maneuver, Team Topologies, EventStorming workshops; industrial application of DDD in enterprise cloud-native systems.
Module 2	Event-Driven Architecture, CQRS & Sagas	Event-driven architecture fundamentals; events as immutable facts; Event Sourcing; Command Query Responsibility Segregation (CQRS); read/write model separation; Saga orchestration vs choreography; distributed transactions; eventual consistency; compensating transactions; Outbox and Inbox patterns; schema evolution; event replay; auditing; idempotent event processing; designing highly scalable asynchronous systems.
Module 3	Service Mesh Internals – Istio, Linkerd & Cilium	Motivation for service mesh; sidecar proxy architecture; Envoy proxy; Istio control plane (Istiod), xDS APIs, Envoy filters; Linkerd architecture and Rust-based proxy; Cilium eBPF-based service mesh; proxyless service mesh; ambient mesh; comparison of service mesh platforms based on performance, security, observability, scalability, and operational complexity.
Module 4	Production Service Mesh Engineering	Mutual TLS (mTLS); SPIFFE/SPIRE workload identity; traffic management using VirtualService, DestinationRule and Gateway; canary deployments, blue-green deployments, shadow traffic; retries, circuit breakers, timeout policies; request authorization using RBAC; distributed tracing (W3C Trace Context), metrics and logging; multi-cluster service mesh; mesh upgrades; WebAssembly (Wasm) extensions; production best practices for cloud-native platforms.
Module 5	API Gateways & Protocol Engineering	API gateway responsibilities; authentication, authorization, rate limiting, caching, observability; Envoy Gateway, Kong, Traefik, Tyk, Apigee, Apollo Router, Hasura; gRPC services, Protocol Buffers, streaming, gRPC-Web, REST-to-gRPC translation; GraphQL Federation; schema composition; contract validation; HTTP/3, WebSocket, Server-Sent Events (SSE), WebTransport; API lifecycle and schema management using Apollo GraphOS and Buf Schema Registry.
Module 6	Microservices Anti-Patterns & Properly-Bounded Decomposition	Distributed monolith; chatty services; shared databases; lockstep deployments; service contract testing using Pact and Spring Cloud Contract; backward compatibility; schema evolution; Strangler Fig pattern; Branch by

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		Abstraction; database decomposition strategies; modular monolith vs microservices vs cells architecture; right-sizing services; migration strategies; enterprise modernization and service boundary design.

Recommended Textbooks & Reference Literature

- Sam Newman, *Building Microservices* (2nd Edition), O'Reilly, 2021.
- Vaughn Vernon, *Implementing Domain-Driven Design*, Addison-Wesley, 2013.
- Eric Evans, *Domain-Driven Design: Tackling Complexity in the Heart of Software*, Addison-Wesley, 2003.
- Alberto Brandolini, *Introducing EventStorming*, Leanpub, 2021.
- Chris Richardson, *Microservices Patterns*, Manning Publications, 2018.
- Paulette Calçado, *Service Meshes: The Hidden Plumbing of Cloud Native*, O'Reilly Report.
- Brendan Burns, Joe Beda & Kelsey Hightower, *Kubernetes: Up & Running* (3rd Edition), O'Reilly, 2022.

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COURSE PROFILE 20: ML SYSTEMS: COMPILERS, TRAINING AND INFERENCE

Course Overview

- **Course Code:** 26CS61A3E **Course Name:** ML Systems: Compilers, Training and Inference
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** DLNP, AIML

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse PyTorch internals through the runtime.	PO1(M), PO2(H), PO3(M)	PSO1	BTL4. Analyze
CO2	Apply ML compilers covering TorchInductor, Apache TVM and analyse their fusion, and scheduling.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO3	Engineer custom Triton kernels for production ML workloads, integrating with PyTorch via custom ops or torch.compile backend.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Implement distributed-training framework primitives covering gradient AllReduce and ZeRO partitioning.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Analyse production inference engine internals covering vLLM's paged attention, continuous batching, and prefix caching.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO6	Build a production ML system end-to-end for a small but real model.	PO1(H), PO2(M), PO3(M), PO4(M)	PSO1	BTL5. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	PyTorch Internals — Autograd, Dispatcher, Eager vs Compiled	PyTorch internals — the architecture (Tensor as core abstraction, ATen library, c10 core, autograd engine); autograd (computational-graph construction, backward pass, accumulators, leaf tensors); the dispatcher (kernel dispatch by device/dtype/layout, dispatch keys, fallthrough); eager-mode internals (Python frontend to C++ ATen to CUDA/CPU kernels); the PyTorch 2 compiled stack (TorchDynamo bytecode-to-FX, AOTAutograd joint

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		forward-backward graph, TorchInductor codegen via Triton and C++); and reading PyTorch source effectively. **Indian context:** PyTorch internals foundational to Indian deep-learning-systems engineering teams.
Module 2	ML Compilers — TorchInductor, JAX/XLA, TVM, MLIR	ML compiler structure — the pipeline (frontend PyTorch/JAX/ONNX to IR to optimization passes to backend); the IRs (FX, XLA HLO, TVM Relay, MLIR dialects); the major compilers (Meta's Triton-based TorchInductor with FX optimizations; Google's JAX+XLA with HLO IR, jit, pmap and sharding; Apache TVM with Relay, TVMScript and AutoTVM/Ansor; and MLIR's multi-level dialects linalg/tosa/mhlo); and the optimization passes (operator fusion, layout transformation NCHW/NHWC/blocked, constant folding, dead-code elimination, kernel scheduling). **Indian context:** ML-compiler engineering foundational to Indian AI-systems and semicon toolchain teams.
Module 3	Custom Triton Kernels for Production ML	Custom Triton kernels for production ML — the rationale (Python-like authoring, compiler optimizations, auto-tuning); kernel structure (program_id, block-level abstractions, automatic memory hierarchy); building production kernels (fused attention, fused softmax, custom activations, sparse ops); auto-tuning configurations (block sizes, num_warps, num_stages); PyTorch integration (custom ops, torch.compile backend); the Triton-versus-hand-written-CUDA tradeoff; and Triton's MLIR-based compiler internals. **Indian context:** production Triton engineering foundational to Indian ML-systems teams.
Module 4	Distributed Training Framework Internals	Distributed-training framework internals — the paradigms (DDP, FSDP, ZeRO 1/2/3, Megatron-LM tensor parallelism, GPipe/1F1B/PipeDream pipeline parallelism, MoE expert parallelism, 3D parallelism); communication primitives (ring/tree/hierarchical AllReduce, ZeRO-3's ReduceScatter+AllGather); communication-computation overlap (gradient bucketing, async AllReduce); memory-saving techniques (gradient checkpointing, ZeRO-Offload CPU offloading, parameter sharding); mixed precision (FP16, BF16, Hopper/Blackwell FP8); and reading DeepSpeed/Megatron-LM/TorchTitan source. **Indian context:** distributed-training internals foundational to Indian foundation-model builders.
Module 5	Production Inference Engine Internals	Production inference-engine internals — the LLM-specific challenges (autoregressive decoding, KV-cache memory pressure, batch heterogeneity, request priority); vLLM internals (paged attention block-allocated KV cache,

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		continuous batching, prefix caching, multi-LoRA serving); SGLang internals (RadixAttention, structured output); speculative decoding (draft-plus-verifier, acceptance-rate analysis); serving quantization (INT8 W8A8/SmoothQuant, INT4 GPTQ/AWQ, FP8, 1-bit BitNet); and hardware-specific serving (vLLM on ROCm, Apple Metal MLC LLM, Groq LPU). **Indian context:** inference-engine internals foundational to Indian GenAI-platform and edge-serving teams.
Module 6	End-to-End ML System Build	End-to-end ML system build — training a small but real 1B-7B LLaMA-architecture model with a mini-DeepSpeed distributed setup; compiling and optimizing via TorchInductor with custom Triton kernels; deploying on a quantized vLLM-based inference stack; monitoring end-to-end (training throughput, inference latency, memory and GPU utilization); system metrics (model-FLOPs utilization, arithmetic intensity, scaling efficiency); and production lessons from frontier labs. **Indian context:** full-stack ML-systems build foundational to Indian AI-infrastructure and foundation-model teams.

Recommended Textbooks & Reference Literature

- *Deep Learning*, Ian Goodfellow, Yoshua Bengio & Aaron Courville, MIT Press, 2016
- *Compilers: Principles, Techniques, and Tools*, Alfred V. Aho, Monica S. Lam, Ravi Sethi & Jeffrey D. Ullman, Pearson, 2006 (2nd ed.)
- *MLIR: A Compiler Infrastructure for the End of Moore's Law*, Chris Lattner et al., IEEE/ACM Design Papers, 2021
- *Neural Network Systems and Architectures*, Selected Research Papers and Open Source Repositories

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COURSE PROFILE 21: SITE RELIABILITY ENGINEERING AND OBSERVABILITY

Course Overview

- **Course Code:** 26CS61B3E **Course Name:** Site Reliability Engineering and Observability
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** OSDS, CDVO

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Engineer SLOs, SLIs, and error budgets with proper mathematical foundation.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Evaluate
CO2	Build production observability using OpenTelemetry by instrumenting applications for metrics, logs, and traces.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO3	Apply Prometheus at scale with long-term storage, alerting, and monitoring optimization.	PO1(H), PO2(M), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO4	Engineer eBPF-based observability solutions for continuous profiling and kernel-level visibility.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Design and execute chaos engineering programs using modern chaos platforms.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO6	Lead incident response using DORA and SPACE reliability metrics.	PO1(L), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Evaluate

Module-wise Syllabus Structure:

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	SLO Engineering & Error Budgets	SLO engineering and error budgets — foundations of Site Reliability Engineering based on Google's SRE principles; Service Level Indicators (SLIs) including request-based and window-based measurements; golden signals (latency, traffic, errors, saturation); USE and RED methodologies; SLO mathematics and realistic reliability target definition; error budget calculation as (1 – SLO) ×

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		time; multi-window multi-burn-rate alerting for fast and slow reliability degradation; error-budget policies including deployment freezing when budgets are exhausted; user-journey versus service-level SLOs; SLO frameworks including OpenSLO, Sloth, and Nobl9. Indian context: SLO engineering is foundational for Indian high-availability product and platform engineering teams.
Module 2	OpenTelemetry — Production Instrumentation	OpenTelemetry production instrumentation — vendor-neutral CNCF observability standard; three observability signals (metrics, logs, and traces) with unified trace context; automatic versus manual instrumentation; OpenTelemetry SDK and Collector architecture; exporters including OTLP, Prometheus, Jaeger, Zipkin, and vendor-specific systems; sampling strategies (head-based, tail-based, probabilistic, parent-based); context propagation using W3C traceparent/tracestate and baggage; semantic conventions; profiling signal integration; span links and trace correlation; best practices including cardinality control, span enrichment, and error handling. Indian context: OpenTelemetry adoption is foundational for Indian production-observability teams.
Module 3	Prometheus & Grafana Stack at Scale	Prometheus and Grafana ecosystem at scale — Prometheus internals including TSDB, write-ahead log, head blocks, and persistent blocks; PromQL including recording rules, alerting rules, and query optimization; federation architectures (hierarchical and cross-cluster); long-term storage solutions including Thanos, Grafana Mimir, and Cortex; cardinality management and optimization using labels, label_replace, and recording rules; Grafana dashboards, unified alerting, and On-Call workflows; Loki log aggregation with LogQL and label-based indexing; Tempo distributed tracing with TraceQL. Indian context: Prometheus and Grafana stack adoption is foundational for Indian monitoring and SRE teams.
Module 4	eBPF-Based Observability	eBPF-based observability — motivation for kernel-level visibility without application instrumentation and with low overhead; eBPF fundamentals including programs through syscalls, kprobes, uprobes, tracepoints, and XDP; eBPF maps, loaders, and frameworks including libbpf, BCC, and bpftrace; observability platforms including Cilium Hubble, Pixie, Inspektor Gadget, Tetragon, Parca, and Pyroscope; bpftrace one-liners for production debugging; eBPF-based security monitoring using Cilium network policy and Tetragon runtime security;

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		performance analysis using flame graphs and USE methodology. Indian context: eBPF observability is foundational for Indian cloud-native performance and security engineering teams.
Module 5	Chaos Engineering	Chaos engineering principles — Netflix Chaos Monkey origin; hypothesis-driven experiments; defining steady state, blast radius, and abort conditions; chaos experiments across infrastructure, platforms, and applications including node failures, Kubernetes pod failures, network partitions, latency injection, and error injection; chaos platforms including Chaos Mesh, LitmusChaos, Gremlin, Steadybit, and Harness; GameDays as planned reliability exercises; continuous chaos integration with CI/CD pipelines; chaos maturity models; SLO validation through controlled failure experiments; real-world examples including Netflix Simian Army and Slack Disasterpiece Theater. Indian context: Chaos engineering is foundational for resilient high-availability platform teams in India.
Module 6	Incident Response & Reliability Practice	Incident response and reliability engineering practices — lifecycle phases including detection, declaration, mitigation, recovery, and postmortem analysis; incident management roles including Incident Commander, Communications Lead, Operations Lead, and SMEs; severity classification and paging strategies; communication patterns using status pages and internal/customer communication channels; mitigation before complete resolution; blameless versus blameful postmortems; postmortem documentation including timeline, contributing factors, and owned action items with deadlines; DORA metrics including deployment frequency, lead time, MTTR, and change failure rate; SPACE framework; developing organizational reliability culture. Indian context: Incident-response practices are foundational for Indian production reliability teams.

Recommended Textbooks & Reference Literature

- *Beyer B. et al., Site Reliability Engineering, O'Reilly, 2016 (Free Online)*
- *Beyer B. et al., The Site Reliability Workbook, O'Reilly, 2018 (Free Online)*
- *Hidalgo A., Implementing Service Level Objectives, O'Reilly, 2020*
- *Majors C., Fong-Jones L., Miranda G., Observability Engineering, O'Reilly, 2022*
- *Allspaw J., Robbins J., Web Operations: Keeping the Data on Time, O'Reilly, 2010*
- *Rosenthal C. et al., Chaos Engineering, O'Reilly, 2020*
- *Rice L., Learning eBPF, O'Reilly, 2023*

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COURSE PROFILE 22: PROCESSOR ARCHITECTURE AND ISA DESIGN

Course Overview

- **Course Code:** 26CS61A4E **Course Name:** Processor Architecture and ISA Design
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** OSDS

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Analyse modern ISA design.	PO1(H), PO2(L), PO3(M), PO4(M)	PSO1	BTL4. Analyze
CO2	Implement a single-cycle and multi-cycle RISC-V CPU in Verilog / Chisel.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO3	Engineer a pipelined RISC-V CPU with hazard detection, forwarding, branch prediction, and proper structural / data / control hazard handling.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Analyse out-of-order execution covering Tomasulo's algorithm, register renaming, and issue queues.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO5	Evaluate cache hierarchy designs using gem5 simulation and SPEC-style benchmarks.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Evaluate
CO6	Design a custom AI / DSP accelerator with associated ISA extensions, simulator, and FPGA prototype.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	ISA Design — RISC-V, x86, ARM	ISA design — the philosophy (RISC versus CISC, load-store, fixed versus variable encoding); the open RISC-V ISA (RV32I/RV64I/RV128I base with M, A, F/D/Q, V, C, B and P extensions); privilege levels (M/S/U); comparison with ARMv9 SVE2 and x86-64 AVX-512; encoding densities; ISA evolution; custom XS extensions

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		for accelerators; and domain-specific ISAs. **Indian context:** RISC-V ISA design central to India's indigenous processor programs (Shakti at IIT-Madras, VEGA at C-DAC).
Module 2	Single-Cycle & Multi-Cycle RISC-V CPU	Single-cycle and multi-cycle RISC-V CPU design — the datapath (register file, ALU, memory interface, control unit); single-cycle design (one instruction per clock, longest-path-limited) versus multi-cycle (multiple cycles, better resource utilization) with its control state machine; RTL in Verilog/SystemVerilog/Chisel with self-checking testbenches; verification via the riscv-tests RV32IM compliance suite; the synthesis flow (RTL to gates to place-and-route); and FPGA implementation on Lattice/Xilinx/Intel via Vivado/Quartus. **Indian context:** RISC-V CPU design foundational to India's Shakti, VEGA and semiconductor-workforce programs.
Module 3	Pipelined RISC-V CPU with Hazard Handling	Pipelined RISC-V CPU with hazard handling — the classical 5-stage pipeline (IF/ID/EX/MEM/WB); the hazards (structural, RAW data, control); forwarding/bypassing (EX/MEM and MEM/WB paths); stalls and bubble insertion for load-use hazards; branch prediction (static, and dynamic 1-bit/2-bit BHT, gshare, perceptron, neural); branch target buffer and return-address stack; pipeline flushing on misprediction; and real cores (SiFive E-series, Rocket, SweRV). **Indian context:** pipelined CPU design foundational to India's Shakti and VEGA processor programs.
Module 4	Out-of-Order Execution & Modern Microarchitecture	Out-of-order execution and modern microarchitecture — the ILP motivation; Tomasulo's algorithm (reservation stations, common data bus); register renaming to eliminate false dependencies; the Reorder Buffer for in-order retirement and precise exceptions; issue queues (unified versus distributed); the load-store queue and memory disambiguation; speculation and recovery; modern OoO cores (Intel Golden Cove, AMD Zen 4, Apple M3/M4, ARM Cortex-A720); the open-source Berkeley BOOM RV64GC core; and performance-counter bottleneck analysis. **Indian context:** out-of-order microarchitecture foundational to India's advanced-processor design ambitions.
Module 5	Memory Hierarchy & Cache Coherence	Memory hierarchy and cache coherence — cache fundamentals (direct-mapped, set-associative, fully associative, with LRU/RRIP/SHiP replacement); the multi-level L1/L2/L3 hierarchy (inclusive versus exclusive); coherence protocols (MESI, MOESI, MOSI,

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		snoopy versus directory-based) in many-core processors; TLBs and virtual-memory translation; prefetchers (stride, stream, neural); NUMA effects; memory controllers (DDR4/DDR5/HBM3); SRAM-versus-DRAM tradeoffs; and side-channel attacks (Spectre, Meltdown) with mitigations. **Indian context:** memory-hierarchy design foundational to India's Shakti, VEGA and AI-accelerator programs.
Module 6	Custom AI / DSP Accelerator Design	Custom AI / DSP accelerator design — defining custom ISA extensions (RISC-V X-custom instruction encoding); spatial compute units (systolic arrays for GEMM, vector processing units); dataflow architectures (weight-stationary, output-stationary, row-stationary); on-chip scratchpad memories versus cache; DMA engine and memory bandwidth optimization; cycle-accurate simulation via Spike/gem5 extensions; host-accelerator software stack (drivers, custom compiler passes); and FPGA prototyping of the full SoC. **Indian context:** AI accelerator design central to Indian fabless semiconductor startups and India Semiconductor Mission (ISM) initiatives.

Recommended Textbooks & Reference Literature

- *Computer Architecture: A Quantitative Approach*, John L. Hennessy & David A. Patterson, Morgan Kaufmann, 2017 (6th ed.)
- *Computer Organization and Design RISC-V Edition*, David A. Patterson & John L. Hennessy, Morgan Kaufmann, 2020 (2nd ed.)
- *The RISC-V Reader: An Open Architecture Atlas*, David Patterson & Andrew Waterman, Strawberry Canyon, 2017
- *Digital Design and Computer Architecture: RISC-V Edition*, Sarah L. Harris & David Harris, Morgan Kaufmann, 2021
- *Synthesis and Verification of RISC-V Processors*, Selected IEEE/ACM Microarchitecture Papers

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COURSE PROFILE 23: CLOUD PLATFORM ENGINEERING AND IaC

Course Overview

- **Course Code:** 26CS61B4E **Course Name:** Cloud Platform Engineering and Infrastructure as Code
- **L-T-P-S Structure:** 3-1-3-0 **Credits:** 3.5 **Prerequisite:** OSDS, DCNP

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Engineer Terraform / OpenTofu infrastructure at fleet scale.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	**BTL5. Create**
CO2	Build typed Infrastructure-as-Code solutions using Pulumi and Cloud Development Kits for production cloud platforms.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	**BTL5. Create**
CO3	Evaluate policy-as-code frameworks and engineer cloud governance using Open Policy Agent, Sentinel, and Conftest.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	**BTL5. Evaluate**
CO4	Engineer secure Infrastructure-as-Code supply chains using SBOMs, the SLSA framework, Sigstore, and DevSecOps practices.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	**BTL5. Create**
CO5	Evaluate cloud FinOps practices covering cost optimization, governance, and engineering-driven financial accountability.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	**BTL5. Evaluate**
CO6	Design platform-as-product solutions enabling internal developer platforms, golden paths, and self-service cloud infrastructure.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	**BTL5. Create**

Module-wise Syllabus Structure:

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	**Terraform / OpenTofu at Fleet Scale**	Terraform/OpenTofu at fleet scale—the architecture (providers, state management, plan/apply lifecycle); module composition (variables, outputs, locals, data sources, dynamic blocks); module registries (Terraform Registry, private registries, semantic versioning); multi-environment infrastructure (workspaces versus Terragrunt); state management at scale (remote backends

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		using AWS S3+DynamoDB, GCS, Terraform Cloud, Spacelift with locking and encryption); large-state operations (splitting, importing, state refactoring); drift detection (Atlantis, Spacelift, scheduled plans); custom provider development; and infrastructure automation best practices. **Indian context:** Terraform-based cloud automation is foundational to Indian cloud-platform engineering, enterprise DevOps, and digital-transformation initiatives.
Module 2	**Typed IaC with Pulumi & CDK**	Typed Infrastructure-as-Code with Pulumi and Cloud Development Kits—the rationale (compile-time guarantees, IDE support, abstraction, refactoring, full programming languages); Pulumi architecture (engine, state, generated providers) using TypeScript, Python, Go, and .NET; Component Resources; Pulumi Cloud; AWS CDK and CloudFormation; Azure Bicep; comparison of Terraform DSL, Pulumi, CDK, and Bicep; infrastructure libraries and reusable platform components; selecting typed IaC for large-scale platform engineering. **Indian context:** Typed IaC is increasingly adopted by Indian platform-engineering teams building large cloud-native systems and enterprise infrastructure platforms.
Module 3	**Policy-as-Code & Cloud Governance**	Policy-as-code and cloud governance—the rationale (preventing cloud misconfigurations before deployment); Open Policy Agent (OPA) and the Rego language; policy packaging and testing; HashiCorp Sentinel; Conftest; Kubernetes-native Kyverno; cloud governance using AWS Service Control Policies (SCPs), AWS Config Rules, GCP Organization Policies, and Azure Policy; CI/CD integration (pre-commit, plan-time, admission-time enforcement); governance policies for networking, encryption, regions, instance types, tagging, and compliance. **Indian context:** Policy-as-code is foundational to Indian cloud-governance, cybersecurity, and DevSecOps initiatives across enterprise and government sectors.
Module 4	**Supply-Chain Security for IaC**	Supply-chain security for Infrastructure-as-Code—the security rationale for IaC; Software Bill of Materials (SBOMs) using CycloneDX and SPDX; Supply-chain Levels for Software Artifacts (SLSA) framework; Sigstore ecosystem (Cosign signing, Fulcio, Rekor transparency log); in-toto attestations; container image signing and admission-time verification (Connaisseur, Kyverno, Sigstore Policy Controller); IaC security scanning using Trivy, Snyk, Grype, tfsec, Checkov, and KICS; GitOps delivery using Atlantis, Spacelift, and Argo CD; secure

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		review workflows and two-person approval policies. **Indian context:** Secure IaC pipelines are foundational to Indian DevSecOps teams supporting secure cloud-native software delivery.
Module 5	**FinOps Practice**	FinOps engineering—the FinOps Foundation Inform–Optimize–Operate lifecycle; cloud cost allocation using tagging strategies; team- and product-based accounting; showback versus chargeback; Savings Plans, Reserved Instances, and Spot Instances; rightsizing, autoscaling optimization, workload migration, and instance-family optimization; container cost allocation using Kubecost and OpenCost; anomaly detection; network egress optimization; multi-cloud cost comparison; cost-aware architectural decisions (managed versus self-managed services); FinOps as an engineering discipline. **Indian context:** FinOps is foundational to cost-efficient cloud adoption across Indian enterprises, startups, SaaS providers, and digital public infrastructure projects.
Module 6	**Platform-as-Product & Internal Developer Experience**	Platform engineering as a discipline distinct from DevOps; the platform-as-product mindset; internal developers as customers; golden paths, paved roads, and standardized developer workflows; environment vending machines for self-service provisioning; Internal Developer Platforms (Backstage, Port, Humanitec); Team Topologies; CNCF Platform Engineering principles; measuring platform success using DORA metrics, SPACE framework, adoption metrics, and internal NPS; centralized, decentralized, and federated operating models; deciding when platform engineering is appropriate. **Indian context:** Platform-as-product is central to Indian enterprise-scale software organizations, cloud-native startups, Global Capability Centers (GCCs), and digital engineering teams.

Recommended Textbooks & Reference Literature

- *Terraform: Up & Running (3rd Edition), Yevgeniy Brikman, O'Reilly Media, 2022.*
- *Pulumi: Up & Running, Paolo Mocenigo, O'Reilly Media, 2024.*
- *Cloud FinOps (2nd Edition), J.R. Storment & Mike Fuller, O'Reilly Media, 2023.*
- *Team Topologies, Matthew Skelton & Manuel Pais, IT Revolution Press, 2019.*
- *Accelerate: The Science of Lean Software and DevOps, Nicole Forsgren, Jez Humble & Gene Kim, IT Revolution Press, 2018.*

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		the Phase-I and Phase-II split; framing a clear, answerable research or engineering question.
Module 2	Literature Survey / Competitive Analysis	For the research track — PRISMA systematic review, citation-graph traversal, identifying seminal versus recent versus adjacent work; for the industry track — competitive analysis of existing products, services and open-source projects, gap analysis, market positioning; identifying the closest three to five prior works the dissertation must outperform; synthesising the state of the art into a defensible baseline.
Module 3	System Design & Methodology	System architecture — high-level diagram, component breakdown, interface design; methodology — algorithms, training procedures, evaluation protocols; data plan — sources, licensing, ethics; tooling and infrastructure decisions; risk register — what could fail and mitigations; reproducibility plan — commitments to open data, open code and open models; success criteria and evaluation metrics.
Module 4	Baseline Implementation	Implement the first working version end-to-end — even if simple, it must demonstrate the full pipeline; set up a reproducible training/inference pipeline; instrument with logging, telemetry and evaluation; establish baseline metrics; code quality — type hints, tests, CI/CD; containerise for portability; document setup so a reviewer can reproduce results in thirty minutes; version control and experiment tracking.
Module 5	Baseline Evaluation	Evaluate the baseline against the benchmarks established in the survey; quantitative metrics with statistical-significance testing; qualitative analysis — error categories and failure modes; ablation study — the contribution of each component; a comparative table against prior art; identifying the gaps that Phase II will close; documenting limitations and threats to validity.
Module 6	Phase-I Defense	A 20-minute presentation to a panel of two to three reviewers (academic supervisor, industry mentor, external faculty); cover problem motivation, literature positioning, methodology, baseline implementation, results and the Phase-II plan; question-and-answer demonstrating depth on every aspect; receiving structured feedback for Phase-II refinement; the decision — pass, pass-with-revisions, or restructure Phase-II; defining clear Phase-II objectives.

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COURSE PROFILE 24: CAPSTONE RESEARCH / INDUSTRY PROJECT – PHASE I

Course Overview

- **Course Code:** 26IE6202E **Course Name:** Capstone Research / Industry Project – Phase I
- **L-T-P-S Structure:** 0-0-36-0 **Credits:** 12 **Prerequisite:** RMIP

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Identify and scope a substantial research or industry problem suitable for a 6-month sustained engineering investigation.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL5. Create
CO2	Conduct comprehensive literature survey or competitive analysis to position the proposed work against current state-of-the-art.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO3	Design system architecture, methodology, and experimental setup with rigorous justification of every design choice.	PO1(H), PO2(M), PO3(M), PO4(M)	PSO1	BTL5. Create
CO4	Implement a functional baseline that demonstrates feasibility of the approach with measurable preliminary results.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO5	Evaluate baseline against established benchmarks.	PO1(M), PO2(H), PO3(M), PO4(L)	PSO1	BTL4. Analyze
CO6	Defend Phase-I work to a panel of academic and industry reviewers with a clear roadmap for Phase-II.	PO1(L), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Evaluate

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Problem Identification & Scoping	Source streams — faculty research labs, industry partnerships (KL corporate MoUs), open-source needs (LangChain/HuggingFace/vLLM issues), product gaps and startup ideas; scoping — six-month feasibility, dissertation-worthiness, defensibility, novelty; stakeholder alignment — supervisor, industry mentor, IPR cell; milestone planning —

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Recommended Textbooks & Reference Literature

- *The Elements of Style*, William Strunk Jr. & E. B. White, Pearson, 1999 (4th ed.)
- *Designing Data-Intensive Applications*, Martin Kleppmann, O'Reilly, 2017
- *Deep Learning*, Ian Goodfellow, Yoshua Bengio & Aaron Courville, MIT Press, 2016
- *Computer Architecture: A Quantitative Approach*, David A. Patterson & John L. Hennessy, Morgan Kaufmann, 2017 (6th ed.)
- *Writing for Computer Science*, Justin Zobel, Springer, 2014 (3rd ed.)

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COURSE PROFILE 25: CAPSTONE RESEARCH / INDUSTRY PROJECT – PHASE II

Course Overview

- **Course Code:** 26IE6303E **Course Name:** Capstone Research / Industry Project – Phase II
- **L-T-P-S Structure:** 0-0-36-0 **Credits:** 12 **Prerequisite:** CAP1

Course Outcome (CO) Articulation Matrix

CO#	Course Outcome (CO) Statement	PO Mapping	PSO Mapping	BTL Level
CO1	Implement the full system or methodology beyond Phase-I baseline, incorporating novel contributions that advance the state-of-the-art.	PO1(M), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Create
CO2	Conduct comprehensive evaluation covering benchmark comparisons, ablations, and error analysis.	PO1(L), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Evaluate
CO3	Produce a dissertation-grade thesis document following IEEE/ACM/Springer or institutional format.	PO1(M), PO2(M), PO3(M), PO4(H)	PSO1	BTL5. Create
CO4	Submit a publishable paper to a peer-reviewed venue OR file a patent disclosure OR ship a product feature OR open-source a substantial library.	PO1(L), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Create
CO5	Defend the dissertation to an external-examiner panel demonstrating mastery of every technical and methodological choice.	PO1(L), PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Evaluate
CO6	Translate the dissertation into a placement / PhD-application / startup-pitch artifact suite.	PO2(H), PO3(M), PO4(M)	PSO1	BTL5. Create

Module-wise Syllabus Structure

Module #	Module Title	Topics Covered & Conceptual Mapping
Module 1	Full System Implementation & Novel Contributions	Build beyond the Phase-I baseline; implement the novel contribution — a new algorithm, architecture, analysis, or product feature; integrate components into a polished end-to-end system; performance-tune for production-grade quality; stress-test against edge cases; code quality at staff-engineer level; maintain reproducibility,

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		documentation and version control throughout; and engineering the system for maintainability and extension.
Module 2	Comprehensive Evaluation	Go beyond Phase-I evaluation; multiple benchmarks — established plus dissertation-specific; ablation studies quantifying every design choice; error analysis — a taxonomy of failure modes; robustness — adversarial inputs, distribution shift, edge cases; fairness analysis where applicable; the cost-performance frontier; reproducibility cross-check by an independent third party; statistical rigour throughout; and reporting results with full honesty about limitations.
Module 3	Dissertation Writing	The full dissertation document (60-100 pages); structure — abstract, introduction, related work, methodology, implementation, evaluation, discussion, conclusion, future work, references, appendices; the narrative arc telling the story of the work; figures and tables that each earn their place; consistent, correct mathematical notation; citation discipline; plagiarism check; rounds of supervisor review and revision; clarity, rigour and academic style.
Module 4	External Output — Paper / Patent / Product / OSS	Translate the dissertation into one or more external outputs — a paper submitted to a peer-reviewed venue (workshop, conference, journal); a patent disclosure filed with the IPR cell, optionally via the PCT route; a product feature shipped to production at an industry partner; or an open-source library published with documentation, examples and community engagement; the outcome is real — visible, reviewable and citable.
Module 5	Final Dissertation Defense	A 30-minute presentation to a panel of supervisor, industry mentor (where applicable), an external examiner from a different institution, and one to two internal faculty; the panel reviews the dissertation, evaluation report and external output before the defence; question-and-answer covering methodology depth, alternative design choices, limitations and future work; the decision — pass, pass-with-revisions, pass-with-major-revisions, or fail; the external examiner's evaluation is binding.
Module 6	Translation to Career Artifacts	Translate the dissertation into career-leverage artifacts; for placements — an arXiv preprint, demo video, GitHub repo with stars, and a blog post explaining the work; for PhD applications — a research statement, reference letters, a paper preprint, and a statement of purpose; for startup founding — a pitch deck, business plan, market sizing, technical demo, and IP strategy; the dissertation is the launch pad, not the destination.

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Recommended Textbooks & Reference Literature

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- *Designing Data-Intensive Applications*, Martin Kleppmann, O'Reilly, 2017
- *Computer Architecture: A Quantitative Approach*, David A. Patterson & John L. Hennessy, Morgan Kaufmann, 2017 (6th ed.)
- *Writing for Computer Science*, Justin Zobel, Springer, 2014 (3rd ed.)

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