SCHOOL OF COMPUTING & INTELLIGENT SYSTEMS

PROGRAMME PROJECT REPORT (PPR)

BACHELOR OF COMPUTER APPLICATIONS

BCA – ONLINE PROGRAMME

THREE-YEAR UNDERGRADUATE

DEGREE PROPOSED SCHEME OF STUDY

– 137 CREDITS

Effective from the academic year 2026–27 (Proposed)

ITM University

School of Computing and Intelligent Systems

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PROGRAMME PROJECT REPORT (PPR)

I. Programme Profile

S. No.	Particulars	Proposed Details
1	Degree Awarding Body	ITM University
2	Teaching Institution	ITM School of Computing and Intelligent System, ITM University
3	Name of the Programme	Bachelor of Computer Application (BCA)
4	Mode of Delivery	Online
5	Minimum Duration	3 Years / 6 Semesters
6	Maximum Duration	As per applicable UGC/University regulations
7	Minimum Eligibility	As per the approved admission regulations of ITM University and applicable regulatory provisions
8	Programme Credits	137
9	Programme Level	Undergraduate / Bachelor's
10	Nature of Target Group	Students seeking undergraduate education in computer applications, information technology and emerging computing technologies through flexible online learning
11	Nature of Programme	Professional / Undergraduate
12	Board pf Studies Approval	2nd March 2026
13	Academic Council Approval2	01st June 2026

Source basis: The programme structure and course scheme in this PPR are derived from the School of Engineering and Technology 2025 BCA/BCA (Honours). The attached scheme identifies the three-year BCA exit as a 137-credit undergraduate programme.

II. Programme Mission and Objectives

- Develop a strong foundation in computer science principles, computational thinking and their applications across diverse technological and professional environments.
- Build proficiency in programming languages, data structures, algorithms, database systems and software development methodologies.
- Develop analytical reasoning, logical thinking, problem-solving and algorithmic design capabilities for addressing real-world computing challenges.
- Enable learners to understand and apply core areas of computer applications, including operating systems, computer networks, web technologies, cybersecurity and software engineering.
- Develop competence in using contemporary programming tools, development environments, databases and digital platforms for designing and implementing technology-based solutions.
- Provide foundational exposure to emerging technologies such as artificial intelligence, machine learning, cloud computing, data analytics and automation, as prescribed in the approved curriculum.
- Foster ethical conduct, professional responsibility, information security awareness, data privacy and responsible use of computing technologies.
- Develop effective technical communication, documentation, teamwork, collaboration and professional presentation skills.
- Encourage innovation, entrepreneurship and application-oriented thinking through programming exercises, practical assignments, projects and problem-based learning.
- Provide opportunities for hands-on programming, virtual laboratory activities, software development projects and internship or practical training components as prescribed in the approved curriculum.
- Develop an understanding of technological advancements and their impact on industries, organisations, society and the global digital economy.
- Encourage research orientation, independent learning, continuous skill development and lifelong professional growth in the rapidly evolving field of computing.

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• **Industry Relevance:** The programme aims to develop industry-relevant competencies in programming, software development, database management, networking, cybersecurity, web technologies and contemporary digital applications.

• **Flexible Access to Education:** The online learning model provides educational opportunities for learners who require flexibility in location, learning schedules and academic engagement.

• **Technology-Enabled Learning**: The programme integrates Learning Management System (LMS) resources, virtual laboratories, coding environments, interactive simulations and online academic support.

• **Development of Professional Competencies**: Emphasis is placed on analytical thinking, technical communication, teamwork, professional ethics, leadership and collaborative problem-solving.

• **Application-Oriented Learning**: The curriculum encourages hands-on learning through programming exercises, digital simulations, practical assignments, software projects, case studies and industry-oriented activities.

• **Innovation and Entrepreneurship:** The programme promotes creativity, technology-driven innovation, independent solution development and entrepreneurial approaches to digital problems.

• **Outcome-Based Academic Design**: Course learning outcomes are aligned with programme learning outcomes to ensure measurable development of academic knowledge, technical skills and professional competencies.

• **Inclusive and Accessible Education**: Digital learning resources and flexible delivery mechanisms aim to enhance access to computing education for learners from diverse geographical, educational and professional backgrounds.

• **Research and Continuous Improvement**: The programme encourages evidence-based problem-solving, technical exploration and continuous academic improvement through faculty review, learner feedback and outcome-attainment analysis.

• **Societal and Technological Responsibility**: The programme promotes cybersecurity awareness, digital citizenship, ethical computing, accessibility and responsible technological practices.

IV. Nature of Prospective Target Group of Learners

• School-leaving learners seeking a structured undergraduate qualification in computer applications, computing technologies and information technology.
• Learners interested in pursuing careers in software development, web development, database administration, IT support, cybersecurity, data analytics and other computing-related fields.
• Learners seeking flexible online undergraduate education alongside professional, academic, family or personal commitments.
• Working professionals and individuals seeking to enhance their knowledge of computing fundamentals, programming and digital technologies, subject to admission eligibility.
• Learners interested in building technical and programming competencies for employment opportunities in the IT and IT-enabled services sectors.
• Learners seeking foundational computer science knowledge before pursuing postgraduate education such as MCA, M.Sc. Computer Science or other relevant professional qualifications.

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- Learners interested in entrepreneurship, application development, digital innovation and technology-based business solutions.
- Learners seeking exposure to emerging technologies, modern development tools, computational thinking and industry-relevant software practices.
- Learners from diverse educational and geographical backgrounds who wish to access structured computing education through a flexible digital learning environment.

V. Appropriateness of the Programme to be Conducted in Online Mode

The Bachelor of Computer Applications (BCA) curriculum is suitable for online delivery because a substantial portion of the programme involves conceptual computing knowledge, programming practice, algorithmic problem-solving, software development, database operations, digital tools and project-based learning. These academic components can be effectively supported through structured self-learning materials, interactive digital resources, virtual laboratories, online coding platforms, simulations, recorded demonstrations and guided practical activities.

The online delivery model enables learners to develop programming and technical competencies through hands-on exercises, coding assignments, software-based experiments, case studies, discussion forums and application-oriented projects. Practical subjects can be supported through browser-based programming environments, virtual machines, simulation tools and downloadable software packages, subject to the University's approved online education framework and applicable regulatory requirements.

The programme may adopt the following online instructional and learner-support mechanisms:

- LMS-Based Learning: Access to structured course materials, digital textbooks, self-learning modules, presentations, recorded lectures, programming examples, assignments and academic activities.
- Synchronous and Asynchronous Interaction: Live online classes, recorded sessions, discussion forums, virtual doubt-clearing sessions, academic mentoring and faculty feedback.
- Virtual Programming Laboratories: Guided programming practice using online compilers, integrated development environments, interactive coding platforms and simulation-based laboratory activities.
- Software-Based Practical Learning: Online demonstrations and guided exercises in programming languages, database management systems, web development tools and other software platforms prescribed in the curriculum.
- Interactive Simulations: Browser-based practical simulations for programming, data structures, networking, cybersecurity, operating systems and other relevant computing subjects.
- Project-Based Learning: Application-oriented assignments, software development projects, problem-solving exercises, debugging activities and case-based computing challenges.
- Digital Assessment: Online quizzes, programming assignments, practical evaluations, project submissions and supervised examinations in accordance with approved University regulations.
- Virtual Project Guidance: Online project mentoring, progress monitoring, code review, digital documentation, demonstrations and viva-voce support, wherever permitted.
- Collaborative Learning: Discussion forums, collaborative coding activities, team projects, peer interaction and technology-enabled communication.
- Learner Support Services: Continuous access to academic guidance, technical assistance, LMS support, assessment-related information and appropriate grievance-redressal mechanisms.

The online BCA programme is intended to maintain academic rigour and practical competency development through a combination of theoretical learning, structured coding practice, simulations, formative evaluation and outcome-based assessment.

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VI. Programme Outcomes (PLOs)

PLO 1: Fundamental Computing Knowledge Demonstrate comprehensive understanding of computer science fundamentals, computing systems, programming concepts and information technology principles, and apply them to practical computing problems.

PLO 2: Programming and Software Development Design, develop, test and debug computer programs and software applications using appropriate programming languages, algorithms, development tools and software engineering practices.

PLO 3: Computational Thinking and Problem-Solving Apply logical reasoning, mathematical foundations, data structures and algorithmic techniques to analyse computational problems and develop efficient solutions.

PLO 4: Database and Information Management Design, implement and manage databases and information systems by applying appropriate data modelling, querying, storage, retrieval and data-management techniques.

PLO 5: Communication and Teamwork Communicate technical concepts effectively through documentation, presentations and professional interaction, and collaborate productively in multidisciplinary and technology-driven environments.

PLO 6: Emerging Technologies and Digital Tools Apply contemporary computing tools and demonstrate foundational understanding of emerging technologies, including artificial intelligence, data analytics, cloud computing and automation, to address relevant technological challenges.

PLO 7: Network, System and Cybersecurity Awareness Explain fundamental principles of operating systems, computer networks, information security and cybersecurity, and apply appropriate practices for reliable and responsible computing.

PLO 8: Critical Thinking and Application Development Analyse real-world requirements, evaluate alternative technical approaches and develop application-oriented computing solutions using systematic problem-solving and software development methodologies.

PLO 9: Professional Ethics and Responsible Computing Demonstrate ethical conduct, professional integrity, awareness of data privacy, cybersecurity responsibilities, sustainability and inclusive practices in the development and use of digital technologies.

PLO 10: Research, Innovation and Lifelong Learning Demonstrate independent learning, technical inquiry, innovation and commitment to continuous professional development to adapt to evolving computing technologies and industry requirements.

VII. Instructional Design

Course Curriculum

The BCA Online Programme is designed to develop foundational and advanced knowledge of computer applications, programming, data structures, database management, web technologies, computer networks, cybersecurity and emerging technologies. The six-semester curriculum progressively integrates theoretical concepts with practical learning, coding exercises, projects and application-oriented activities, as prescribed in the approved curriculum.

Learning Materials

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- Structured Self-Learning Materials (SLMs) and digital study resources.
- Recorded lectures, presentations, tutorials and interactive learning activities.
- Virtual laboratories, programming simulators and guided practical exercises.
- Case studies, coding assignments, quizzes and project-based activities.
- Digital library resources, technical documentation and supplementary readings.

Academic Review

The curriculum shall be periodically reviewed through the appropriate University academic and statutory bodies, incorporating feedback from faculty, industry experts, learners and other stakeholders. Reviews will focus on technological advancements, industry requirements, learner performance and continuous improvement of academic quality.

Outcome-Based Approach

Course Learning Outcomes (COs) shall be aligned with Programme Learning Outcomes (PLOs) and appropriate Bloom's Taxonomy levels. Learning attainment will be evaluated through assignments, online assessments, programming exercises, practical activities and projects to ensure academic quality, technical competency and effective learning outcomes.

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VIII. Programme Structure: Bachelor of Computer Applications (3 Years)

Semester I – Foundations of Computing and Digital Skills

Course Code	Course Title	Lecture	Tutorial	Practical	Credit
BCAOL 101	Fundamentals of Information Technology	3	0	0	3
BCAOL 102	Web Technology	0	0	4	2
BCAOL 103	Python Programming	0	0	6	3
BCAOL 104	Communication Skills	2	0	2	3
BCAOL 105	Mathematics for Computing	4	0	0	4
BCAOL 106	Digital Productivity Tools	0	0	4	2
BCAOL 107	Aptitude & Reasoning Skills-I	3	0	0	3
Semester Total		12	0	16	20

Semester II – Programming, AI and Database Foundations

Course Code	Course Title	Lecture	Tutorial	Practical	Credit
BCAOL 201	Programming in C	3	0	4	5
BCAOL 202	Introduction to Artificial Intelligence	3	0	0	3
BCAOL 203	Database Management System	3	0	2	4
BCAOL 204	Probability & Statistics	3	0	0	3
BCAOL 205	Professional Communication Skills-I	2	0	2	3
BCAOL 206	PBL-2: Logic Building Project	0	0	2	1
BCAOL 207	Cyber Ethics & Digital Society	2	0	0	2
Semester Total		16	0	10	21

Semester Credit Total: 41 Credits (Semesters I–II)

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Semester III – Object-Oriented Programming and Computer Systems

Course Code	Course Title	Lecture	Tutorial	Practical	Credit
BCAOL 301	Object-Oriented Programming with Java	3	0	4	5
BCAOL 302	Data Structure & Algorithms	3	0	4	5
BCAOL 303	PBL-3: Mini Project	0	0	4	2
BCAOL 304	Digital Computer Principles	3	0	0	3
BCAOL 305	Entrepreneurship Development	2	0	0	2
BCAOL 306	Operating System	3	0	2	4
BCAOL 307	Indian Constitution & Civic Values	2	0	0	2
Semester Total		16	0	14	23

Semester IV – Full Stack, Networks and Data Analytics

Course Code	Course Title	Lecture	Tutorial	Practical	Credit
BCAOL 401	Full Stack Development	0	0	6	3
BCAOL 402	Computer Network	4	0	2	5
BCAOL 403	Data Warehousing and Mining	3	0	4	5
BCAOL 404	Cyber Security & Ethical Hacking	3	0	2	4
BCAOL 405	Data Analysis using Python	0	0	6	3
BCAOL 406	Aptitude & Reasoning Skills-II	2	0	0	2
BCAOL 407	Minor Project	0	0	4	2
Semester Total		12	0	24	24

Semester Credit Total: 47 Credits (Semesters III–IV)

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Semester V – Machine Learning, Cloud Computing and Industry Skills

Course Code	Course Title	Lecture	Tutorial	Practical	Credit
BCAOL 501	Machine Learning	4	0	2	5
BCAOL 502	Cloud Computing	3	0	4	5
BCAOL 503	Elective-I	3	0	4	5
BCAOL 504	Advanced Soft Skills & Leadership	3	0	2	4
BCAOL 505	Internship-II*	0	0	4	2
BCAOL 506	Digital Marketing	0	0	6	3
Semester Total		13	0	22	24

Semester VI – Software Projects, Digital Forensics and Professional Practice

Course Code	Course Title	Lecture	Tutorial	Practical	Credit
BCAOL 601	Software Project Management	3	0	4	5
BCAOL 602	Digital Forensics	3	0	0	3
BCAOL 603	Elective-II	3	0	4	5
BCAOL 604	Professional Communication Skills-II	3	0	0	3
BCAOL 605	Environmental Studies and Disaster Management	2	0	0	2
BCAOL 606	Major Project-Phase 1	0	0	10	5
BCAOL 607	Internship / Training-I*	0	0	4	2
Semester Total		14	0	22	25

Credit Summary

Semester	Credits
Semester I	20
Semester II	21
Semester III	23
Semester IV	24
Semester V	24
Semester VI	25
Total – Three-Year BCA	137

The source scheme explicitly states: "3 Years BCA Program Total Credits = 137"

XI. Discipline Specific Elective (DSE) Basket

The BCA scheme provides discipline-specific elective choices in computing and emerging technologies. Elective-I is offered in Semester V and Elective-II in Semester VI. Availability and allocation are subject to approved University/School academic regulations.

DSE	Code	Course / Option	Credit
DSE-1	BCAOL 503	Mobile Application Development	5
DSE-1	BCAOL 503	Data Analytics	5
DSE-1	BCAOL 503	Data Visualization Tools	5
DSE-2	BCAOL 603	Cyber Law	5
DSE-2	BCAOL 603	Image Processing	5

Note: The BCA source elective-basket table repeats BCAOL 503 for Elective-II, while the semester scheme identifies Elective-II as BCAOL 603. The code shown above follows the Semester VI scheme and requires University confirmation.

Other Approved Learning Opportunities

- MOOC/NPTEL/SWAYAM courses as approved by the School/Faculty each year.
- Performer's courses, as applicable under the approved academic framework.

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- Extra-credit courses offered by the student's own school/department or another school/department, as permitted by ITM University norms.
- Optional/audit NCC and Indian Knowledge Systems (IKS) components, subject to approved credit and award rules.

XII. Faculty and Support Staff

Staff Category	Proposed Requirement
Professor / Associate Professor	As per applicable UGC, University and online/ODL education norms and approved staffing plan
Assistant Professor	As per applicable UGC, University and online/ODL education norms and approved staffing plan
Academic / Programme Support Staff	As per approved programme delivery and learner-support requirements
Technical / LMS / Laboratory Support Staff	As per approved LMS, programming laboratory, digital platform and learner-support requirements
Administrative Support Staff	As per approved University staffing plan

XIII. Delivery Mechanism

- Learning Management System (LMS)-based delivery with structured modules, activities and assessments.
- Recorded and/or synchronous online teaching and academic counselling as scheduled by the University.
- Digital self-learning material, programming examples, readings, presentations, lab manuals and assignments.
- Online discussion forums, live doubt-clearing sessions, mentoring and feedback mechanisms.
- Application-oriented learning through programming, databases, web development, data analytics, projects and internships.
- Practical support through suitable programming tools, virtual/local lab environments, code repositories and demonstrations.
- Digital learner support for academic, technical and assessment-related matters.
- Medium of instruction: To be confirmed from approved University regulations.

XIV. Procedure for Admissions, Curriculum Transaction and Evaluation

Admission Procedure

Admission shall follow the eligibility criteria and admission procedure approved by ITM University and applicable regulatory requirements. Academic credentials and required documents shall be verified as prescribed.

Duration of the Programme

The proposed three-year BCA programme is organized into six semesters. The maximum permissible completion period shall follow applicable University and regulatory provisions.

Eligibility

The specific qualifying-examination and minimum eligibility requirements must be inserted from current approved ITM University admission regulations; these are not confirmed in the supplied BCA scheme.

Fee Structure

The total fee for the BCA programme is ₹1,20,000 for the complete three-year **duration**

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Credit System

The six-semester BCA scheme specifies 137 base credits: 20, 21, 23, 24, 24 and 25 credits respectively. Optional/audit NCC and IKS components are not included in these base-credit totals. The applicable credit-hour equivalence and ODL learning-hour framework require approval/confirmation by the University.

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Evaluation

Assessment should include continuous/internal assessment and end-term examinations, with programming/laboratory practicals, projects, internship/training and viva-voce where prescribed. Exact marks distribution, passing rules, examination pattern and grading must be taken from the approved University regulations.

Proposed Assessment Components

- Assignments and programming exercises
- Quizzes and problem-solving activities
- Case studies and application-based activities
- Online participation and academic activities
- Laboratory records, software demonstrations and practical examinations
- Mini project, minor project and major project evaluation with viva-voce
- Internship/training reports and evaluation

XV. Requirement of Laboratory Support and Library Resources

The programme should provide digital library access to e-books, computing journals, databases, learning repositories and appropriate reference materials in computer applications. Courses in programming, web technology, databases, artificial intelligence, networks, cybersecurity, cloud computing and data analytics require suitable software tools, practical demonstrations and learner support, subject to institutional licensing and technical arrangements.

The final PPR should specify approved ITM University library subscriptions, LMS facilities, virtual/physical laboratory arrangements, licensed and open-source software, and technical support available to BCA Online learners.

XVI. Cost Estimate of the Programme and Provisions

The cost structure should be prepared on the basis of the approved programme budget and University financial provisions. Major heads may include:

S. No.	Expense Head	Calculation Basis	Amount (₹)
1	Faculty remuneration	41 courses × ₹15,000	6,15,000
2	Video recording and editing	900 hours × ₹2,000	18,00,000
3	Interactive content and instructional design	41 courses × ₹10,000	4,10,000
4	Online assessments and question banks	41 courses × ₹4,000	1,64,000
5	LMS procurement and implementation	Allocated share	4,77,876
6	LMS hosting and technical support	Allocated share	2,38,938
7	Recording studio and equipment	Allocated share	5,97,345
8	Faculty training	Allocated share	29,867
9	Programme coordination	Allocated share	1,19,469
10	Academic quality assurance	41 courses × ₹2,500	1,02,500
11	Virtual programming labs and computing tools	Proposed BCA-specific allocation	4,50,000
12	Cloud, AI/ML and data analytics lab resources	Proposed BCA-specific allocation	2,50,000
13	Cybersecurity and networking practical tools	Proposed BCA-specific allocation	2,00,000
14	Technical lab support and maintenance	Proposed BCA-specific allocation	1,50,000

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	Subtotal		56,04,995
15	Contingency reserve (10%)	Approx. 10%	5,60,500
	Total Proposed BCA Budget		₹61,65,495

XVII. Quality Assurance Mechanism

Quality assurance should operate through approved University internal quality assurance and online education mechanisms. Continuous improvement should draw on curriculum review, learner feedback, course-outcome analysis, examination review, faculty development, academic audits and stakeholder inputs.

- Periodic review of programme and course outcomes.
- Monitoring online teaching-learning and learner engagement.
- Analysis of assessment performance and learning-outcome attainment.
- Feedback from students, faculty, alumni and relevant industry stakeholders.
- Corrective and improvement action plans.
- Periodic review of digital resources, programming tools, laboratory access and learner support.
- Academic review of practical, project and internship components.

XVIII. NEP 2020 / Multiple Entry-Exit Context

The proposed BCA Online Programme covers a three-year, six-semester award with 137 base credits. Any multiple entry-exit provisions, re-entry, continuation into a fourth-year Honours/Research pathway, or credit recognition must be governed by the University's approved NEP 2020 regulations and applicable regulatory approvals. Such progression is not established by the supplied three-year BCA scheme and should not be assumed.

XIX. Annexure – Programme Credit Summary

Semester	Focus Area	Credits
I	Computing Foundations and Digital Skills	20
II	Programming, AI and Database Foundations	21
III	Object-Oriented Programming, Algorithms and Systems	23
IV	Full Stack, Networks, Security and Data Analytics	24
V	Machine Learning, Cloud Computing and Industry Exposure	24
VI	Software Projects, Digital Forensics and Professional Skills	25
Total	Three-Year BCA	137

END OF PROGRAMME PROJECT REPORT

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BCA – SEMESTER 1

BCAOL 101 – Fundamentals of Information Technology

Course Code	Course Title	L–T–P	Credits
BCAOL 101	Fundamentals of Information Technology	3-0-0	3

Course Objectives

- Introduce learners to computing concepts and terminology.
- Build digital-system literacy required for later BCA courses.
- Develop awareness of networks, Internet, security and emerging technologies.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Understand the architecture and role of information technology systems.
CO2	Explain data representation, hardware, software, operating systems and networks.
CO3	Use common digital services safely and effectively.
CO4	Relate emerging technologies to contemporary computing applications.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Computing Foundations Evolution and generations of computers; functional units; CPU, memory and I/O; Unit Detailed Syllabus Content number systems and data representation; computer lassification; performance concepts. Detailed subtopics: Binary, octal and hexadecimal representation;bits/bytes/words; CPU registers, cache and memory hierarchy; input-output Interfaces; primary vs secondary storage; computer performance measures and common peripheral devices.	9 Hours
Module 2	Software and Operating Systems System/application software; translators; operating-system functions; files and processes; utilities; open-source software; software licensing. Detailed subtopics: Compiler, interpreter, assembler and linker; process and file concepts; GUI/CLI; device drivers; utilities; software installation/update; open-source vs proprietary licensing; basic backup and recovery.	9 Hours
Module 3	Data Communication and Internet Communication components; LAN/WAN; Internet, web, browsers, search, e-mail, cloud services; basic protocols; digital collaboration. Detailed subtopics: OSI/TCP-IP awareness; IP address and DNS concepts; browser-server interaction; HTTP/HTTPS; e-mail protocols; search strategies; cloud storage/collaboration; safe browsing and password hygiene.	9 Hours
Module 4	Digital Society and Emerging IT Cyber hygiene, privacy, digital identity, e-governance; overview of AI, IoT, cloud, blockchain, data analytics and green computing.Detailed subtopics: Digital identity and footprint; privacy and consent; phishing/social engineering awareness; e-governance and digital payments; AI/ML, IoT, cloud, blockchain and data analytics; accessibility and green computing.	9 Hours
Module 5	Systems Integration and Case Analysis Application of the major concepts to an integrated computing scenario; comparison of alternatives; performance, reliability, security and aintainability considerations; structured case analysis and problem-solving exercises. Detailed subtopics: Integrated case analysis of a personal/organizational computing system; hardware-software-network interdependence; reliability, security, performance, maintainability and sustainability trade-offs; structured troubleshooting.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Create a labelled block diagram of a computer and explain data flow.
- Compare three operating systems and recommend one for a stated use case.
- Prepare a digital-safety checklist and analyse a phishing scenario.

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Recommended Books

- P.K. Sinha & Priti Sinha, Computer Fundamentals, BPB.
- V. Rajaraman, Fundamentals of Computers, PHI.

MOOC / OER Reference

- NPTEL/SWAYAM: introductory Computer Science / Computer Fundamentals offerings; use the current approved SWAYAM catalogue.

Video / Digital Reference

- NPTEL introductory computing lectures; CEC/SWAYAM digital-literacy videos.

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BCA – SEMESTER 1

BCAOL 102 – Web Technology

Course Code	Course Title	L–T–P	Credits
BCAOL 102	Web Technology	0-0-4	2

Course Objectives

- Develop practical web-authoring competence.
- Introduce responsive and accessible front-end design.
- Build confidence through guided hands-on tasks suitable for ODL learners.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Create standards-based web pages using HTML and CSS.
CO2	Use responsive layouts, forms and client- side scripting.
CO3	Apply basic accessibility and usability principles.
CO4	Publish and test a small multi-page website.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Web Foundations Internet and WWW; client-server model; URLs, HTTP/HTTPS; browsers and developer tools; HTML document structure; semantic HTML. Detailed subtopics: HTTP request-response cycle, status codes and headers; semantic HTML5 structure; hyperlinks, lists, tables, forms, media elements; browser developer tools; accessibility landmarks and basic ARIA awareness.	6 Hours
Module 2	Styling CSS syntax, selectors, box model, typography, colours, positioning, flexbox/grid; responsive design and media queries. Detailed subtopics: CSS cascade, inheritance and specificity; box model; typography; positioning; Flexbox and Unit Detailed Syllabus Content Grid; responsive breakpoints; media queries; responsive images; reusable classes and component-like styling.	6 Hours
Module 3	Client-side Interaction JavaScript basics; variables, operators, control structures, functions, arrays; DOM selection and manipulation; events; form validation. Detailed subtopics: JavaScript data types, scope, operators, control structures, functions, arrays/objects; DOM traversal/manipulation; events and event propagation; form validation; local storage awareness; debugging with console tools.	6 Hours

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Module 4	Web Quality and Deployment Accessibility basics, usability, cross-browser testing, debugging, performance basics, hosting/deployment and version-control awareness. Detailed subtopics: Cross-browser compatibility; usability heuristics; accessibility checks; performance basics; asset optimization; version-control awareness; deployment/hosting concepts; web security basics including HTTPS, input validation and XSS/CSRF awareness.	6 Hours
Module 5	Integrated Digital Portfolio Application of the tools and techniques through an integrated portfolio task; quality checks, accessibility, collaboration/version control where relevant, documentation and demonstration of the finished digital artefact. Detailed subtopics: Integrated multi-page or single-page portfolio; requirement interpretation; navigation design; responsive testing; accessibility validation; code organization; deployment checklist; documentation and demonstration.	6 Hours

Internal Assessment / Learner Engagement Exercises

- Build a semantic personal profile page.
- Create a responsive three-page website using Flexbox/Grid.
- Implement JavaScript form validation and DOM interaction.

Laboratory / Practical Exercises

- HTML/CSS page creation
- responsive layout
- JavaScript DOM
- forms
- final mini-site.

Recommended Books

- Jon Duckett, HTML & CSS: Design and Build Websites, Wiley.
- Jennifer Robbins, Learning Web Design, O'Reilly.

MOOC / OER Reference

- SWAYAM/NPTEL: Web Technology / Internet Technology courses; select current semester offering.

Video / Digital Reference

- NPTEL web technology lectures; MDN Web Docs learning videos/resources.

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BCA – SEMESTER 1

BCAOL 103 – Python Programming

Course Code	Course Title	L–T–P	Credits
BCAOL 103	Python Programming	0-0-6	3

Course Objectives

- Build programming logic through an accessible first language.
- Develop reusable, readable and testable code.
- Prepare learners for data analysis, AI and later application courses.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Write correct Python programs using core language constructs.
CO2	Use functions, collections, files, modules and exceptions.
CO3	Apply object-oriented and problem-solving techniques.
CO4	Test and debug small Python applications.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Python Basics Python environment; variables, data types, expressions, input/output; decisions; loops; tracing and debugging. Detailed subtopics: Python interpreter/IDE/notebook environment; variables, dynamic typing, numeric/string/Boolean types; operators and precedence; formatted input/output; conditional statements; loops; tracing and debugging.	9 Hours
Module 2	Collections and Functions Strings, lists, tuples, sets, dictionaries; functions; parameters; recursion basics; comprehensions. Detailed subtopics: Lists, tuples, sets and dictionaries; indexing/slicing; mutability; nested collections; functions, parameters, return values, scope, recursion basics, Unit Detailed Syllabus Content comprehensions and lambda awareness.	9 Hours
Module 3	Files, Modules and Exceptions Text/CSV files; modules and packages; exception handling; standard library; virtual environments awareness. Detailed subtopics: Text/CSV/JSON file handling; pathlib/os basics; modules/packages; imports; standard library; exception hierarchy; try/except/else/finally; custom exceptions; virtual environments and package management awareness.	9 Hours

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Module 4	OOP and Applied Python Classes, objects, inheritance basics; simple problem-solving patterns; testing basics; introductory use of libraries. Detailed subtopics: Classes, objects, constructors, instance/class attributes, encapsulation, inheritance and polymorphism basics; regular expressions awareness; testing, logging and reusable module design.	9 Hours
Module 5	Integrated Application Development Integration of course concepts through a small application; coding standards; testing and debugging; version/documentation practices; security and accessibility considerations where relevant; demonstration and reflective review. Detailed subtopics: Small application integrating collections, files and OOP; coding standards, docstrings, validation, exception handling, test cases, version/documentation practice and reflective debugging.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Trace and correct five short Python programs.
- Write a menu-driven data-processing program.
- Build a small file-based application with exception handling.

Laboratory / Practical Exercises

- Expressions
- control flow
- collections
- functions
- files
- exceptions
- classes
- mini application.

Recommended Books

- Allen B. Downey, Think Python, O'Reilly.
- Reema Thareja, Python Programming Using Problem Solving Approach, Oxford.

MOOC / OER Reference

- NPTEL/SWAYAM: The Joy of Computing using Python / Programming, Data Structures and Algorithms Using Python.

Video / Digital Reference

- NPTEL Python programming lecture series and demonstrations.

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BCA – SEMESTER 1

BCAOL 104 – Communication Skills

Course Code	Course Title	L–T–P	Credits
BCAOL 104	Communication Skills	2-0-2	3

Course Objectives

- Strengthen language and professional communication.
- Develop confidence for remote collaboration and interviews.
- Integrate written and oral communication with computing contexts.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Communicate clearly in academic and workplace contexts.
CO2	Read, summarise and present technical information.
CO3	Write professional e-mail, reports and résumés.
CO4	Demonstrate effective listening, speaking and presentation skills.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Foundations Communication process, barriers, listening, vocabulary, grammar in context, reading strategies. Detailed subtopics: Communication process and models; sender-receiver-feedback; barriers; active listening; reading for gist/detail; vocabulary building; grammar in context; note-taking and summarisation.	9 Hours
Module 2	Academic and Technical Writing Paragraphs, summaries, notes, e-mail, notices, instructions, short technical descriptions and reports. Detailed subtopics: Paragraph cohesion; professional e-mail; memo, notice, agenda and minutes; instructions; technical descriptions; summaries and short reports; Unit Detailed Syllabus Content tone, clarity and reader-centred organization.	9 Hours
Module 3	Oral Communication Conversation, group discussion, meetings, telephone/video-call etiquette, pronunciation, non-verbal communication. Detailed subtopics: Conversation management; pronunciation and fluency; non-verbal communication; group discussion; meetings; telephone/video-call etiquette; active participation and respectful disagreement.	9 Hours
Module 4	Employability Communication Résumé, cover letter, interview, presentation planning, visual aids, online	9 Hours

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	professional identity and netiquette. Detailed subtopics: Résumé and cover letter; interview preparation; STAR responses; presentation planning; slide hierarchy; visual aids; voice modulation; Q&A handling; online professional identity and netiquette.	
Module 5	Integrated Professional Communication Practice Application through workplace scenarios, presentation/interview tasks, collaborative communication, peer feedback, digital professionalism and reflective improvement using a structured rubric. Detailed subtopics: Integrated workplace simulation involving e-mail, meeting, short report and presentation; peer feedback; self-evaluation rubric; cross-cultural and inclusive communication; reflective improvement plan.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Write and peer-review a professional e-mail.
- Record a 3-minute technical explanation and self-evaluate using a rubric.
- Prepare a résumé and mock interview response set.

Laboratory / Practical Exercises

- Listening tasks
- presentation recording
- GD simulation
- résumé and interview practice.

Recommended Books

- Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford.
- T.N. Chhabra, Business Communication, Sun India.

MOOC / OER Reference

- SWAYAM/NPTEL: Developing Soft Skills and Personality / Technical English offerings.

Video / Digital Reference

- NPTEL soft-skills and communication lecture series.

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BCA – SEMESTER 1

BCAOL 105 – Mathematics for Computing

Course Code	Course Title	L–T–P	Credits
BCAOL 105	Mathematics for Computing	4-0-0	4

Course Objectives

- Provide mathematical foundations for computer applications.
- Develop logical and abstract reasoning.
- Prepare learners for algorithms, statistics and data-oriented courses.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Apply set, relation and function concepts to computing problems.
CO2	Use logic and proof techniques in elementary contexts.
CO3	Solve problems involving matrices, combinatorics and recurrence.
CO4	Model basic computing situations mathematically.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Sets, Relations and Functions Sets, operations, Cartesian products, relations, equivalence/partial order, functions, composition, inverse. Detailed subtopics: Set operations and identities; Cartesian products; relations, equivalence and partial order; functions, one-one/onto/bijection, composition and inverse; computing examples.	12 Hours
Module 2	Logic and Proof Propositions, connectives, truth tables, normal forms, predicates, quantifiers, implication, direct/contradiction/induction basics. Detailed subtopics: Propositions, connectives, truth tables, tautology/contradiction, implication/equivalence, normal forms; Unit Detailed Syllabus Content predicates and quantifiers; rules of inference; direct proof, contradiction and induction basics.	12 Hours
Module 3	Matrices and Algebraic Tools Matrices, determinants, systems of linear equations, elementary transformations, applications. Detailed subtopics: Matrix operations, transpose, determinant, inverse, rank and elementary transformations; systems of linear equations; introductory applications in graphics/data representation.	12 Hours
Module 4	Combinatorics and Recurrence Counting principles, permutations, combinations, pigeonhole principle,	12 Hours

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	recurrence relations, elementary graph concepts. Detailed subtopics: Counting principles, permutations and combinations; pigeonhole principle; recurrence formulation and simple solving; graph terminology, paths, cycles, trees and connectivity awareness.	
Module 5	Applied Problem Solving Integrated problem sets connecting the units; interpretation of results; use of mathematical/reasoning techniques in computing and employability contexts; timed/self-assessment practice with feedback and error analysis. Detailed subtopics: Integrated problem solving connecting logic, relations, matrices, combinatorics and graph ideas; modelling of computing scenarios; interpretation, error analysis and timed self-assessment.	12 Hours

Internal Assessment / Learner Engagement Exercises

- Solve a logic/truth-table worksheet.
- Model a small relation and test its properties.
- Solve counting and recurrence problems with written reasoning.

Recommended Books

- Kenneth Rosen, Discrete Mathematics and Its Applications, McGraw-Hill.
- B.S. Grewal, Higher Engineering Mathematics, Khanna.

MOOC / OER Reference

- NPTEL/SWAYAM: Discrete Mathematics / Mathematics for Computer Science.

Video / Digital Reference

- NPTEL Discrete Mathematics lecture series.

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BCA – SEMESTER 1

BCAOL 106 – Digital Productivity Tools

Course Code	Course Title	L–T–P	Credits
BCAOL 106	Digital Productivity Tools	0-0-4	2

Course Objectives

- Develop practical digital productivity for study and work.
- Enable learners to organise, analyse and present information.
- Promote collaborative and cloud-enabled work habits.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Create professional documents, spreadsheets and presentations.
CO2	Use formulas, charts and data tools in spreadsheets.
CO3	Collaborate using cloud-based productivity platforms.
CO4	Apply safe file-management and digital- workflow practices.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Documents Styles, templates, tables, references, mail merge, page layout, accessibility and PDF export. Detailed subtopics: Styles, themes and templates; page/section breaks; tables; headers/footers; citations/references; mail merge; track changes/comments; accessibility checks; PDF export and document protection awareness.	6 Hours
Module 2	Spreadsheets Data entry, relative/absolute references, functions, sorting/filtering, conditional formatting, charts, pivot concepts. Detailed subtopics: Relative/absolute/mixed references; logical, text, date and lookup functions; sorting/filtering; data validation; Unit Detailed Syllabus Content conditional formatting; charts; pivot-table concepts; error checking and spreadsheet hygiene.	6 Hours
Module 3	Presentations Slide structure, visual hierarchy, diagrams, multimedia, speaker notes, delivery and accessibility. Detailed subtopics: Slide master/themes; layout and visual hierarchy; charts/SmartArt/diagrams; multimedia; speaker notes; animation restraint; accessibility; presentation delivery and export/share options.	6 Hours
Module 4	Collaboration Cloud drives, sharing permissions,	6 Hours

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	versioning, online forms, calendars, collaborative editing, backup and cyber hygiene. Detailed subtopics: Cloud-drive organization; sharing roles/permissions; version history; collaborative editing; forms, calendars and online meeting tools; backup/sync; naming conventions; cyber hygiene.	
Module 5	Integrated Digital Portfolio Application of the tools and techniques through an integrated portfolio task; quality checks, accessibility, collaboration/version control where relevant, documentation and demonstration of the finished digital artefact. Detailed subtopics: Integrated digital portfolio containing a formatted report, analytical spreadsheet and presentation; consistent branding; accessibility, version control, collaboration evidence and reflective quality review.	6 Hours

Internal Assessment / Learner Engagement Exercises

- Prepare a formatted 4-page report with table of contents.
- Analyse a supplied dataset using formulas and charts.
- Create and deliver a 6-slide presentation from the analysis.

Laboratory / Practical Exercises

- Word-processing
- spreadsheet formulas/charts
- presentation
- cloud collaboration.

Recommended Books

- Microsoft 365 / LibreOffice official user documentation.
- Shelly Cashman Series, Microsoft Office introductory text (latest available edition).

MOOC / OER Reference

- SWAYAM/AICTE self-paced digital productivity / office automation courses.

Video / Digital Reference

- Official Microsoft Learn / LibreOffice tutorial videos.

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BCA – SEMESTER 1

BCAOL 107 – Aptitude & Reasoning Skills-I

Course Code	Course Title	L–T–P	Credits
BCAOL 107	Aptitude & Reasoning Skills-I	3-0-0	3

Course Objectives

- Strengthen numerical and logical reasoning.
- Support employability and competitive-test preparation.
- Develop accuracy, estimation and structured problem solving.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Solve fundamental quantitative aptitude problems.
CO2	Apply logical reasoning to patterns and arrangements.
CO3	Interpret basic tables and charts.
CO4	Use time-efficient strategies for objective assessments.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Arithmetic Percentages, ratio/proportion, averages, profit/loss, simple/compound interest. Detailed subtopics: Percentages, ratio-proportion, averages, profit-loss-discount, simple/compound interest; estimation and shortcut strategies; error checking.	9 Hours
Module 2	Applied Arithmetic Time-work, pipes/cisterns, time-speed-distance, mixtures, ages. Detailed subtopics: Time and work, pipes/cisterns, time-speed-distance, boats/trains, mixtures/alligation and ages; unit consistency and structured solution methods.	9 Hours
Module 3	Logical Reasoning Series, analogy, classification, coding-decoding, directions, blood relations, syllogisms. Detailed subtopics: Number/letter series, Unit Detailed Syllabus Content analogy, classification, coding-decoding, direction sense, blood relations, ranking and elementary syllogisms.	9 Hours
Module 4	Data Interpretation Tables, bar/line/pie charts, caselets; approximation, estimation and timed practice. Detailed subtopics: Tables, bar/line/pie charts and simple caselets; ratio/percentage change; approximation; identifying	9 Hours

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	relevant data and avoiding calculation traps.	
Module 5	Applied Problem Solving Integrated problem sets connecting the units; interpretation of results; use of mathematical/reasoning techniques in computing and employability contexts; timed/self-assessment practice with feedback and error analysis. Detailed subtopics: Mixed timed practice; question selection strategy, accuracy-speed balance, error log, reflective improvement and placement-style mock assessment.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Weekly 20-question timed quiz.
- Solve and explain five reasoning puzzles.
- Interpret two datasets and justify answers.

Recommended Books

- R.S. Aggarwal, Quantitative Aptitude, S. Chand.

- R.S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand.

MOOC / OER Reference

- SWAYAM/AICTE employability and quantitative aptitude offerings.

Video / Digital Reference

- NPTEL/SWAYAM employability-skills videos.

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BCA – SEMESTER 2

BCAOL 201 – Programming in C

Course Code	Course Title	L–T–P	Credits
BCAOL 201	Programming in C	3-0-4	5

Course Objectives

- Build low-level programming understanding and algorithmic thinking.
- Develop disciplined procedural programming skills.
- Prepare learners for data structures and systems courses.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Develop structured C programs using decisions and loops.
CO2	Use functions, arrays, strings, pointers and structures.
CO3	Perform file operations and dynamic memory management.
CO4	Debug and test modular C programs.

Course Content

Module	Detailed syllabus content	Hours
Module 1	C Foundations Program structure, tokens, data types, operators, I/O, decisions, loops, compilation and debugging. Detailed subtopics: C program structure; tokens, identifiers, constants, data types, type conversion, operators and precedence; formatted I/O; compilation stages and compiler warnings.	15 Hours
Module 2	Functions and Arrays Functions, scope, recursion, arrays, strings, searching/sorting basics. Detailed subtopics: Nested selection and iteration; break/continue; trace tables; functions, prototypes, parameter passing, scope/storage classes and recursion.	15 Hours
Module 3	Pointers and User-defined Types Pointers, pointer arithmetic, arrays/pointers, structures, unions, enums, typedef. Detailed subtopics: One- and Unit Detailed Syllabus Content multidimensional arrays; strings and standard string functions; searching/sorting basics; command-line arguments awareness.	15 Hours
Module 4	Dynamic Memory and Files malloc/calloc/realloc/free; command-line arguments; text/binary files; modular programs. Detailed subtopics: Pointers, pointer arithmetic, arrays/pointers, pointer-to-	15 Hours

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	pointer; structures, unions, enum, typedef; structures with pointers; dynamic data structures awareness.	
Module 5	Integrated Application Development Integration of course concepts through a small application; coding standards; testing and debugging; version/documentation practices; security and accessibility considerations where relevant; demonstration and reflective review. Detailed subtopics: malloc/calloc/realloc/free; memory leaks and dangling pointers; text/binary files, random access and error handling; modular application, test cases and debugging discipline.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Dry-run and debug short C fragments.
- Implement array/search/sort functions.
- Build a file-based record-management program.

Laboratory / Practical Exercises

- Control flow
- functions
- arrays/strings
- pointers
- structures
- files
- final record application.

Recommended Books

- E. Balagurusamy, Programming in ANSI C, McGraw-Hill.
- Kernighan & Ritchie, The C Programming Language, Pearson.

MOOC / OER Reference

- NPTEL/SWAYAM: Problem Solving Through Programming in C.

Video / Digital Reference

- NPTEL C programming demonstrations.

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BCA – SEMESTER 2

BCAOL 202 – Introduction to Artificial Intelligence

Course Code	Course Title	L–T–P	Credits
BCAOL 202	Introduction to Artificial Intelligence	3-0-0	3

Course Objectives

- Provide a conceptually sound introduction to AI.
- Connect AI techniques with real applications.
- Develop responsible-AI awareness before advanced ML courses.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain the goals, history and major approaches of AI.
CO2	Represent and solve elementary search and reasoning problems.
CO3	Differentiate symbolic AI, machine learning and generative AI at an introductory level.
CO4	Discuss responsible and ethical use of AI.

Course Content

Module	Detailed syllabus content	Hours
Module 1	AI Foundations Definitions, history, intelligent agents, problem formulation, applications and limitations. Detailed subtopics: AI definitions and history; rational agents; PEAS; environment properties; problem formulation; goal/utility-based agents and representative application domains.	9 Hours
Module 2	Search and Problem Solving State spaces, uninformed/informed search, heuristics, game-playing overview. Detailed subtopics: State-space representation; BFS, DFS, uniform-cost awareness, greedy best-first and A* intuition; heuristics; completeness/optimality considerations; Unit Detailed Syllabus Content minimax/game-playing overview.	9 Hours
Module 3	Knowledge and Learning Knowledge representation, rules, inference, uncertainty overview; supervised/unsupervised/reinforcement learning concepts. Detailed subtopics: Propositional/first-order knowledge representation overview; production rules; semantic networks; inference; uncertainty and probabilistic reasoning awareness.	9 Hours
Module 4	Contemporary AI and Ethics NLP, computer vision, recommender systems, generative AI overview; bias,	9 Hours

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	privacy, explainability, safety and responsible use. Detailed subtopics: Supervised, unsupervised and reinforcement learning distinctions; features/labels, train-test idea; neural networks overview; NLP, computer vision and recommender-system examples.	
Module 5	Applied Analytics/AI Case Work End-to-end applied workflow using a suitable dataset/problem; evaluation and interpretation; limitations and error analysis; responsible use, privacy/bias considerations where relevant; communication of findings through a notebook, report or demonstration. Detailed subtopics: Generative AI and foundation-model awareness; prompting, hallucination, bias, privacy, explainability, safety, human oversight; applied case analysis and responsible-use principles.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Map an everyday problem to an intelligent-agent model.
- Manually compare BFS and heuristic search on a small graph.
- Write a responsible-use analysis of a generative-AI scenario.

Recommended Books

- Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson.
- Ela Kumar, Artificial Intelligence, I.K. International.

MOOC / OER Reference

- NPTEL/SWAYAM: Artificial Intelligence: Search Methods for Problem Solving / Introduction to Machine Learning (selected introductory weeks).

Video / Digital Reference

- NPTEL AI lecture series; SWAYAM introductory AI videos.

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BCA – SEMESTER 2

BCAOL 203 – Database Management System

Course Code	Course Title	L–T–P	Credits
BCAOL 203	Database Management System	3-0-2	4

Course Objectives

- Build sound database design and SQL skills.
- Develop understanding of integrity, transactions and data management.
- Prepare learners for data warehousing and application development.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Model data using ER and relational concepts.
CO2	Write SQL for data definition, manipulation and querying.
CO3	Apply normalization and transaction concepts.
CO4	Design and implement a small relational database.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Database Foundations DBMS concepts, architecture, data models, ER modelling, keys, constraints. Detailed subtopics: DBMS architecture; schema/instance; data independence; ER/EER modelling, weak entities, cardinality and participation; keys and integrity constraints; ER-to-relational mapping.	12 Hours
Module 2	Relational Model and SQL Relational algebra basics; DDL, DML, joins, subqueries, views, functions and constraints. Detailed subtopics: Relational algebra; SQL DDL/DML; joins, nested queries, set operations, grouping/aggregation, views and constraints; stored procedures/triggers Unit Detailed Syllabus Content awareness.	12 Hours
Module 3	Database Design Functional dependencies, normalization through BCNF overview, schema refinement. Detailed subtopics: Functional dependencies, attribute closure; partial/transitive dependency; lossless and dependency-preserving decomposition; normalization from 1NF through BCNF.	12 Hours
Module 4	Transactions and Administration ACID, concurrency, locking overview, recovery, indexing basics, security, backup and database applications. Detailed subtopics: Transactions and ACID; schedules and serializability;	12 Hours

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	locks/two-phase locking; deadlock awareness; logging, checkpoints and recovery concepts.	
Module 5	Systems Integration and Case Analysis Application of the major concepts to an integrated computing scenario; comparison of alternatives; performance, reliability, security and maintainability considerations; structured case analysis and problem-solving exercises. Detailed subtopics: B+ tree/hash indexing; query-processing/optimization overview; roles/privileges, authorization and backup; NoSQL categories and relational-vs-NoSQL decision criteria.	12 Hours

Internal Assessment / Learner Engagement Exercises

- Create an ER model from a case study.
- Write SQL queries of increasing complexity.
- Normalize a supplied relation and justify each decomposition.

Laboratory / Practical Exercises

- Create schema
- constraints
- CRUD
- joins/subqueries
- views
- transactions
- mini database.

Recommended Books

- Ramez Elmasri & Shamkant Navathe, Fundamentals of Database Systems, Pearson.
- Korth, Silberschatz & Sudarshan, Database System Concepts, McGraw-Hill.

MOOC / OER Reference

- NPTEL/SWAYAM: Introduction to Database Systems / Database Management System.

Video / Digital Reference

- NPTEL DBMS lecture series.

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BCA – SEMESTER 2

BCAOL 204 – Probability & Statistics

Course Code	Course Title	L–T–P	Credits
BCAOL 204	Probability & Statistics	3-0-0	3

Course Objectives

- Develop statistical literacy for computing and analytics.
- Build foundations for machine learning and data analysis.
- Emphasise interpretation alongside calculation.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Summarise data using descriptive statistics.
CO2	Apply basic probability and random- variable concepts.
CO3	Use common probability distributions.
CO4	Interpret correlation, regression and elementary inference.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Descriptive Statistics Data types, frequency distributions, central tendency, dispersion, moments, skewness and visualisation. Detailed subtopics: Data types and measurement scales; frequency distributions; mean/median/mode; range, variance, standard deviation, coefficient of variation; quartiles, skewness and visualization.	9 Hours
Module 2	Probability Sample spaces, conditional probability, Bayes theorem, independence, counting applications. Detailed subtopics: Sample space, events, addition/multiplication laws, conditional probability, independence and Bayes theorem; counting applications.	9 Hours
Module 3	Random Variables and Discrete/continuous variables; expectation; Unit Detailed Syllabus Content Distributions binomial, Poisson and normal distributions. Detailed subtopics: Discrete/continuous random variables; probability mass/density/distribution functions; expectation and variance; binomial, Poisson and normal distributions.	9 Hours
Module 4	Statistical Relationships and Inference Correlation, simple regression, sampling concepts, confidence intervals and hypothesis-testing overview.	9 Hours

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	Detailed subtopics: Covariance and correlation; Pearson correlation; simple linear regression, least-squares idea and interpretation; association vs causation.	
Module 5	Applied Problem Solving Integrated problem sets connecting the units; interpretation of results; use of mathematical/reasoning techniques in computing and employability contexts; timed/self-assessment practice with feedback and error analysis. Detailed subtopics: Population/sample, sampling distributions awareness, standard error, confidence interval and hypothesis-testing concepts; interpretation of p-values and Type-I/II errors at introductory level.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Compute and interpret descriptive statistics for a small dataset.
- Solve conditional probability/Bayes problems.
- Interpret correlation/regression output from a supplied example.

Recommended Books

- S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand.
- Sheldon Ross, A First Course in Probability, Pearson.

MOOC / OER Reference

- NPTEL/SWAYAM: Probability and Statistics / Introduction to Statistical Hypothesis Testing.

Video / Digital Reference

- NPTEL Probability and Statistics lecture series.

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BCA – SEMESTER 2

BCAOL 205 – Professional Communication Skills-I

Course Code	Course Title	L–T–P	Credits
BCAOL 205	Professional Communication Skills-I	2-0-2	3

Course Objectives

- Advance workplace communication beyond foundational language skills.
- Develop collaboration, documentation and presentation competence.
- Prepare learners for internships and project teamwork.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Write clear professional correspondence and reports.
CO2	Participate effectively in online and face- to-face meetings.
CO3	Deliver structured presentations.
CO4	Apply professional etiquette in digital workplaces.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Workplace Writing Professional e-mail, memos, notices, agendas, minutes and tone. Detailed subtopics: Professional tone and audience analysis; e-mail, memo, notice, agenda/minutes and action items; digital etiquette and response-time norms.	9 Hours
Module 2	Reports and Documentation Short reports, proposals, technical instructions, summaries, citations and plagiarism awareness. Detailed subtopics: Technical report structure; executive summary; proposals; instructions; process description; citation/referencing; plagiarism awareness and source evaluation.	9 Hours
Module 3	Meetings and Collaboration Meeting roles, online meeting etiquette, negotiation basics, teamwork and conflict Unit Detailed Syllabus Content communication. Detailed subtopics: Online/offline meetings, facilitation, teamwork, active listening, feedback, negotiation and conflict communication; intercultural/inclusive communication.	9 Hours
Module 4	Presentations and Employability Presentation design, storytelling, Q&A, professional profile, interview communication. Detailed subtopics: Presentation storytelling, visual evidence, technical-to-nontechnical translation, Q&A,	9 Hours

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	résumé/profile improvement and interview communication.	
Module 5	Integrated Professional Communication Practice Application through workplace scenarios, presentation/interview tasks, collaborative communication, peer feedback, digital professionalism and reflective improvement using a structured rubric. Detailed subtopics: Integrated workplace communication portfolio: meeting documents, status report, presentation and reflective note; peer/faculty review using structured rubric.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Draft an agenda, minutes and follow-up e-mail.
- Prepare a two-page technical report with references.
- Deliver a recorded 5-minute presentation and reflection.

Laboratory / Practical Exercises

- Email/report writing
- online meeting simulation
- recorded presentation.

Recommended Books

- Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford.
- Lesikar et al., Business Communication, McGraw-Hill.

MOOC / OER Reference

- NPTEL/SWAYAM: Soft Skills / Effective Writing / Technical Communication offerings.

Video / Digital Reference

- NPTEL communication and soft-skills lecture series.

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BCA – SEMESTER 2

BCAOL 206 – PBL-2: Logic Building Project

Course Code	Course Title	L–T–P	Credits
BCAOL 206	PBL-2: Logic Building Project	0-0-2	1

Course Objectives

- Connect early programming concepts with problem-based learning.
- Develop planning, iteration and presentation habits.
- Encourage independent learning and peer feedback.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Translate a simple problem into requirements and logic.
CO2	Use flowcharts/pseudocode and modular decomposition.
CO3	Implement a small working solution.
CO4	Document and demonstrate the solution.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Problem Selection Problem identification, scope, user story, inputs/outputs and constraints. Detailed subtopics: Problem identification; stakeholder/user need; scope and measurable objectives; inputs/outputs, constraints and assumptions; feasibility.	3 Hours
Module 2	Solution Design Flowcharts, pseudocode, decomposition, data choices and test cases. Detailed subtopics: Algorithm decomposition; flowcharts and pseudocode; data choices; modular design; acceptance criteria and test-case planning.	3 Hours
Module 3	Implementation Incremental coding, debugging, versioning basics and peer review. Detailed subtopics: Incremental implementation; coding conventions; basic version/file organization; debugging; peer review and mentor feedback. Unit Detailed Syllabus Content	3 Hours
Module 4	Demonstration Testing, short report, README/user guide, presentation and viva. Detailed subtopics: Functional testing; boundary/error cases; defect log; iteration and user feedback; evidence capture.	3 Hours
Module 5	Integration, Documentation and Viva Consolidation of the approved work; validation against objectives;	3 Hours

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	documentation and evidence portfolio; ethics and academic integrity; presentation/demonstration; reflective learning; viva voce and future-work plan. Detailed subtopics: Final README/user guide, source files, test evidence, short report, live demonstration, presentation and individual viva/reflection.	

Internal Assessment / Learner Engagement Exercises

- Submit problem statement and flowchart.
- Peer-review another learner's design.
- Demonstrate the working solution with test cases.

Laboratory / Practical Exercises

- One guided logic-building project
- minimum milestones: proposal, design, prototype, test report, demo.

Recommended Books

- Robert C. Martin, Clean Code, Pearson (selected beginner-friendly principles).
- Course-specific lab/manual prepared by CDOE.

MOOC / OER Reference

- Relevant SWAYAM programming course selected according to project language.

Video / Digital Reference

- Instructor-created walkthrough videos and NPTEL programming demonstrations.

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BCA – SEMESTER 2

BCAOL 207 – Cyber Ethics & Digital Society

Course Code	Course Title	L–T–P	Credits
BCAOL 207	Cyber Ethics & Digital Society	2-0-0	2

Course Objectives

- Develop responsible and ethical technology use.
- Create awareness of cyber risks, privacy and digital rights.
- Prepare learners to make reasoned decisions in technology contexts.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain ethical issues in digital environments.
CO2	Recognise privacy, intellectual-property and cyber-safety concerns.
CO3	Evaluate online behaviour using ethical principles.
CO4	Practice responsible digital citizenship.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Digital Society Digital identity, inclusion, platforms, digital footprints, information quality and misinformation. Detailed subtopics: Digital society, digital divide and inclusion; digital identity, footprints, reputation and platform-mediated life; misinformation and information-quality awareness.	6 Hours
Module 2	Ethics and Professional Conduct Ethical frameworks, professional responsibility, codes of conduct, algorithmic impacts. Detailed subtopics: Ethical frameworks; values, professional responsibility, conflicts of interest, codes of conduct and responsible technology design.	6 Hours
Module 3	Privacy, IP and Security Personal data, consent, surveillance, copyright, plagiarism, software piracy, Unit Detailed Syllabus Content cyber hygiene. Detailed subtopics: Privacy, consent, surveillance, personal data and confidentiality; copyright, fair use awareness, software licensing, plagiarism and piracy.	6 Hours
Module 4	Responsible Technology Social media ethics, AI ethics, accessibility, sustainability, case studies and digital citizenship. Detailed subtopics: Cyber hygiene, passwords/MFA, phishing/social	6 Hours

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	engineering, cyberbullying, identity misuse, safe transactions and responsible social-media behaviour.	
Module 5	Contemporary Issues and Case Analysis Application of course concepts to contemporary cases; evidence-based interpretation; ethical/civic dimensions; structured discussion and reflective writing connecting the subject with professional and digital life. Detailed subtopics: AI/algorithmic ethics, accessibility, sustainability and environmental impacts; case analysis using stakeholder, rights, harm and responsibility perspectives.	6 Hours

Internal Assessment / Learner Engagement Exercises

- Analyse an online privacy notice.
- Case analysis on plagiarism/copyright.
- Create a responsible-digital-citizenship infographic and reflection.

Recommended Books

- Herman Tavani, Ethics and Technology, Wiley.
- Deborah G. Johnson, Computer Ethics, Pearson.

MOOC / OER Reference

- SWAYAM courses on Cyber Security, Cyber Law, Ethics and Values; use current approved catalogue.

Video / Digital Reference

- NPTEL cyber-security/cyber-ethics lectures; CEC digital citizenship videos.

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BCA – SEMESTER 3

BCAOL 301 – Object-Oriented Programming with Java

Course Code	Course Title	L–T–P	Credits
BCAOL 301	Object-Oriented Programming with Java	3-0-4	5

Course Objectives

- Develop object-oriented modelling and programming competence.
- Build reusable and maintainable Java code.
- Prepare learners for enterprise/mobile/software-development concepts.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Develop Java programs using classes and objects.
CO2	Apply inheritance, interfaces, polymorphism and exception handling.
CO3	Use collections, files and basic GUI/event concepts.
CO4	Design and test a small object-oriented application.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Java Foundations and Classes JDK/JVM, syntax, data types, control flow, arrays, classes, objects, constructors, encapsulation. Detailed subtopics: JDK/JVM/JRE; compilation and bytecode; variables, operators, control flow, arrays; classes, objects, constructors, this/static/final and encapsulation.	15 Hours
Module 2	OOP Mechanisms Inheritance, overriding, polymorphism, abstract classes, interfaces, packages and access control. Detailed subtopics: Inheritance, method overloading/overriding, runtime polymorphism, abstract classes, interfaces, packages and access modifiers. Unit Detailed Syllabus Content	15 Hours
Module 3	Robust Java Exceptions, strings, generics overview, collections, file I/O, basic multithreading concepts. Detailed subtopics: Exception hierarchy, try/catch/finally, custom exceptions; strings; generics awareness; collections List/Set/Map, iterators/comparators and lambda/stream awareness.	15 Hours
Module 4	Application Development Event-driven programming/GUI overview, JDBC introduction, testing and small layered application. Detailed subtopics: File and NIO basics;	15 Hours

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	object serialization awareness; threads and synchronization concepts; event-driven GUI basics.	
Module 5	Integrated Application Development Integration of course concepts through a small application; coding standards; testing and debugging; version/documentation practices; security and accessibility considerations where relevant; demonstration and reflective review. Detailed subtopics: JDBC connection, prepared statements and transactions; testing/logging awareness; integrated object-oriented application with layered structure and documentation.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Model a real-world domain using classes.
- Implement inheritance/interface exercises.
- Build a small Java application with collections, files or JDBC.

Laboratory / Practical Exercises

- Classes
- inheritance/interfaces
- exceptions
- collections
- file I/O
- JDBC/GUI mini application.

Recommended Books

- Herbert Schildt, Java: The Complete Reference, McGraw-Hill.
- Cay Horstmann, Core Java, Pearson.

MOOC / OER Reference

- NPTEL/SWAYAM: Programming in Java / Object Oriented System Development using UML, Java and Patterns.

Video / Digital Reference

- NPTEL Java lecture and coding demonstrations.

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BCA – SEMESTER 3

BCAOL 302 – Data Structure & Algorithms

Course Code	Course Title	L–T–P	Credits
BCAOL 302	Data Structure & Algorithms	3-0-4	5

Course Objectives

- Develop algorithmic problem-solving ability.
- Connect abstract data structures with implementations.
- Prepare learners for advanced software and data courses.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Implement fundamental linear and non- linear data structures.
CO2	Analyse basic algorithm time and space complexity.
CO3	Apply searching, sorting and traversal algorithms.
CO4	Select appropriate structures for stated problems.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Algorithm Analysis and Linear Structures Complexity basics; arrays; linked lists; stacks; queues; applications. Detailed subtopics: Abstract data types; algorithm correctness; time/space complexity; Big-O/Theta/Omega; empirical benchmarking; arrays and linked-list variants.	15 Hours
Module 2	Trees Binary trees, BST, traversals, heaps and priority queues; balanced-tree awareness. Detailed subtopics: Stacks and queues, circular/deque concepts, recursion stack; applications in expression processing, scheduling and backtracking awareness.	15 Hours
Module 3	Graphs and Hashing Graph representations, BFS/DFS, shortest-path overview; hashing and collision handling. Unit Detailed Syllabus Content Detailed subtopics: Binary trees, traversals, BST operations, AVL/balancing awareness, heaps and priority queues.	15 Hours
Module 4	Searching and Sorting Linear/binary search; bubble, selection, insertion, merge, quick and heap sort; comparison and use cases. Detailed subtopics: Hash functions, load factor, chaining/open addressing; graph adjacency matrix/list, BFS/DFS, connectedness and topological sorting.	15 Hours

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Module 5	Applications and Current Developments Integration of the principal concepts through contemporary applications and case studies; guided problem solving; ethical/professional considerations; reflective self-assessment and communication of learning. Detailed subtopics: Searching and sorting; merge/quick/heap sort; shortest-path and MST overview; divide-and-conquer, greedy and dynamic-programming problem patterns.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Compare complexity of two alternative solutions.
- Implement stack/queue/list operations.
- Implement tree traversal and graph BFS/DFS; benchmark two sorting methods.

Laboratory / Practical Exercises

- Lists/stacks/queues
- trees
- graphs
- hashing
- searching
- sorting
- complexity experiments.

Recommended Books

- Mark Allen Weiss, Data Structures and Algorithm Analysis, Pearson.
- Narasimha Karumanchi, Data Structures and Algorithms Made Easy.

MOOC / OER Reference

- NPTEL/SWAYAM: Programming, Data Structures and Algorithms Using Python / Data Structures and Algorithms.

Video / Digital Reference

- NPTEL DSA lecture series.

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BCA – SEMESTER 3

BCAOL 303 – PBL-3: Mini Project

Course Code	Course Title	L–T–P	Credits
BCAOL 303	PBL-3: Mini Project	0-0-4	2

Course Objectives

- Integrate programming and database/web concepts.
- Develop teamwork, self-management and documentation.
- Provide authentic ODL learning through milestone-based mentoring.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Plan a small software project from a defined need.
CO2	Create requirements, design and test artefacts.
CO3	Develop a functional prototype using an approved technology stack.
CO4	Present, document and defend project decisions.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Proposal and Requirements Problem statement, users, scope, functional/non-functional requirements, feasibility. Detailed subtopics: Problem statement, stakeholder identification, user stories/use cases, objectives, scope and feasibility.	6 Hours
Module 2	Design Architecture, data model, UI sketches, modules, test plan, schedule. Detailed subtopics: Requirements baseline; architecture, database/data structure choice, UI sketches and test strategy.	6 Hours
Module 3	Build and Test Iterative implementation, source control, test cases, defect log, mentor review. Detailed subtopics: Project plan, task breakdown, milestones, risks, repository/version discipline and Unit Detailed Syllabus Content supervisor review.	6 Hours
Module 4	Report and Viva User guide, technical report, demo, presentation, reflection and viva. Detailed subtopics: Incremental development, defect tracking, functional/non-functional testing and refinement.	6 Hours
Module 5	Integration, Documentation and Viva Consolidation of the approved work;	6 Hours

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	validation against objectives; documentation and evidence portfolio; ethics and academic integrity; presentation/demonstration; reflective learning; viva voce and future-work plan. Detailed subtopics: Final artefact, report, README/user guide, test evidence, presentation, demonstration, peer reflection and viva.	

Internal Assessment / Learner Engagement Exercises

- Proposal + requirements submission.
- Mid-term prototype demonstration.
- Final report, source code, test evidence and viva.

Laboratory / Practical Exercises

- One mini project with at least three supervised milestones and final viva.

Recommended Books

- Roger Pressman & Bruce Maxim, Software Engineering: A Practitioner's Approach, McGraw-Hill.

- Course-specific project handbook prepared by CDOE.

MOOC / OER Reference

- Relevant SWAYAM/NPTEL course matched to the selected project domain.

Video / Digital Reference

- Instructor-recorded project clinics; NPTEL software engineering demonstrations.

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BCA – SEMESTER 3

BCAOL 304 – Digital Computer Principles

Course Code	Course Title	L–T–P	Credits
BCAOL 304	Digital Computer Principles	3-0-0	3

Course Objectives

- Provide hardware foundations for computer applications.
- Develop ability to reason about digital logic.
- Support later systems, networks and architecture learning.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain digital number systems and Boolean algebra.
CO2	Design elementary combinational and sequential circuits.
CO3	Describe memory and processor building blocks.
CO4	Relate digital logic to computer organisation.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Number Systems and Logic Binary/octal/hex, complements, codes, Boolean algebra, gates, simplification, K-maps. Detailed subtopics: Binary/octal/hexadecimal systems; complements and codes; Boolean algebra, logic gates and simplification; Karnaugh maps.	9 Hours
Module 2	Combinational Circuits Adders/subtractors, multiplexers, decoders, encoders, comparators. Detailed subtopics: Combinational circuits: adders/subtractors, multiplexers/demultiplexers, decoders/encoders, comparators and code converters.	9 Hours
Module 3	Sequential Circuits Latches, flip-flops, registers, counters, Unit Detailed Syllabus Content timing concepts. Detailed subtopics: Latches and flip-flops; excitation tables; registers, shift registers, synchronous/asynchronous counters and timing concepts.	9 Hours
Module 4	Computer Building Blocks Memory hierarchy basics, buses, ALU/control concepts, I/O interfaces and digital-system overview. Detailed subtopics: Memory devices and hierarchy awareness; ROM/RAM; buses;	9 Hours

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	ALU and control-unit building blocks; basic CPU organization.	
Module 5	Systems Integration and Case Analysis Application of the major concepts to an integrated computing scenario; comparison of alternatives; performance, reliability, security and maintainability considerations; structured case analysis and problem-solving exercises. Detailed subtopics: Integrated digital-system design problems; use of logic simulator where feasible; propagation delay, fan-in/fan-out and reliability awareness.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Convert and perform arithmetic across number systems.
- Simplify Boolean expressions using K-maps.
- Design a small combinational/sequential circuit on paper or simulator.

Recommended Books

- M. Morris Mano & Michael Ciletti, Digital Design, Pearson.
- Thomas Floyd, Digital Fundamentals, Pearson.

MOOC / OER Reference

- NPTEL/SWAYAM: Digital Circuits / Digital Computer Organization.

Video / Digital Reference

- NPTEL Digital Circuits lecture series.

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BCA – SEMESTER 3

BCAOL 305 – Entrepreneurship Development

Course Code	Course Title	L–T–P	Credits
BCAOL 305	Entrepreneurship Development	2-0-0	2

Course Objectives

- Develop entrepreneurial awareness among computing learners.
- Connect technology skills with innovation and self-employment.
- Introduce business planning, finance and support ecosystems.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain entrepreneurial mindset and opportunity recognition.
CO2	Develop a basic business model and value proposition.
CO3	Estimate elementary market, cost and revenue assumptions.
CO4	Present a concise venture pitch responsibly.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Entrepreneurial Mindset Entrepreneurship, traits, innovation, intrapreneurship, social entrepreneurship, failure and learning. Detailed subtopics: Entrepreneurial mindset, creativity and innovation; entrepreneur vs manager/intrapreneur; social entrepreneurship; learning from failure.	6 Hours
Module 2	Opportunity and Customer Problem discovery, customer segments, value proposition, market research, competition. Detailed subtopics: Opportunity identification, problem interviews, customer segments, jobs/pains/gains, value proposition and elementary market research. Unit Detailed Syllabus Content	6 Hours
Module 3	Business Model and Finance Business Model Canvas, revenue/cost, pricing, break-even basics, funding sources and startup support. Detailed subtopics: Business Model Canvas; revenue streams, cost structure, pricing, unit economics and break-even intuition; startup finance sources.	6 Hours
Module 4	Launch and Growth MVP, digital marketing, IP awareness, legal/ethical considerations, pitch deck and scaling. Detailed subtopics: MVP, prototyping, validation, go-to-market, digital channels,	6 Hours

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	intellectual-property awareness, legal/ethical considerations.	
Module 5	Applied Business/Entrepreneurial Case Integration through a small venture/campaign case; customer or stakeholder analysis; planning and metrics; ethical and legal considerations; concise pitch/report and reflection on assumptions and evidence. Detailed subtopics: Pitch deck, storytelling, traction metrics, networking, incubation/startup ecosystem, scaling risks and reflective venture plan.	6 Hours

Internal Assessment / Learner Engagement Exercises

- Interview two potential users and summarise needs.
- Prepare a one-page Business Model Canvas.
- Record a 3-minute venture pitch with assumptions.

Recommended Books

- Robert D. Hisrich et al., Entrepreneurship, McGraw-Hill.
- Alexander Osterwalder & Yves Pigneur, Business Model Generation, Wiley.

MOOC / OER Reference

- SWAYAM/NPTEL: Entrepreneurship / Innovation, Business Models and Entrepreneurship.

Video / Digital Reference

- NPTEL entrepreneurship lecture series.

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BCA – SEMESTER 3

BCAOL 306 – Operating System

Course Code	Course Title	L–T–P	Credits
BCAOL 306	Operating System	3-0-2	4

Course Objectives

- Build conceptual understanding of resource management.
- Connect theory with practical OS observations.
- Prepare learners for systems, networking and security courses.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain major operating-system services and structures.
CO2	Analyse process scheduling and synchronization problems.
CO3	Explain memory, file and storage management.
CO4	Use basic operating-system commands and observe system behaviour.

Course Content

Module	Detailed syllabus content	Hours
Module 1	OS and Processes OS functions, structures, system calls; processes, threads, states, CPU scheduling. Detailed subtopics: OS functions and structures; kernel/user mode; interrupts and system calls; processes, PCB, states, context switching and threads.	12 Hours
Module 2	Concurrency and Deadlocks Synchronization, critical section, semaphores/monitors concepts, deadlocks and handling. Detailed subtopics: Scheduling criteria and FCFS, SJF, Priority, Round Robin; synchronization, race conditions, critical section, mutex/semaphore/monitor concepts.	12 Hours
Module 3	Memory Management Paging, segmentation, virtual memory, page replacement and allocation. Detailed subtopics: Deadlock conditions, Unit Detailed Syllabus Content resource-allocation graphs, prevention/avoidance/detection; Banker's algorithm awareness.	12 Hours
Module 4	Files, I/O and Security File systems, directories, disk scheduling, I/O, protection/security, Linux/Windows overview. Detailed subtopics: Contiguous allocation, paging, segmentation, TLB, page tables, virtual memory, page replacement and thrashing awareness.	12 Hours

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Module 5	Systems Integration and Case Analysis Application of the major concepts to an integrated computing scenario; comparison of alternatives; performance, reliability, security and maintainability considerations; structured case analysis and problem-solving exercises. Detailed subtopics: File systems, directories, allocation, disk scheduling, I/O buffering; protection/access control; Linux/Windows observations; virtualization/container overview.	12 Hours

Internal Assessment / Learner Engagement Exercises

- Compare CPU scheduling algorithms on a supplied workload.
- Solve page-replacement exercises.
- Use Linux commands to inspect processes, memory and file permissions.

Laboratory / Practical Exercises

- Linux shell/process commands
- scheduling simulation
- memory/page replacement
- permissions/file system exercises.

Recommended Books

- Abraham Silberschatz et al., Operating System Concepts, Wiley.
- William Stallings, Operating Systems: Internals and Design Principles, Pearson.

MOOC / OER Reference

- NPTEL/SWAYAM: Operating System Fundamentals / Introduction to Operating Systems.

Video / Digital Reference

- NPTEL Operating Systems lecture series.

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BCA – SEMESTER 3

BCAOL 307 – Indian Constitution & Civic Values

Course Code	Course Title	L–T–P	Credits
BCAOL 307	Indian Constitution & Civic Values	2-0-0	2

Course Objectives

- Develop constitutional literacy and civic responsibility.
- Connect rights and duties with contemporary social/digital contexts.
- Promote democratic, ethical and inclusive citizenship.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain foundational features of the Indian Constitution.
CO2	Identify fundamental rights, duties and directive principles.
CO3	Describe key institutions and democratic processes.
CO4	Relate constitutional values to responsible citizenship and digital society.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Constitutional Foundations Making of Constitution, Preamble, salient features, federalism, citizenship. Detailed subtopics: Constituent Assembly, making of the Constitution, Preamble, salient features, citizenship and federal character.	6 Hours
Module 2	Rights, Duties and DPSP Fundamental Rights, remedies, Directive Principles, Fundamental Duties. Detailed subtopics: Fundamental Rights, reasonable restrictions, constitutional remedies, Directive Principles and Fundamental Duties.	6 Hours
Module 3	Institutions Parliament, Executive, Judiciary, Centre-State relations, constitutional bodies, local government. Detailed subtopics: Parliament, Unit Detailed Syllabus Content President/Prime Minister/Council of Ministers, Supreme Court/High Courts and judicial review; separation/checks and balances.	6 Hours
Module 4	Civic Values Democracy, secularism, equality, social justice, electoral participation, digital citizenship and contemporary constitutional issues. Detailed subtopics: Centre-State relations, Finance/Election/other constitutional	6 Hours

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	bodies; Panchayati Raj and urban local governance.	
Module 5	Contemporary Issues and Case Analysis Application of course concepts to contemporary cases; evidence-based interpretation; ethical/civic dimensions; structured discussion and reflective writing connecting the subject with professional and digital life. Detailed subtopics: Constitutional values in contemporary citizenship: equality, secularism, social justice, democratic participation, digital rights/responsibilities and case discussion.	6 Hours

Internal Assessment / Learner Engagement Exercises

- Explain one Fundamental Right through a current-life scenario.
- Prepare a comparison chart of major constitutional institutions.
- Reflect on civic responsibility in social-media participation.

Recommended Books

- D.D. Basu, Introduction to the Constitution of India, LexisNexis.
- M. Laxmikanth, Indian Polity, McGraw-Hill (selected chapters).

MOOC / OER Reference

- SWAYAM/CEC/UGC courses on Constitutional Studies / Indian Government and Politics.

Video / Digital Reference

- CEC/SWAYAM videos on the Constitution of India.

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BCA – SEMESTER 4

BCAOL 401 – Full Stack Development

Course Code	Course Title	L–T–P	Credits
BCAOL 401	Full Stack Development	0-0-6	3

Course Objectives

- Integrate front-end, server and database skills.
- Emphasise project-based practical learning.
- Develop deployment, testing and API literacy.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Develop responsive front-end interfaces.
CO2	Build server-side routes/APIs using an approved stack.
CO3	Connect applications to persistent data storage.
CO4	Deploy and document a small full-stack application.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Front-end Foundations Semantic HTML, CSS responsive design, JavaScript ES concepts, DOM, forms, fetch/API use. Detailed subtopics: Semantic HTML/CSS/JavaScript refresher; component-based UI concepts, state, events, routing and responsive/accessibility practices.	9 Hours
Module 2	Front-end Application Structure Components/modules, state concepts, client-side routing overview, validation and accessibility. Detailed subtopics: Front-end data flow; forms and validation; asynchronous fetch; API consumption; loading/error states and reusable components.	9 Hours
Module 3	Back-end and APIs Server runtime/framework, routing, REST concepts, middleware, authentication Unit Detailed Syllabus Content concepts, error handling. Detailed subtopics: Server-side runtime/framework; routes/controllers; REST resource design; middleware; input validation; authentication/authorization concepts.	9 Hours
Module 4	Data, Testing and Deployment Database integration, CRUD, testing basics, security hygiene, environment configuration, deployment and documentation. Detailed subtopics: Relational/NoSQL persistence; CRUD, schema/model	9 Hours

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	validation, ORM awareneşs; secure data handling and environment configuration.	
Module 5	Integrated Application Development Integration of course concepts through a small application; coding standards; testing and debugging; version/documentation practices; security and accessibility considerations where relevant; demonstration and reflective review. Detailed subtopics: Testing, logging, container/deployment awareness, CI/CD basics, performance/security checklist and integrated full-stack project.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Build a responsive front end from a supplied brief.
- Create a CRUD REST API.
- Integrate front end + API + database and deploy/demo.

Laboratory / Practical Exercises

- Responsive UI
- JS/fetch
- REST API
- DB CRUD
- authentication concept demo
- deployment project.

Recommended Books

- David Flanagan, JavaScript: The Definitive Guide, O'Reilly.
- Ethan Brown, Web Development with Node and Express, O'Reilly (or equivalent approved stack text).

MOOC / OER Reference

- NPTEL/SWAYAM: Web Technology / Modern Application Development offerings.

Video / Digital Reference

- NPTEL web-development lectures; official framework documentation videos.

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BCA – SEMESTER 4

BCAOL 402 – Computer Network

Course Code	Course Title	L–T–P	Credits
BCAOL 402	Computer Network	4-0-2	5

Course Objectives

- Develop foundational networking competence.
- Combine protocol theory with practical configuration.
- Prepare learners for cloud, cybersecurity and distributed applications.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain layered network architectures and protocols.
CO2	Analyse addressing, routing and transport concepts.
CO3	Configure and troubleshoot basic network scenarios.
CO4	Explain common network services and security controls.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Network Foundations OSI/TCP-IP, physical media, switching, framing, Ethernet, error/flow control. Detailed subtopics: OSI/TCP-IP models; signals/media awareness; Ethernet framing, MAC addressing, switching, VLAN concepts and error detection.	15 Hours
Module 2	Network Layer IPv4/IPv6 basics, subnetting, ARP/ICMP, routing concepts and algorithms. Detailed subtopics: IPv4 subnetting/VLSM, IPv6 format, ARP, ICMP, NAT and routing tables; static vs dynamic routing; distance-vector/link-state concepts.	15 Hours
Module 3	Transport and Applications TCP/UDP, reliability, congestion overview; DNS, HTTP, e-mail, DHCP and common services. Detailed subtopics: TCP/UDP, Unit Detailed Syllabus Content ports/sockets, connection establishment, flow/congestion control and reliability.	15 Hours
Module 4	Wireless, Management and Security Wi-Fi basics, network devices, troubleshooting tools, firewalls/VPN concepts, secure protocols. Detailed subtopics: DNS, HTTP/HTTPS, SMTP/IMAP, DHCP and application services; Wi-Fi architecture and wireless security basics.	15 Hours

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Module 5	Applied Case Studies and Professional Practice Integrated case studies connecting architecture, operations, risk, security, legal/ethical responsibilities and current practice; guided troubleshooting/analysis where applicable; preparation of a concise technical or compliance report. Detailed subtopics: Firewalls, ACLs, VPN and segmentation; packet capture; ping/traceroute/nslookup/dig; structured troubleshooting and cloud-networking awareness.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Subnetting worksheet and addressing plan.
- Analyse packet flow for a web request.
- Use simulator/commands to configure and troubleshoot a small network.

Laboratory / Practical Exercises

- Packet capture/analysis

- IP/subnetting
- simulator topology
- ping/traceroute/DNS
- basic routing/security.

Recommended Books

- James Kurose & Keith Ross, Computer Networking: A Top-Down Approach, Pearson.
- Behrouz Forouzan, Data Communications and Networking, McGraw-Hill.

MOOC / OER Reference

- NPTEL/SWAYAM: Computer Networks and Internet Protocol.

Video / Digital Reference

- NPTEL Computer Networks lecture series.

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BCA – SEMESTER 4

BCAOL 403 – Data Warehousing and Mining

Course Code	Course Title	L–T–P	Credits
BCAOL 403	Data Warehousing and Mining	3-0-4	5

Course Objectives

- Connect database knowledge with analytics.
- Develop hands-on experience with warehouse/mining workflows.
- Prepare learners for data analytics and machine learning.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain data warehouse architecture and dimensional modelling.
CO2	Perform elementary ETL and OLAP operations.
CO3	Apply basic classification, clustering and association techniques.
CO4	Evaluate data-mining results using suitable measures.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Data Warehousing Operational vs analytical systems, architecture, ETL, data quality, metadata. Detailed subtopics: Operational vs analytical systems; warehouse characteristics and architecture; staging area; ETL/ELT, data profiling, quality, lineage and metadata.	15 Hours
Module 2	Dimensional Modelling and OLAP Facts/dimensions, star/snowflake schemas, cubes, roll-up/drill-down/slice/dice. Detailed subtopics: Dimensional modelling: grain, facts, dimensions, surrogate keys, star/snowflake schemas, slowly changing dimensions and conformed dimensions.	15 Hours
Module 3	Data Mining Foundations Preprocessing, similarity, association rules, classification and evaluation. Unit Detailed Syllabus Content Detailed subtopics: OLAP cubes, hierarchies, roll-up, drill-down, slice, dice and pivot; materialised aggregates and performance awareness.	15 Hours
Module 4	Clustering and Applications Clustering concepts, outliers, text/web mining overview, ethics/privacy and case studies. Detailed subtopics: Data preprocessing; association rules with support/confidence/lift; classification workflow, confusion matrix and overfitting awareness.	15 Hours

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Module 5	Applied Analytics/AI Case Work End-to-end applied workflow using a suitable dataset/problem; evaluation and interpretation; limitations and error analysis; responsible use, privacy/bias considerations where relevant; communication of findings through a notebook, report or demonstration. Detailed subtopics: Clustering, similarity/distance, outlier awareness, text/web mining overview; privacy, bias, interpretability and responsible analytics.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Design a star schema for a business case.
- Perform data cleaning and simple OLAP analysis.
- Run one classification/clustering/association exercise and interpret results.

Laboratory / Practical Exercises

- ETL/data cleaning
- dimensional model
- OLAP
- association
- classification
- clustering using approved tool/Python.

Recommended Books

- Jiawei Han, Micheline Kamber & Jian Pei, Data Mining: Concepts and Techniques, Morgan Kaufmann.
- Paulraj Ponniah, Data Warehousing Fundamentals, Wiley.

MOOC / OER Reference

- NPTEL/SWAYAM: Data Mining / Data Warehousing and Data Mining.

Video / Digital Reference

- NPTEL Data Mining lecture series.

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BCA – SEMESTER 4

BCAOL 404 – Cyber Security & Ethical Hacking

Course Code	Course Title	L–T–P	Credits
BCAOL 404	Cyber Security & Ethical Hacking	3-0-2	4

Course Objectives

- Develop defensive cybersecurity awareness and skills.
- Provide controlled, authorised practical exposure to security tools.
- Emphasise ethics, law, documentation and risk reduction.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain common cyber threats, vulnerabilities and defensive controls.
CO2	Apply basic secure configuration and vulnerability-assessment concepts in authorised labs.
CO3	Interpret elementary cryptographic and authentication mechanisms.
CO4	Demonstrate ethical, legal and responsible security practice.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Security Foundations CIA triad, risk, threat modelling, malware/social engineering, security policies and ethics. Detailed subtopics: Security principles, assets, threats, vulnerabilities, attack surface, risk assessment and defence-in-depth; ethics and legal authorization.	12 Hours
Module 2	System and Network Security Hardening, authentication, access control, patching, firewalls, IDS/IPS concepts, secure protocols. Detailed subtopics: Authentication/MFA, access control, password/key hygiene, cryptography concepts, system hardening, patching and endpoint controls.	12 Hours
Module 3	Web and Application Security Common web vulnerabilities at Unit Detailed Syllabus Content conceptual/defensive level, secure coding, input validation, session/security headers. Detailed subtopics: Network segmentation, firewalls, IDS/IPS concepts, VPN/TLS, Wi-Fi security and secure protocols; packet/log inspection.	12 Hours
Module 4	Assessment and Incident Response Vulnerability assessment in isolated labs, logging, incident lifecycle, evidence handling overview, reporting and remediation.	12 Hours

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	Detailed subtopics: OWASP-style web vulnerabilities, input validation, session/access-control risks, secure coding and dependency vulnerability awareness.	
Module 5	Applied Case Studies and Professional Practice Integrated case studies connecting architecture, operations, risk, security, legal/ethical responsibilities and current practice; guided troubleshooting/analysis where applicable; preparation of a concise technical or compliance report. Detailed subtopics: Authorized vulnerability assessment in isolated labs; CVSS awareness; logging/SIEM concepts; incident response, remediation, reporting and responsible disclosure.	12 Hours

Internal Assessment / Learner Engagement Exercises

- Create a threat model for a small web application.
- Audit security settings in an isolated lab VM and propose remediation.
- Analyse a sanitised incident log and write a short incident report.

Laboratory / Practical Exercises

- Isolated VM hardening
- password/access-control exercises
- packet/log analysis
- safe vulnerability scanning
- secure coding checks.

Recommended Books

- William Stallings, Computer Security: Principles and Practice, Pearson.
- Michael E. Whitman & Herbert Mattord, Principles of Information Security, Cengage.

MOOC / OER Reference

- NPTEL/SWAYAM: Introduction to Cyber Security / Ethical Hacking (defensive and authorised-lab components only).

Video / Digital Reference

- NPTEL cyber-security lecture series; OWASP educational videos/resources.

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BCA – SEMESTER 4

BCAOL 405 – Data Analysis using Python

Course Code	Course Title	L–T–P	Credits
BCAOL 405	Data Analysis using Python	0-0-6	3

Course Objectives

- Develop practical data-analysis workflow skills.
- Connect statistics with Python tools.
- Emphasise reproducibility, interpretation and communication.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Load, clean and transform datasets using Python.
CO2	Perform exploratory analysis and visualisation.
CO3	Compute descriptive statistics and simple analytical summaries.
CO4	Communicate reproducible findings through notebooks/reports.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Data Analysis Environment Jupyter/notebooks, NumPy basics, pandas Series/DataFrame, importing data. Detailed subtopics: Jupyter/notebook workflow; NumPy arrays, vectorization and pandas Series/DataFrame; CSV/Excel/JSON import and data provenance.	9 Hours
Module 2	Cleaning and Transformation Missing values, duplicates, types, filtering, grouping, merging and reshaping. Detailed subtopics: Missing values, duplicates, types, dates/categories; filtering, sorting, grouping, merge/join/concat and reshaping.	9 Hours
Module 3	Exploration and Visualisation Descriptive statistics, distributions, relationships, matplotlib-based charts, good visual practice. Unit Detailed Syllabus Content Detailed subtopics: Descriptive statistics, distribution/outlier exploration and correlation; exploratory question formation.	9 Hours
Module 4	Applied Analysis Time/category analysis basics, correlation, simple regression awareness, reproducible notebook and narrative reporting. Detailed subtopics: Matplotlib-based visualization; chart selection, labels/annotation, accessibility, misleading-visual avoidance and narrative explanation.	9 Hours

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Module 5	Integrated Application Development Integration of course concepts through a small application; coding standards; testing and debugging; version/documentation practices; security and accessibility considerations where relevant; demonstration and reflective review. Detailed subtopics: Simple regression/classification awareness; reproducible notebook, random seeds/environment notes, privacy/ethics and final analytical findings brief.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Clean a deliberately messy dataset.
- Create an exploratory-analysis notebook with at least five justified visualisations.
- Prepare a one-page findings brief from a dataset.

Laboratory / Practical Exercises

- NumPy
- pandas import/clean/group/merge
- matplotlib visualisation
- EDA notebook
- final dataset analysis.

Recommended Books

- Wes McKinney, Python for Data Analysis, O'Reilly.
- Jake VanderPlas, Python Data Science Handbook, O'Reilly.

MOOC / OER Reference

- NPTEL/SWAYAM: Python for Data Science / Data Analytics with Python.

Video / Digital Reference

- NPTEL Python for Data Science videos.

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BCA – SEMESTER 4

BCAOL 406 – Aptitude & Reasoning Skills-II

Course Code	Course Title	L–T–P	Credits
BCAOL 406	Aptitude & Reasoning Skills-II	2-0-0	2

Course Objectives

- Extend Semester-I aptitude competence.
- Support placement and postgraduate entrance readiness.
- Develop disciplined timed-practice habits.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Solve advanced quantitative and logical- reasoning problems.
CO2	Interpret multi-variable data efficiently.
CO3	Apply verbal/analytical reasoning to placement-style questions.
CO4	Manage time and accuracy in mixed aptitude tests.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Advanced Quantitative Number properties, algebraic reasoning, progressions, geometry/mensuration basics. Detailed subtopics: Number properties, divisibility, remainders, HCF/LCM, algebraic simplification and equations; estimation strategies.	6 Hours
Module 2	Advanced Reasoning Seating/arrangements, puzzles, statement-assumption/conclusion, data sufficiency. Detailed subtopics: Progressions, geometry/mensuration basics, time-work, time-speed-distance and percentage/rate mixtures at advanced practice level.	6 Hours
Module 3	Data Interpretation Combined charts, caselets, missing data, percentage change, ratios and approximation. Detailed subtopics: Seating/arrangements, Unit Detailed Syllabus Content puzzles, statement-assumption/conclusion, cause-effect, logical deduction and data sufficiency.	6 Hours
Module 4	Placement Practice Mixed timed sets, verbal reasoning, error analysis, strategy and mock tests. Detailed subtopics: Combined tables/charts/caselets, missing data, percentage change, ratios and approximation under time constraints.	6 Hours
Module 5	Applied Problem Solving Integrated problem sets connecting the	6 Hours

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	units; interpretation of results; use of mathematical/reasoning techniques in computing and employability contexts; timed/self-assessment practice with feedback and error analysis. Detailed subtopics: Placement-style mixed mocks, question triage, speed-accuracy strategy, error categorization and personalized improvement plan.	

Internal Assessment / Learner Engagement Exercises

- Two timed mixed aptitude tests.
- Solve and explain three advanced puzzles.
- Maintain an error log and improvement plan.

Recommended Books

- Arun Sharma, How to Prepare for Quantitative Aptitude, McGraw-Hill.
- R.S. Aggarwal, Verbal & Non-Verbal Reasoning, S. Chand.

MOOC / OER Reference

- SWAYAM/AICTE employability and aptitude courses.

Video / Digital Reference

- SWAYAM/NPTEL employability-skills videos.

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BCA – SEMESTER 4

BCAOL 407 – Minor Project

Course Code	Course Title	L–T–P	Credits
BCAOL 407	Minor Project	0-0-4	2

Course Objectives

- Integrate learning from Semesters I–IV.
- Strengthen independent problem solving and project discipline.
- Provide authentic evidence of practical competence.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Define and scope a modest computing problem.
CO2	Apply an appropriate development/data methodology.
CO3	Build, test and document a working solution.
CO4	Present outcomes and reflect on limitations and future work.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Initiation Problem definition, literature/market scan, scope, objectives, ethics and feasibility. Detailed subtopics: Problem formulation, user/stakeholder need, scope, objectives, literature/technology scan and feasibility.	6 Hours
Module 2	Design Requirements, architecture/data design, UI/prototype, project plan and test strategy. Detailed subtopics: Requirements, architecture/data model, UI/prototype, project plan, technology selection, risk/ethics/security review.	6 Hours
Module 3	Implementation and Validation Iterative build, mentor reviews, testing, issue tracking and improvement. Detailed subtopics: Incremental implementation, repository/version evidence, mentor reviews, issue tracking Unit Detailed Syllabus Content and change management.	6 Hours
Module 4	Documentation and Viva Report, code/data repository, user documentation, presentation, demo and viva. Detailed subtopics: Testing strategy, functional/non-functional tests, defect evidence, usability/performance/security checks and refinement.	6 Hours
Module 5	Integration, Documentation and Viva Consolidation of the approved work;	6 Hours

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	validation against objectives; documentation and evidence portfolio; ethics and academic integrity; presentation/demonstration; reflective learning; viva voce and future-work plan. Detailed subtopics: Final artefact, report, deployment/user guide, presentation, live demonstration, viva and reflection on limitations/future work.	

Internal Assessment / Learner Engagement Exercises

- Proposal and project plan.
- Mid-project review with evidence of implementation.
- Final report, artefact, test evidence, presentation and viva.

Laboratory / Practical Exercises

- One supervised minor project with proposal, review, final demo and viva.

Recommended Books

- Roger Pressman & Bruce Maxim, Software Engineering: A Practitioner's Approach.

- CDOE Minor Project Handbook (to be approved).

MOOC / OER Reference

- Domain-specific SWAYAM/NPTEL MOOC selected with supervisor approval.

Video / Digital Reference

- Recorded project clinics and domain-specific NPTEL videos.

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BCA – SEMESTER 5

BCAOL 501 – Machine Learning

Course Code	Course Title	L–T–P	Credits
BCAOL 501	Machine Learning	4-0-2	5

Course Objectives

- Develop practical introductory machine-learning competence.
- Connect statistics/data analysis with predictive modelling.
- Promote correct evaluation and responsible interpretation.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain core supervised and unsupervised learning concepts.
CO2	Prepare data and train elementary ML models.
CO3	Evaluate models using appropriate metrics.
CO4	Recognise overfitting, bias and responsible-ML concerns.

Course Content

Module	Detailed syllabus content	Hours
Module 1	ML Foundations Learning paradigms, workflow, features/labels, train-validation-test, preprocessing and leakage. Detailed subtopics: ML problem formulation; supervised/unsupervised/reinforcement paradigms; features/labels, train-validation-test split, preprocessing, pipelines and leakage.	15 Hours
Module 2	Supervised Learning Linear/logistic regression, k-NN, decision trees, basic ensemble awareness; classification/regression metrics. Detailed subtopics: Linear/logistic regression, k-NN and Naive Bayes; assumptions, regularisation intuition and classification/regression metrics.	15 Hours
Module 3	Unsupervised Learning Clustering, dimensionality-reduction overview, anomaly concepts. Unit Detailed Syllabus Content Detailed subtopics: Decision trees, random forests, ensemble concepts, cross-validation and hyperparameter-tuning awareness; imbalance and feature engineering.	15 Hours
Module 4	Model Improvement and Responsibility Cross-validation, regularisation concepts, feature engineering, pipelines, explainability/bias basics and deployment awareness. Detailed subtopics: k-means and	15 Hours

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	hierarchical clustering; PCA/dimensionality-reduction overview; anomaly detection concepts and cluster evaluation.	
Module 5	Applied Analytics/AI Case Work End-to-end applied workflow using a suitable dataset/problem; evaluation and interpretation; limitations and error analysis; responsible use, privacy/bias considerations where relevant; communication of findings through a notebook, report or demonstration. Detailed subtopics: Explainability/feature importance, fairness/bias, privacy, model cards, reproducibility, deployment awareness and end-to-end applied case.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Compare baseline models on a supplied dataset.
- Evaluate a classifier with confusion matrix and metrics.
- Write a short model card covering data, metrics, limitations and ethical risks.

Laboratory / Practical Exercises

- Data preprocessing
- regression
- classification
- clustering
- evaluation/cross-validation
- mini ML notebook.

Recommended Books

- Tom Mitchell, Machine Learning, McGraw-Hill.
- Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, O'Reilly.

MOOC / OER Reference

- NPTEL/SWAYAM: Introduction to Machine Learning / Machine Learning.

Video / Digital Reference

- NPTEL Machine Learning lecture series.

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BCA – SEMESTER 5

BCAOL 502 – Cloud Computing

Course Code	Course Title	L–T–P	Credits
BCAOL 502	Cloud Computing	3-0-4	5

Course Objectives

- Build cloud-computing conceptual and practical literacy.
- Connect networks, systems and application deployment.
- Develop awareness of cost, security, reliability and sustainability.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain cloud service/deployment models and virtualization.
CO2	Use basic cloud compute, storage and networking services in guided labs.
CO3	Explain containers, scalability and cloud security fundamentals.
CO4	Design a simple cloud solution for a stated requirement.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Cloud Foundations Characteristics, IaaS/PaaS/SaaS, public/private/hybrid, virtualization, regions/zones and shared responsibility. Detailed subtopics: Cloud characteristics, IaaS/PaaS/SaaS, public/private/hybrid/multi-cloud; regions/zones, shared responsibility and virtualization.	15 Hours
Module 2	Core Services Compute, storage, networking, identity/access, databases, monitoring and pricing concepts. Detailed subtopics: Compute instances, autoscaling concepts, object/block/file storage, virtual networks/subnets/routing, load balancing, DNS and managed databases.	15 Hours
Module 3	Cloud-native Concepts Containers, orchestration overview, Unit Detailed Syllabus Content serverless, autoscaling, APIs and DevOps/CI-CD awareness. Detailed subtopics: Containers, registries, orchestration overview, serverless/FaaS, API gateways, messaging/event-driven services and CI/CD awareness.	15 Hours
Module 4	Security, Reliability and Architecture IAM, encryption, backup/DR, high availability, cost optimisation, sustainability and reference architectures. Detailed subtopics: IAM roles/policies,	15 Hours

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	least privilege, encryption/key management, secrets, logs/metrics/alerts, backup and disaster recovery.	
Module 5	Applied Case Studies and Professional Practice Integrated case studies connecting architecture, operations, risk, security, legal/ethical responsibilities and current practice; guided troubleshooting/analysis where applicable; preparation of a concise technical or compliance report. Detailed subtopics: High availability, reliability, performance, migration approaches, cost models, tagging/budgets, FinOps awareness and cloud sustainability.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Map a conventional application to cloud services.
- Complete guided compute/storage/IAM lab in an approved sandbox.
- Design a simple cloud architecture with security and cost considerations.

Laboratory / Practical Exercises

- Sandbox account/approved simulator: VM/compute, storage, IAM, networking, container/serverless demonstration, architecture exercise.

Recommended Books

- Rajkumar Buyya et al., Mastering Cloud Computing, McGraw-Hill.
- Thomas Erl et al., Cloud Computing: Concepts, Technology & Architecture, Pearson.

MOOC / OER Reference

- NPTEL/SWAYAM: Cloud Computing; Google Cloud Computing Foundations.

Video / Digital Reference

- NPTEL Cloud Computing lecture series and guided cloud demonstrations.

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BCA – SEMESTER 5

BCAOL 503 – A

Course Code	Course Title	L–T–P	Credits
BCAOL 503	A	3-0-4	5

Course Objectives

- Develop practical mobile-app development competence.
- Apply UI, data and API concepts in a constrained device context.
- Promote privacy, accessibility and testing.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Design mobile user interfaces for common interaction patterns.
CO2	Build a small mobile application using an approved framework.
CO3	Use local/network data and device capabilities responsibly.
CO4	Test, package and document a mobile application.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Mobile Platforms and UI Mobile ecosystem, project structure, layouts/components, navigation, responsive/adaptive UI. Detailed subtopics: Mobile ecosystem; native vs cross-platform; project structure; activities/screens/components; layout and responsive/adaptive UI principles.	15 Hours
Module 2	Application Logic State, lifecycle, events, forms, validation and reusable components. Detailed subtopics: Navigation, lifecycle/state, events, forms, validation and reusable UI components; accessibility and localization awareness.	15 Hours
Module 3	Data and Services Local storage/database, REST APIs, JSON, permissions and selected device services. Unit Detailed Syllabus Content Detailed subtopics: Local storage/database, preferences, file storage and offline-first concepts; JSON and data serialization.	15 Hours
Module 4	Quality and Release Testing/debugging, performance, security/privacy, accessibility, packaging and deployment overview. Detailed subtopics: REST API consumption, asynchronous calls, permissions, camera/location/notification/device-	15 Hours

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	service awareness and privacy.	
Module 5	Integrated Application Development Integration of course concepts through a small application; coding standards; testing and debugging; version/documentation practices; security and accessibility considerations where relevant; demonstration and reflective review. Detailed subtopics: Testing/debugging, performance/battery considerations, security, packaging/signing, store/release awareness and final app demonstration.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Prototype three mobile screens and navigation.
- Build a CRUD/data-driven mobile app.
- Test on emulator/device and submit release checklist.

Laboratory / Practical Exercises

- UI/navigation
- local storage
- API consumption
- permissions
- testing
- final mobile mini-app.

Recommended Books

- Reto Meier, Professional Android, Wrox (or current framework-equivalent text).
- Official Android/Flutter/React Native documentation for approved stack.

MOOC / OER Reference

- SWAYAM/NPTEL mobile computing/application development offerings where available.

Video / Digital Reference

- Official platform tutorial videos plus NPTEL Mobile Computing lectures.

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BCA – SEMESTER 5

BCAOL 503 – B

Course Code	Course Title	L–T–P	Credits
BCAOL 503	B	3-0-4	5

Course Objectives

- Develop end-to-end analytics thinking.
- Integrate data preparation, statistics and visual communication.
- Build decision-oriented interpretation skills.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Frame analytical questions from business/problem contexts.
CO2	Prepare and explore structured data.
CO3	Apply descriptive and elementary predictive analytical methods.
CO4	Communicate findings using appropriate visualisations and narratives.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Analytics Process Problem framing, data sources, quality, lifecycle, ethics and reproducibility. Detailed subtopics: Analytics lifecycle, problem framing, stakeholder questions, data sources, quality, governance, ethics and reproducibility.	15 Hours
Module 2	Descriptive Analytics Data preparation, descriptive statistics, segmentation, KPI design and exploratory analysis. Detailed subtopics: Cleaning, transformation, descriptive statistics, segmentation, KPI definitions and exploratory data analysis.	15 Hours
Module 3	Predictive Foundations Correlation, regression/classification overview, evaluation and common pitfalls. Detailed subtopics: Correlation, regression/classification concepts, train-test logic, model metrics and common Unit Detailed Syllabus Content analytical pitfalls.	15 Hours
Module 4	Communication and Decision Support Dashboards, visualisation principles, storytelling, recommendations, limitations and case studies. Detailed subtopics: Dashboards, visualization principles, cohort/funnel/time-series awareness and decision-oriented storytelling.	15 Hours

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Module 5	Applied Analytics/AI Case Work End-to-end applied workflow using a suitable dataset/problem; evaluation and interpretation; limitations and error analysis; responsible use, privacy/bias considerations where relevant; communication of findings through a notebook, report or demonstration. Detailed subtopics: Integrated business/organizational case; recommendation development, uncertainty/limitations, privacy and communication to non-technical stakeholders.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Define KPIs for a case study.
- Prepare and analyse a dataset using an approved analytics tool.
- Build a dashboard/report and present evidence-based recommendations.

Laboratory / Practical Exercises

- Data cleaning
- EDA
- KPI analysis
- basic model
- dashboard/report.

Recommended Books

- Camm et al., Business Analytics, Cengage.
- Wes McKinney, Python for Data Analysis, O'Reilly.

MOOC / OER Reference

- NPTEL/SWAYAM: Data Analytics with Python / Business Analytics for Management Decision.

Video / Digital Reference

- NPTEL data analytics and visualisation lectures.

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BCA – SEMESTER 5

BCAOL 503 – C

Course Code	Course Title	L–T–P	Credits
BCAOL 503	C	3-0-4	5

Course Objectives

- Develop visual data-literacy and dashboard skills.
- Emphasise communication rather than decorative graphics.
- Expose learners to contemporary visualisation tools.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Select appropriate visual encodings for different data types.
CO2	Create clear static and interactive visualisations.
CO3	Build a basic dashboard using an approved tool.
CO4	Critique visualisations for accuracy, accessibility and ethics.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Visualisation Principles Data types, perception, encodings, chart selection, scales, colour, annotation and misleading graphics. Detailed subtopics: Data types, visual perception and pre-attentive attributes; chart-selection principles, scales, axes, colour, annotation and misleading graphics.	15 Hours
Module 2	Data Preparation for Visualisation Cleaning, aggregation, calculated fields, hierarchies and data models. Detailed subtopics: Data cleaning/aggregation for visualization; calculated fields, hierarchies, joins/relationships and simple data-model concepts.	15 Hours
Module 3	Dashboards and Interactivity Filters, parameters, drill-down, maps, KPI Unit Detailed Syllabus Content cards, layout and storytelling. Detailed subtopics: Interactive dashboards: filters, parameters, drill-down, tooltips, KPI cards, maps and layout hierarchy.	15 Hours
Module 4	Quality and Publication Accessibility, performance, sharing, governance, reproducibility and dashboard critique. Detailed subtopics: Dashboard performance, accessibility, colour-blind-safe choices, mobile layouts, sharing/publishing and governance.	15 Hours

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Module 5	Applied Analytics/AI Case Work End-to-end applied workflow using a suitable dataset/problem; evaluation and interpretation; limitations and error analysis; responsible use, privacy/bias considerations where relevant; communication of findings through a notebook, report or demonstration. Detailed subtopics: Visual storytelling, narrative sequence, audience adaptation, usability testing, peer critique and final interactive dashboard presentation.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Redesign three misleading charts.
- Create an interactive dashboard from a supplied dataset.
- Conduct a peer usability/accessibility review.

Laboratory / Practical Exercises

- Chart selection
- calculated fields
- dashboard
- filters/drill-down
- storytelling
- accessibility review.

Recommended Books

- Cole Nussbaumer Knaflic, Storytelling with Data, Wiley.
- Andy Kirk, Data Visualisation, Sage.

MOOC / OER Reference

- SWAYAM/NPTEL: Data Visualization / Data Analytics offerings; supplement with approved tool learning paths.

Video / Digital Reference

- NPTEL visualisation lectures; official Power BI/Tableau learning videos.

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BCA – SEMESTER 5

BCAOL 504 – Advanced Soft Skills & Leadership

Course Code	Course Title	L–T–P	Credits
BCAOL 504	Advanced Soft Skills & Leadership	3-0-2	4

Course Objectives

- Prepare learners for collaborative technology workplaces.
- Develop leadership, emotional intelligence and professional behaviour.
- Support internship and project readiness.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Demonstrate self-management and professional interpersonal skills.
CO2	Apply teamwork, conflict-resolution and negotiation techniques.
CO3	Use situational leadership concepts in project settings.
CO4	Reflect on professional growth through evidence and feedback.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Self and Professional Effectiveness Self-awareness, emotional intelligence, time/stress management, growth mindset. Detailed subtopics: Self-awareness, emotional intelligence, strengths/values, growth mindset, time management, resilience and stress management.	12 Hours
Module 2	Teams and Collaboration Team roles, trust, feedback, conflict, inclusion and remote teamwork. Detailed subtopics: Team roles, psychological safety, trust, active listening, feedback, collaboration tools and remote-team etiquette.	12 Hours
Module 3	Leadership and Decision Making Leadership styles, motivation, delegation, ethical decisions and situational leadership. Detailed subtopics: Conflict styles, negotiation, influence, motivation, Unit Detailed Syllabus Content delegation and situational leadership.	12 Hours
Module 4	Career Effectiveness Negotiation, networking, professional presence, interview leadership scenarios and personal development plan. Detailed subtopics: Ethical decision making, inclusion, cross-cultural leadership, stakeholder communication and meeting facilitation.	12 Hours
Module 5	Integrated Professional Communication Practice	12 Hours

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	Application through workplace scenarios, presentation/interview tasks, collaborative communication, peer feedback, digital professionalism and reflective improvement using a structured rubric. Detailed subtopics: Professional networking, personal brand, interview leadership scenarios, career planning and evidence-based personal development plan.	

Internal Assessment / Learner Engagement Exercises

- Complete a self-assessment and development plan.
- Role-play a team conflict and submit reflection.
- Lead a short virtual team task and obtain peer feedback.

Laboratory / Practical Exercises

- Role plays
- virtual team exercise
- presentation

- mock interview/negotiation.

Recommended Books

- Stephen P. Robbins & Timothy Judge, Organizational Behavior, Pearson (selected chapters).
- Dale Carnegie, How to Win Friends and Influence People, Simon & Schuster (selected applications).

MOOC / OER Reference

- NPTEL/SWAYAM: Developing Soft Skills and Personality / Leadership and Team Effectiveness.

Video / Digital Reference

- NPTEL soft skills, leadership and teamwork videos.

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BCA – SEMESTER 5

BCAOL 505 – Internship-II*

Course Code	Course Title	L–T–P	Credits
BCAOL 505	Internship-II*	0-0-4	2

Course Objectives

- Provide structured exposure to professional practice.
- Connect curriculum with authentic workplace problems.
- Develop employability evidence through portfolio and reflection.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Apply academic learning in a supervised work/practice setting.
CO2	Maintain professional records of assigned tasks and learning.
CO3	Demonstrate workplace communication, ethics and reliability.
CO4	Reflect on skills gained and areas for improvement.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Preparation Organisation/domain orientation, learning agreement, ethics, safety, confidentiality and objectives. Detailed subtopics: Learning agreement; organization/domain orientation; internship objectives; confidentiality, ethics, safety and expected professional conduct.	6 Hours
Module 2	Workplace Practice Assigned tasks, weekly log, mentor interaction, professional communication and problem solving. Detailed subtopics: Assigned tasks, weekly activity log, mentor meetings, time/task management and workplace communication.	6 Hours
Module 3	Evidence and Reflection Portfolio, artefacts where permitted, challenges, skills mapping and supervisor Unit Detailed Syllabus Content feedback. Detailed subtopics: Application of technical skills, problem solving, documentation and collaboration; evidence capture subject to organizational permission.	6 Hours
Module 4	Report and Viva Structured internship report, presentation, reflective account and viva. Detailed subtopics: Midpoint review,	6 Hours

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	supervisor feedback, skills gap identification and improvement actions.	
Module 5	Integration, Documentation and Viva Consolidation of the approved work; validation against objectives; documentation and evidence portfolio; ethics and academic integrity; presentation/demonstration; reflective learning; viva voce and future-work plan. Detailed subtopics: Final report, permitted work samples/portfolio, supervisor evaluation, presentation, reflective competence mapping and viva.	6 Hours

Internal Assessment / Learner Engagement Exercises

- Approved internship learning agreement.
- Weekly logbook + midpoint mentor review.
- Final report, supervisor feedback and viva.

Laboratory / Practical Exercises

- Workplace/approved virtual internship tasks

- logbook
- supervisor review
- final presentation/viva.

Recommended Books

- University/CDOE Internship Handbook (to be approved).
- Relevant professional/technical references selected by supervisor.

MOOC / OER Reference

- Optional domain-specific SWAYAM/NPTEL course may support internship learning; not a substitute for internship.

Video / Digital Reference

- CDOE internship orientation and report-writing videos.

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BCA – SEMESTER 5

BCAOL 506 – Digital Marketing

Course Code	Course Title	L–T–P	Credits
BCAOL 506	Digital Marketing	0-0-6	3

Course Objectives

- Develop practical digital-promotion skills.
- Connect analytics, content and platform strategy.
- Enable learners to plan and measure small campaigns.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain major digital marketing channels and customer journeys.
CO2	Create basic content, search, social and e- mail campaign plans.
CO3	Use web/social metrics to evaluate performance.
CO4	Apply ethical, privacy-aware digital marketing practice.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Digital Marketing Foundations Customer journey, personas, value proposition, owned/earned/paid media, campaign objectives. Detailed subtopics: Digital strategy, customer journey/funnel, personas, value proposition and owned/earned/paid media.	9 Hours
Module 2	Content, Search and Social Content strategy, SEO basics, search ads concepts, social platforms, community management. Detailed subtopics: Content strategy, editorial calendar, keyword intent, on-page SEO, search ads concepts and campaign structure.	9 Hours
Module 3	E-mail, Web and Conversion Landing pages, e-mail campaigns, funnels, conversion concepts, A/B testing. Detailed subtopics: Social media objectives, content formats, community Unit Detailed Syllabus Content management, influencer awareness and brand safety.	9 Hours
Module 4	Analytics, Ethics and Planning KPIs, attribution overview, web/social analytics, privacy/consent, campaign plan and reporting. Detailed subtopics: Email segmentation/automation, landing pages, conversion rate optimization, A/B testing and marketing-funnel metrics.	9 Hours

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Module 5	Applied Business/Entrepreneurial Case Integration through a small venture/campaign case; customer or stakeholder analysis; planning and metrics; ethical and legal considerations; concise pitch/report and reflection on assumptions and evidence. Detailed subtopics: Web/social analytics, UTM tracking, KPI design, attribution overview, privacy/consent, ethical targeting and integrated campaign plan.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Create a persona and customer journey.
- Perform a basic SEO/content audit of a public webpage.
- Build a campaign plan with KPIs and mock dashboard.

Laboratory / Practical Exercises

- Keyword/content exercise
- campaign mock-up

- e-mail/landing-page prototype
- analytics interpretation.

Recommended Books

- Dave Chaffey & Fiona Ellis-Chadwick, Digital Marketing, Pearson.
- Philip Kotler et al., Marketing 5.0, Wiley (selected chapters).

MOOC / OER Reference

- NPTEL/SWAYAM: Digital Marketing / Marketing Management offerings.

Video / Digital Reference

- NPTEL marketing/digital marketing lectures; platform learning-centre videos.

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BCA – SEMESTER 6

BCAOL 601 – Software Project Management

Course Code	Course Title	L–T–P	Credits
BCAOL 601	Software Project Management	3-0-4	5

Course Objectives

- Develop management competence for software projects.
- Integrate software engineering with planning and teamwork.
- Prepare learners for major project execution.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Plan software scope, schedule, resources and risks.
CO2	Use estimation and project-tracking techniques.
CO3	Apply agile and traditional project- management concepts.
CO4	Prepare project artefacts and communicate project status.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Project Foundations Project lifecycle, stakeholders, scope, WBS, feasibility, governance and ethics. Detailed subtopics: Project characteristics, lifecycle, stakeholders, business case, scope statement, WBS and governance.	15 Hours
Module 2	Estimation and Scheduling Size/effort concepts, estimation methods, network planning, Gantt, milestones and resource allocation. Detailed subtopics: Size/effort estimation concepts; function-point/LOC awareness; scheduling, dependencies, critical path, Gantt and resource allocation.	15 Hours
Module 3	Risk, Quality and Configuration Risk register, quality planning, reviews/testing relationship, configuration/change management. Unit Detailed Syllabus Content Detailed subtopics: Risk identification/analysis, risk register, quality planning, reviews, configuration/change management and project documentation.	15 Hours
Module 4	Agile and Project Control Scrum/Kanban concepts, backlog, sprint planning, metrics, status reporting, closure and lessons learned. Detailed subtopics: Agile values; Scrum roles/events/artifacts, backlog, user stories, estimation, Kanban/WIP, hybrid delivery and distributed-team practices.	15 Hours

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Module 5	Integration, Documentation and Viva Consolidation of the approved work; validation against objectives; documentation and evidence portfolio; ethics and academic integrity; presentation/demonstration; reflective learning; viva voce and future-work plan. Detailed subtopics: Monitoring and control, earned-value awareness, status reporting, stakeholder communication, closure, retrospective and lessons learned.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Create WBS and schedule for a small software project.
- Prepare a risk register and mitigation plan.
- Run a simulated sprint and submit status report/retrospective.

Laboratory / Practical Exercises

- Project plan

- estimation/schedule
- risk register
- agile board
- progress report.

Recommended Books

- Bob Hughes et al., Software Project Management, McGraw-Hill.
- Roger Pressman & Bruce Maxim, Software Engineering, McGraw-Hill.

MOOC / OER Reference

- NPTEL/SWAYAM: Software Project Management / Software Engineering.

Video / Digital Reference

- NPTEL Software Engineering and project-management lectures.

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BCA – SEMESTER 6

BCAOL 602 – Digital Forensics

Course Code	Course Title	L–T–P	Credits
BCAOL 602	Digital Forensics	3-0-0	3

Course Objectives

- Introduce legally and ethically sound digital-forensics concepts.
- Develop evidence-handling and analytical awareness.
- Connect cybersecurity with incident investigation.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain principles and process of digital forensics.
CO2	Identify common sources of digital evidence.
CO3	Describe acquisition, preservation and analysis concepts.
CO4	Prepare a basic forensic report while maintaining ethics and chain of custody.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Forensic Foundations Digital evidence, forensic process, roles, legal/ethical principles, chain of custody. Detailed subtopics: Digital evidence, forensic readiness, investigation lifecycle, legal/ethical boundaries, chain of custody and documentation.	9 Hours
Module 2	Acquisition and Preservation Volatile/non-volatile evidence, imaging concepts, hashing, write protection, documentation. Detailed subtopics: Volatile/non-volatile acquisition concepts; imaging, hashing, write protection, integrity verification and evidence storage.	9 Hours
Module 3	Artefacts and Analysis File systems overview, deleted files concepts, logs, browser/email/mobile/network artefacts overview. Unit Detailed Syllabus Content Detailed subtopics: File-system concepts, deleted-file awareness, metadata, OS logs, browser/email/application artefacts and timeline fundamentals.	9 Hours
Module 4	Reporting and Incident Context Timeline concepts, validation, limitations, report structure, expert communication and case studies. Detailed subtopics: Network packet/log artefacts, mobile/cloud evidence	9 Hours

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	awareness, time synchronization and attribution limitations.	
Module 5	Applied Case Studies and Professional Practice Integrated case studies connecting architecture, operations, risk, security, legal/ethical responsibilities and current practice; guided troubleshooting/analysis where applicable; preparation of a concise technical or compliance report. Detailed subtopics: Correlation, validation, anti-forensics awareness, reporting structure, limitations, expert communication and simulated case analysis.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Create a chain-of-custody form for a simulated case.
- Interpret supplied hashes/logs/metadata from a sanitised dataset.
- Write a short forensic findings report from provided evidence.

Recommended Books

- Bill Nelson et al., Guide to Computer Forensics and Investigations, Cengage.
- Eoghan Casey, Digital Evidence and Computer Crime, Academic Press.

MOOC / OER Reference

- NPTEL/SWAYAM cyber security / digital forensics offerings where available.

Video / Digital Reference

- NPTEL cyber-security lectures; approved forensic-tool demonstration videos.





BCA – SEMESTER 6

BCAOL 603 – A

Course Code	Course Title	L–T–P	Credits
BCAOL 603	A	3-0-4	5

Course Objectives

- Develop legal awareness for computing professionals.
- Connect cyber ethics/security with statutory responsibilities.
- Promote compliant handling of data, content and digital evidence.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain the legal framework relevant to digital transactions and cyber conduct in India.
CO2	Identify common cyber offences and legal issues in electronic evidence.
CO3	Discuss privacy, data protection, IP and intermediary responsibilities at an introductory level.
CO4	Analyse cyber-law cases using structured legal reasoning.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Foundations of Cyber Law Cyberspace, jurisdiction, electronic records/signatures, e-contract concepts and Indian legal framework. Detailed subtopics: Cyberspace, jurisdiction and Indian cyber-law framework; electronic records, electronic signatures and e-contract concepts.	15 Hours
Module 2	Cyber Offences and Investigation Common offences, unauthorised access/fraud/identity misuse concepts, complaint and investigation process overview. Detailed subtopics: Cyber offences and incident categories; unauthorized access, identity misuse, fraud, harassment and Unit Detailed Syllabus Content complaint/investigation process overview.	15 Hours
Module 3	Data, Privacy and Intellectual Property Privacy/data-protection principles, consent, confidentiality, copyright, trademarks, software/IP issues. Detailed subtopics: Privacy and data-protection principles, consent, confidentiality, breach responsibilities and organizational compliance awareness.	15 Hours
Module 4	Platforms and Evidence Intermediary/platform responsibility overview, electronic evidence concepts,	15 Hours

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	compliance case studies and professional responsibilities. Detailed subtopics: Copyright, software licensing, trademarks/domain names and intellectual-property issues in digital environments.	
Module 5	Applied Case Studies and Professional Practice Integrated case studies connecting architecture, operations, risk, security, legal/ethical responsibilities and current practice; guided troubleshooting/analysis where applicable; preparation of a concise technical or compliance report. Detailed subtopics: Intermediary/platform responsibility, electronic evidence, professional liability and structured case-law analysis using issue-rule-application-conclusion.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Analyse a hypothetical cyber-incident fact pattern.
- Prepare a compliance checklist for a small website/app.
- Summarise a reported cyber-law judgment in issue-rule-analysis-conclusion format.

Laboratory / Practical Exercises

- Case analysis
- compliance checklist
- mock incident documentation
- no offensive security activity.

Recommended Books

- Karnika Seth, Computers, Internet and New Technology Laws, LexisNexis.
- Relevant current bare acts/rules and official government guidance as approved by the University.

MOOC / OER Reference

- SWAYAM courses on Cyber Law / Cyber Security and Law; verify current semester offering.

Video / Digital Reference

- CEC/SWAYAM cyber-law lectures; official government cyber-awareness videos.

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BCA – SEMESTER 6

BCAOL 603 – B

Course Code	Course Title	L–T–P	Credits
BCAOL 603	B	3-0-4	5

Course Objectives

- Develop foundations of digital image processing.
- Connect mathematical concepts with visual computing.
- Prepare learners for computer vision and AI applications.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Explain digital image representation and basic transformations.
CO2	Apply spatial and frequency-domain enhancement concepts.
CO3	Perform elementary segmentation and morphological operations.
CO4	Implement a small image-processing workflow using Python or an approved tool.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Image Fundamentals Sampling/quantisation, pixels, colour models, histograms and image file concepts. Detailed subtopics: Digital image representation, pixels, resolution, sampling/quantization, image formats and colour models.	15 Hours
Module 2	Enhancement and Filtering Point operations, histogram methods, spatial filters, noise reduction, sharpening; frequency-domain overview. Detailed subtopics: Intensity transformations, histograms, smoothing/noise reduction, sharpening and spatial convolution.	15 Hours
Module 3	Segmentation and Morphology Thresholding, edge detection, region Unit Detailed Syllabus Content concepts, erosion/dilation/opening/closing. Detailed subtopics: Frequency-domain concepts, Fourier transform awareness, filtering and restoration overview.	15 Hours
Module 4	Features and Applications Basic feature extraction, compression overview, image quality, introductory computer vision applications and ethics. Detailed subtopics: Thresholding, edge detection, region segmentation,	15 Hours

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	morphology, connected components and contour analysis.	
Module 5	Applied Analytics/AI Case Work End-to-end applied workflow using a suitable dataset/problem; evaluation and interpretation; limitations and error analysis; responsible use, privacy/bias considerations where relevant; communication of findings through a notebook, report or demonstration. Detailed subtopics: Feature extraction, compression overview, quality assessment, introductory computer-vision applications and ethical/privacy considerations.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Analyse histograms of contrasting images.
- Implement smoothing, sharpening and edge detection.
- Build a mini workflow for segmentation or feature extraction.

Laboratory / Practical Exercises

- Image I/O
- histogram
- filtering
- edge detection
- morphology
- segmentation
- mini application.

Recommended Books

- Rafael C. Gonzalez & Richard Woods, Digital Image Processing, Pearson.
- S. Sridhar, Digital Image Processing, Oxford.

MOOC / OER Reference

- NPTEL/SWAYAM: Digital Image Processing.

Video / Digital Reference

- NPTEL Digital Image Processing lecture series.

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BCA – SEMESTER 6

BCAOL 604 – Professional Communication Skills-II

Course Code	Course Title	L–T–P	Credits
BCAOL 604	Professional Communication Skills-II	3-0-0	3

Course Objectives

- Prepare learners for final projects, internships and employment.
- Strengthen technical documentation and stakeholder communication.
- Develop persuasive and cross-cultural communication.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Produce professional technical and project documentation.
CO2	Communicate persuasively with technical and non-technical audiences.
CO3	Handle interviews, meetings and presentations confidently.
CO4	Demonstrate ethical and inclusive communication in distributed teams.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Technical Documentation Requirements summaries, user guides, executive summaries, project reports and documentation standards. Detailed subtopics: Advanced technical documentation: SRS summaries, design notes, user guides, project status reports and executive summaries.	9 Hours
Module 2	Persuasive Communication Proposals, recommendations, evidence, visual communication and stakeholder adaptation. Detailed subtopics: Persuasive proposals/recommendations; evidence selection, argument structure, stakeholder adaptation and visual communication.	9 Hours
Module 3	Professional Interaction Interviews, meetings, negotiation, conflict, Unit Detailed Syllabus Content cross-cultural and inclusive communication. Detailed subtopics: Meetings, facilitation, negotiation, conflict resolution, cross-cultural and inclusive communication in distributed teams.	9 Hours
Module 4	Digital Professional Presence Portfolio, LinkedIn/profile principles, presentation/viva, remote-work etiquette and communication ethics. Detailed subtopics: Technical/HR interviews, portfolio and professional	9 Hours

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	profile; presentation/viva strategy and difficult-question handling.	
Module 5	Integrated Professional Communication Practice Application through workplace scenarios, presentation/interview tasks, collaborative communication, peer feedback, digital professionalism and reflective improvement using a structured rubric. Detailed subtopics: Capstone communication portfolio: technical-to-nontechnical translation, project presentation, documentation quality, peer feedback and reflective development.	9 Hours

Internal Assessment / Learner Engagement Exercises

- Rewrite a technical explanation for a non-technical audience.
- Prepare an executive summary and project status update.
- Mock technical interview + final project presentation.

Recommended Books

- Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford.
- Gerald J. Alred et al., Handbook of Technical Writing, Bedford/St. Martin's.

MOOC / OER Reference

- NPTEL/SWAYAM: Technical Communication / Soft Skills / Employment Communication.

Video / Digital Reference

- NPTEL communication and soft-skills videos.

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BCA – SEMESTER 6

BCAOL 605 – Making of Modern India

Course Code	Course Title	L–T–P	Credits
BCAOL 605	Making of Modern India	2-0-0	2

Course Objectives

- Provide multidisciplinary historical understanding.
- Develop critical reading and evidence-based interpretation.
- Connect technology learners with social and national context.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Outline major social, political and economic developments in modern India.
CO2	Explain selected reform, nationalist and institution-building movements.
CO3	Interpret historical developments using multiple perspectives and evidence.
CO4	Relate historical change to contemporary citizenship and development.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Colonial Transformation Expansion of colonial rule, economy, society, education and early resistance. Detailed subtopics: Expansion of colonial rule, administrative/economic transformation, land systems and early resistance.	6 Hours
Module 2	Reform and Nationalism Social/religious reform, emergence of nationalism, major movements and diverse participation. Detailed subtopics: Socio-religious reform movements, education/public sphere, emergence of nationalism and early political organizations.	6 Hours
Module 3	Independence and Partition Mass movements, constitutional developments, independence and partition. Detailed subtopics: Swadeshi, Gandhian Unit Detailed Syllabus Content mass movements, revolutionary/other strands, workers/peasants/women and diverse regional participation.	6 Hours
Module 4	Nation Building Constitutional democracy, planned development, social change, science/technology and selected post-independence transformations.	6 Hours

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	Detailed subtopics: Constitutional developments, World War context, independence, partition and immediate challenges.	
Module 5	Contemporary Issues and Case Analysis Application of course concepts to contemporary cases; evidence-based interpretation; ethical/civic dimensions; structured discussion and reflective writing connecting the subject with professional and digital life. Detailed subtopics: Post-independence nation building: Constitution, democracy, planning, social reform, science/technology, economic change and selected contemporary continuities.	6 Hours

Internal Assessment / Learner Engagement Exercises

- Create a timeline with evidence notes.
- Compare two historical interpretations of a selected event.
- Write a short source-based reflection on science/technology in nation building.

Recommended Books

- Bipan Chandra et al., India's Struggle for Independence, Penguin.
- Sekhar Bandyopadhyay, From Plassey to Partition and After, Orient BlackSwan.

MOOC / OER Reference

- SWAYAM/CEC courses on Modern Indian History / India's Freedom Struggle.

Video / Digital Reference

- CEC/SWAYAM Modern India lecture series.

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BCA – SEMESTER 6

BCAOL 606 – Major Project – Phase I

Course Code	Course Title	L–T–P	Credits
BCAOL 606	Major Project – Phase I	Refer to source	5

Course Objectives

- Provide a capstone integration experience.
- Develop research, design, documentation and project-management skills.
- Create a strong foundation for a complete software/data/system solution.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Formulate a substantial computing problem and project objectives.
CO2	Conduct a focused literature/technology review.
CO3	Prepare requirements, architecture/design and implementation plan.
CO4	Develop and demonstrate a validated Phase-I prototype.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Problem and Review Problem statement, stakeholder need, literature/technology review, gap, objectives and scope. Detailed subtopics: Problem statement, stakeholder/research context, literature/technology review, gap identification, objectives and measurable deliverables.	15 Hours
Module 2	Requirements and Design SRS/data requirements, architecture, models, UI/data design, ethics/security considerations. Detailed subtopics: SRS/research design, architecture, data model, interface design, methodology, security/privacy/ethics and test/evaluation plan.	15 Hours
Module 3	Planning and Prototype Milestones, risks, tools, repository, Unit Detailed Syllabus Content prototype/core module implementation and test strategy. Detailed subtopics: Milestone schedule, risk register, version-control/repository plan, prototype strategy and supervisor review records.	15 Hours
Module 4	Phase-I Review Prototype validation, interim report, presentation, viva and Phase-II roadmap where applicable. Detailed subtopics: Core	15 Hours

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	implementation/prototype or data/research pipeline, unit/integration tests, experiment logs and evidence of progress.	
Module 5	Integration, Documentation and Viva Consolidation of the approved work; validation against objectives; documentation and evidence portfolio; ethics and academic integrity; presentation/demonstration; reflective learning; viva voce and future-work plan. Detailed subtopics: Phase-I report, architecture/design artefacts, prototype demonstration, presentation, viva and clear Phase-II/final-completion roadmap.	15 Hours

Internal Assessment / Learner Engagement Exercises

- Proposal + literature/technology review.
- SRS/design review with supervisor.
- Phase-I prototype, interim report, repository evidence, presentation and viva.

Laboratory / Practical Exercises

- Supervised capstone: proposal, SRS/design, prototype, testing evidence, review presentation and viva.

Recommended Books

- Roger Pressman & Bruce Maxim, Software Engineering: A Practitioner's Approach.
- University/CDOE Major Project Handbook (to be approved).

MOOC / OER Reference

- A domain-relevant SWAYAM/NPTEL MOOC may be prescribed by the supervisor as supplementary learning.

Video / Digital Reference

- CDOE project orientation, research-method and documentation videos; domain-specific NPTEL lectures.

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BCA – SEMESTER 6

BCAOL 607 – Internship / Training-I*

Course Code	Course Title	L–T–P	Credits
BCAOL 607	Internship / Training-I*	0-0-4	2

Course Objectives

- Provide structured industry/practice exposure.
- Strengthen workplace readiness before graduation.
- Create evidence of applied competence and professional behaviour.

Course Outcomes (COs)

CO	Course Outcome (On completion, students will be able to)
CO1	Apply computing skills in a supervised professional/training context.
CO2	Demonstrate punctuality, ethics, communication and task ownership.
CO3	Maintain evidence of learning and problem solving.
CO4	Present a reflective account of professional development.

Course Content

Module	Detailed syllabus content	Hours
Module 1	Orientation Learning agreement, organisation/domain, objectives, confidentiality, professional conduct. Detailed subtopics: Training/internship learning agreement, organization/domain orientation, objectives, ethics, confidentiality and professional expectations.	6 Hours
Module 2	Guided Practice Assigned technical/professional tasks, mentor meetings, weekly log and problem solving. Detailed subtopics: Assigned technical/professional tasks, weekly log, mentor interaction, communication and time/task management.	6 Hours
Module 3	Competency Evidence Portfolio, permitted artefacts, skills Unit Detailed Syllabus Content mapping, supervisor feedback and improvement. Detailed subtopics: Application of programming/data/network/cloud/security or other relevant skills; documentation and evidence permitted by host organization.	6 Hours
Module 4	Closure Report, presentation, reflection, supervisor assessment and viva. Detailed subtopics: Midpoint supervisor review, competency mapping,	6 Hours

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	problem/challenge reflection and corrective development plan.	
Module 5	Integration, Documentation and Viva Consolidation of the approved work; validation against objectives; documentation and evidence portfolio; ethics and academic integrity; presentation/demonstration; reflective learning; viva voce and future-work plan. Detailed subtopics: Final report, supervisor assessment, allowed portfolio artefacts, presentation, reflective summary and viva/authentication.	6 Hours

Internal Assessment / Learner Engagement Exercises

- Learning agreement and orientation quiz.
- Weekly log + midpoint review.
- Final report, supervisor evaluation, presentation and viva.

Laboratory / Practical Exercises

- Supervised internship/training with documented hours/tasks, logbook, mentor review and viva.

Recommended Books

- University/CDOE Internship Handbook (to be approved).
- Domain references selected jointly by learner and supervisor.

MOOC / OER Reference

- Domain-specific SWAYAM/NPTEL course may supplement, but not replace, supervised internship/training.

Video / Digital Reference

- CDOE internship orientation, workplace ethics and report-writing videos.

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