Examination Manual

1. The University's examination manual upholds the principles of fairness, integrity, and adherence to the Choice Based Credit System (CBCS) as mandated by the University Grants Commission (UGC). To ensure a comprehensive and balanced evaluation of student competencies, the University employs various examination methods, including MCQ-based examinations, open-book examinations, choice-based assessments, assignments, presentations, practical-based evaluations, and viva-voce examinations.
2. Each course conducts two types of assessments: **Formative Assessments** and **Summative Assessments**. Formative assessments use diverse methods to evaluate students' comprehension and learning gaps and monitor academic progress during a lesson, unit, or course. Summative assessments are conducted at the end of an instructional unit. These assessments evaluate student learning by comparing performance to a standard or benchmark.
3. **Summative assessments:** All written summative assessments of the University shall have three areas of assessment: **foundational knowledge of the subject**, **conceptual understanding of the subject**, and **critical thinkin**g. The weightage of each component varies depending on the course level.
    - Questions assessing **foundational knowledge** should probe the basic understanding, such as defining an idea or applying a formula to solve a problem. These questions must be straightforward, and each shall be mapped to a single course learning outcome.
    - Questions assessing **conceptual understanding** should explore the depth of the topic through problems and applications, requiring students to grasp the concepts thoroughly. Each question in the category here shall be mapped to multiple course learning outcomes.
    - Questions assessing **critical thinking** should explore the in-depth understanding of the topic through open-ended questions, requiring students to demonstrate exploratory thinking abilities. Each of these questions here shall be mapped to multiple course learning outcomes.
    - In summative assessments, up to 10% of the questions may extend beyond the prescribed syllabus while remaining within the broad scope of the subject.
4. **Formative assessments**: Each course must include at least three distinct types of formative assessments—such as quizzes, assignments, presentations, collaborative projects, or hands-on problem-solving tasks—to ensure a diverse evaluation framework. Formative assessments should have three or more separate components to avoid reliance on a single-class test. At least one formative assessment must be conducted every five weeks to promote continuous learning and timely feedback.
5. The weightage for formative and summative assessments in total marks calculation in the semester is based on the course level as outlined below:
    - **400 level**: Sixty percent (60%) of the assessment comprises formative assessments, while forty percent (40%) constitutes summative assessments. The summative assessment includes a written examination with a maximum duration of three hours. The formative assessments can include up to 60% collaborative components.

- **500 Level**: The courses at 500 levels adopt a more flexible assessment approach, primarily focusing on presentations, projects, and research output. Seventy percent (70%) of the assessment is formative, and thirty percent (30%) is summative. The formative assessments can include up to 60% collaborative components.
    i. **Courses with Lecture Component:** Courses have a written examination as the summative assessment.
    ii. **Courses with only Project/Research Component:** For 500-level courses that involve thesis/Capstone project with research-only assessments, summative assessments are conducted by a committee appointed by the Controller of Examinations (CoE) in consultation with the School Chair. Committee members must possess expertise in the student's research area to ensure a thorough and knowledgeable assessment process. A final written examination is optional for these courses.

6. All courses use a **criterion-referenced grading system** for summative and formative assessments. This system focuses on students meeting predefined learning objectives rather than comparing their performance with peers. Final letter grades are based on the student's total formative and summative marks out of 100 in the course.
7. Each course should use rubrics to assess student work. Rubrics are practical tools that provide a transparent and fair framework for evaluating and grading assignments, projects, and examinations. They communicate expectations to students and help instructors' grades consistently.

   A rubric has three main parts:
   - **Criteria/Performance Indicators:** These areas are assessed, such as understanding, application, analysis, or creativity.
   - **Descriptors:** These describe what is expected for each level of performance within each criterion, detailing what constitutes excellent, good, fair, or poor work.
   - **Scale/Levels of Performance:** This is the rating system that shows how well a student has met each criterion, often using numerical scores or qualitative labels such as Excellent, Good, Fair, and Poor.

   Instructors must clearly define rubrics and share them with students at the start of the course. This transparency ensures that students understand how they are evaluated and what is required to achieve each grade level. Using rubrics ensures that grading is fair, objective, and aligned with the course goals, improving the learning experience for everyone.
8. To ensure transparency and fairness, instructors must inform students about all assessment methods, grading criteria, and detailed rubrics at the beginning of each course. This includes setting clear performance standards that align with the course learning outcomes and providing rubrics that outline the expectations for each grade level. This allows students to understand how they are evaluated and what they must do to achieve each grade. Grading practices must be consistent across all courses to maintain equity.
9. Instructors must provide constructive feedback on formative assessments within two weeks of submission. This feedback should highlight student strengths, address improvement areas, and guide students' learning process. Communication should be clear and effective, utilizing appropriate channels such as the Learning Management System (LMS). Timely and meaningful feedback ensures that students receive the necessary support to enhance their academic performance and achieve the course learning outcomes.

10. To maintain consistent grading standards across all courses, faculty may add up to 20 marks out of 100, when necessary, to align with the University's uniform grade boundaries given below. Under no circumstances should marks be reduced; a student's final grade must not be lower than their grade from the raw score. Adjustments must be applied uniformly and reasonably to all students within the course. Faculty must provide the reasons for the adjustment and the method used. To ensure transparency, all adjustments must be reported to the School Pass Board for oversight and record-keeping.
11. The mapping between the criterion-referenced grading to the grade point and grade assigned is shown below:

Letter Grade	Grade Point	Performance Description	Grade boundary %
O	10	**Outstanding**: Exceptional mastery; exceeds expectations	**90 or above**
A+	9	**Excellent**: Strong attainment; exceeds in most areas.	**[80, 90)**
A	8	**Very Good**: Solid understanding; meets all key outcomes.	**[70, 80)**
B+	7	**Good**: Competent performance; meets most outcomes.	**[60, 70)**
B	6	**Above Average**: Adequate understanding; improvement needed.	**[50, 60)**
C	5	**Average**: Meets minimum criteria; significant improvement required	**[45, 50)**
P	4	**Pass:** Marginal achievement; minimal outcomes met.	**[40, 45)**
F	0	**Fail**: Does not meet minimum outcomes.	**Below 40**
Ab	0	**Absent**: Did not participate in the summative assessment.	

12. To pass a course, a student must achieve a minimum grade point of 4 (corresponding to a 'P' grade) and secure at least 40% in the summative assessment component. The minimum passing grade for a capstone project is a `C'.
13. The University strictly prohibits plagiarism and academic dishonesty in all assignments, project reports, term papers, and other coursework. Academic dishonesty includes copying, paraphrasing without proper acknowledgment, self-plagiarism, and collusion. Students must ensure that all submitted work is original and properly cited. Violations may result in penalties ranging from warnings to expulsion, as determined by the Board of Examination after a fair and thorough investigation.
14. The University has zero tolerance for exam malpractice, such as cheating, carrying unauthorized materials, impersonation, or unauthorized communication during exams. Students must strictly follow the exam rules provided by the University and invigilators. In the event a student is found guilty of exam malpractice, the following disciplinary actions may be imposed:
    - Immediate removal from the exam hall
    - Cancellation of exam results
    - Academic probation or suspension

- Permanent expulsion from the University

All exam malpractice incidents are reviewed by the Board of Examination, which conducts a fair and thorough investigation. Students accused of malpractice have the right to present their side before making a final decision.

15. Students are required to settle all outstanding dues to the University before participating in the assessment of the summative assessment component. Hall tickets for examinations are issued only after all dues have been cleared. Ensuring that all financial obligations are met is mandatory for eligibility to sit for the final examinations.
16. In courses with lecture components, a minimum of 75% attendance for the students/research scholars is required to be eligible to sit in the final summative examination. Female students require a minimum of 73% attendance for summative evaluations.
17. The maximum condonation for the shortage of attendance shall be 10 days a semester. Condonation can be allowed a maximum of 2 times during the entire program, and the total condonation shall not exceed 20 days. Condonation shall be sanctioned by the Dean Academics in writing, on written requests from the students, and on remittance of a fee of Rs. 2000/- on each occasion.
18. Those who are not eligible for registration for an Examination due to the shortage of attendance shall be required to repeat the semester along with the next batch after obtaining readmission. The readmission fee is Rs 5000 in addition to the semester fee.
19. After grading summative assessments, instructors must provide students with a **two-working-day window** during which they can visit and review their graded answer sheets with the instructor. Following this review period, instructors must submit the final grades to the School Office **within 14 days** of the last examination date.
20. Students may first discuss any concerns regarding grades or assessments directly with their course instructor. If the issue remains unresolved, students may submit a formal written appeal to the School Chair within two weeks of the decision, including supporting evidence. The appeal is evaluated by a Review Panel consisting of the School Chair, an external academic member, and a faculty member not involved in the original decision. The Review Panel conducts a thorough and impartial assessment of the appeal and provides a final, binding decision in writing.
21. The University conducts regular course evaluations to gather course and instructor feedback. This feedback is exclusively used to enhance teaching and learning processes and is not utilized for other purposes, such as staff promotions. All feedback is collected anonymously to ensure honesty and candid responses, fostering a transparent and constructive assessment environment.
22. The cumulative grade point averages (CGPA) are calculated by weighing grade points by the corresponding credit numbers. These grades count toward the GP using the same formula, which is weighed by the credit number assigned. The Semester Grade Point Average (SGPA) and CGPA are calculated using the standard formula.
23. The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits in all the courses undergone by a student, i.e.,

    $$SGPA\ (Si) = \sum(Ci \times Gi) / \sum Ci$$

    where Ci is the number of credits of the i^{th} course, and Gi is the grade point scored by the student in the i^{th} course.

24. The CGPA is also calculated in the same manner, taking into account all the courses a student has undertaken over all the semesters of a program, i.e.,

    $$CGPA = \sum(Ci \times Si) / \sum Ci$$

    where Si is the SGPA for the i^{th} semester, and Ci is the total number of credits.

25. In case of continued class disruptions due to the pandemic or other factors, the University may conduct the practical examinations and Viva-Voice Examinations through any online meeting app. In the case of intermediate semesters, the practical examinations may be performed during the ensuing semesters.

26. A challenge examination is a University examination that allows a student to demonstrate their proficiency in a particular course, and successful completion of the examination allows a student to avoid enrolling in a regular course (core and elective courses).

    - Examinations vary depending on the type of course being challenged. Students are limited to only one challenge examination attempt per course. If a student fails an examination, they must enroll in that course as a regular student. The CoE conducts all challenge examinations. The examination registration form is given in Appendix J. A student can register for up to two challenge exams in a semester.
    - Every School should submit a list of courses eligible for the challenge examination to the CoE at least one month before the commencement of every academic year. At least three weeks before the commencement of a semester, a notice inviting registrations for challenge examinations is issued. Students wishing to take a challenge examination for a course should apply to the School Chair in the prescribed format. The School may conduct a Prior Learning Assessment before permitting a student to register for a challenge exam. Soon after registration closes, the CoE announces an examination schedule.
    - Each School is solely responsible for designating which courses may be challenged by examinations. Once announced and designed, repeated changes to the status are discouraged. Schools do not provide formal preparation for written and lab examinations to students appearing for the challenge examinations. Additionally, offering challenge examinations for courses with formative assessments, in which student participation is integral to the learning experience, is discouraged. However, an alternative assessment mechanism must be specified if a school offers such a course for challenge examination.
    - The challenge examination may only be attempted once per course. A challenge Examination may not be attempted for a course in which the student is currently enrolled (offered by the University or Swayam courses approved by the School as equivalent to courses offered by the University/School) or has previously taken (earned a grade, failed, withdrawn, or audited). Students are not permitted to enroll in a regular course (core or elective) for which they intend to enroll in the Challenge Examination.
    - **Pass criteria:** Only pass or fail, and no grades are awarded. The minimum pass mark is 70%. The Pass Board meeting is scheduled immediately after receiving marks of evaluation for all courses to finalize the results. The result is released once CoE receives the Pass Board's minutes. The official grade sheet is released only after the publication of the results of the respective semester. If a student fails a challenge examination, they are advised to enroll in the regular course with the consent of the School Chair. The student must, after that, attend regular classes and take both formative and summative assessments.
    - The students can obtain a maximum of 12 credits through challenge exams. The maximum of 12 credits obtained via challenge exams is cumulative; once reached, students can only pursue further challenge exams if credits remain within this cap.

These credits count towards the total credits for the program. All challenge examination courses are not counted for SGPA and CGPA computations. However, passing such courses enables them to be counted towards the total credits earned. The list of completed challenge courses, along with the credits earned, is included on transcripts. Once recorded on a student's transcript, challenge examination credits become a permanent part of the academic record.

- The pattern of a question paper is similar to that of the regular examination. The School assesses the question papers first, followed by the CoE. The School evaluates the answer scripts. The entire evaluation process for all courses that are challenged should be completed before the commencement of a semester or a suitable date announced by the CoE in exceptional cases. Abstention from the examination is only permitted for medical reasons. Absence from the examination without valid grounds results in a fine of Rs. 10000. The summative examinations should test the students on at least 80% of the course learning outcomes.

27. Students must indicate audit and credit courses on the course registration form, which must be duly attested by the student, the School Chair, and the Dean Academic at the beginning of each semester. Once the registration form is submitted, course selection changes are not entertained. The CGPA computation does not include credit points earned through audited courses. Additionally, a maximum of 12 credits can be audited throughout the program of study.
28. Each course level would have a different type of examination, the responsibility of which is divided between the CoE, School Chair, or Course instructor as outlined below:
    - **400-500 Level**: The CoE is in charge of the conduct of the summative examination for 400-500 Level courses.
    - **500 Level**: The School Research Committee shall be in charge of the conduct of the examination of final-year projects. The valuation shall be conducted by a committee of two faculty members and an external examiner (outside the School). The valuation shall be based on the open seminar and research output submitted by the student. The research output is expected to be of high quality and suitable for publication in a journal or leading conference.
29. The instructor sets the question paper with a detailed answer scheme. If multiple instructors are there, then this needs to be set by one of the instructors. The instructor sets up two sets. This is sent to an internal evaluator (within the School) and an external evaluator (outside the School), where they could peer evaluate and suggest modifications. The reviewers check the completeness of the syllabus and coverage. These sets come to the CoE, who, in turn, decides on which question paper set to take. The School needs to submit the list of requirements to the CoE Office along with the set of question papers.
30. The reviewers fill in the FINAL EXAM INTERNAL QA FORM provided in APPENDIX G and submit it to the School Chair, who shall approve it and forward it to the CoE, along with the question papers.
31. A good and reasonable examination paper must have various difficulty levels to accommodate students' different capabilities. Bloom’s taxonomy framework helps the faculty to set well-balanced examination papers, testing the different cognitive skills without a tilt towards a tough or easy paper perception. If the present examination questions focus more on lower cognitive skills, conscious efforts must be made to bring application or higher cognitive skills to the assessment. At the University level, an upper limit is recommended for lower-order skills (for example, no more than 40% weightage for knowledge-oriented questions). It is

important to note that, as the nature of every course is different, the weightage for different cognitive levels in the question papers can also vary from course to course.

32. An open-book examination allows students to consult approved materials under timed conditions, ideal for testing application, analysis, and evaluation skills at higher Bloom's taxonomy levels. Programs should select suitable courses for this format.

    Advantages

    - Reduces memory stress, encouraging problem-solving and higher-order thinking.
    - Reflects real-life scenarios that test comprehension and information use.

    Design tips

    - Craft questions that require application and analysis, not just locating information.
    - Provide ample time, as open-book questions are more complex. Limit to 2-3 core concepts or extend exam time as needed.

33. The CoE, School Chair, or Course Instructor must strictly adhere to the academic calendar approved for the program.
34. The students should be notified at the start of the semester about the conduct of examinations and other related activities.
35. The School Pass Board comprises the School Chair and all School faculty members. The School Pass Board coordinates the evaluations, and the results of the examinations are confidentially handed over to the CoE.
36. The School Pass Board reviews grade distributions for all courses to ensure fairness and consistency. If a grade distribution is significantly skewed—such as an unusually high number of very high or very low grades—the School Board investigates the causes by examining factors contributing to the skewed distribution, such as assessment difficulty or teaching methods. Based on this investigation, they recommend actions to determine if grade revisions are necessary or if adjustments to course content, teaching strategies, or assessment methods should be made.
37. The Exam results are announced by the CoE's office after approval by the Vice-Chancellor (or Board of Governors) in line with the academic calendar.
38. If a student fails a course and does not take a makeup examination, they must repeat the course when it is next offered. If the course is unavailable within the next 12 months, the School may arrange an alternative course to ensure the student can meet graduation requirements on time.
39. Students may be permitted to retake the summative assessment through a makeup examination under the following exceptional circumstances:
    - **Medical Emergencies or Exceptional Circumstances**: Applicable in cases such as self-hospitalization, demise of immediate family members (parents, children, or spouse), or other severe circumstances deemed acceptable by the University. A formal request must be submitted to the CoE, along with valid documentation, preferably before the scheduled examination or within one week after the examination date. Upon verification and approval, the CoE arranges a makeup examination within three weeks of the publication of the results with no grade cap applied.
    - **Failure in Summative Assessment with Strong Formative Performance**: If a student fails the summative assessment but has secured at least 70% in the formative assessments, they may apply for a makeup examination. The application must be submitted to the CoE within a week of the result announcement, and formative assessment scores are carried forward. The makeup examination is scheduled at the

next available opportunity, with a grade cap of one grade lower than what could have been achieved initially. This ensures fairness to students who pass all assessments on the first attempt.

- **Mass Failure in a Course**: If 25% or more of the students in a class fail a course, the affected students may apply for a makeup examination. The application must be submitted to the CoE within a week of the result announcement, and formative assessment scores are carried forward. The makeup examination is scheduled at the next available opportunity. The student's grade after the makeup examination is one grade lower than the grade earned based on their combined formative assessment scores and the makeup examination results. Note that individual grade scaling is separate and does not apply when a collective makeup exam is offered. This ensures fairness to students who pass all assessments on the first attempt.

This makeup examination option is available once per course; no further appeals are permitted.

Appendix

A. The performance indicators when preparing the question paper.
B. Revised Bloom’s taxonomy
C. The mapping of course levels to Bloom's taxonomy levels and sample questions for each level.
D. The project and thesis evaluations: Example rubrics for Communication (Written and Oral)
E. The project and thesis evaluations: Example rubrics for Assessment of Design Projects.
F. The project and thesis evaluations: Example rubrics for Mini Project
G. The final exam paper template.
H. End-semester Examination QA Form in Appendix H.
I. The proforma of the course report is to be submitted by the course instructor to the School Chair.
J. Challenge Examination request.
K. Example of Grade Adjustment.

APPENDIX A

Competencies and Performance Indicators (PIs)

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to solve complex engineering problems.	
Competency	Indicators
1.2 Demonstrate competence in mathematical modeling	1.2.1 Apply the knowledge of discrete structures, linear algebra, statistics, and numerical techniques to solve problems 1.2.2 Apply the concepts of probability, statistics, and queuing theory in modeling computer-based systems, data, and network protocols.
1.5 Demonstrate competence in basic sciences	1.5.1 Apply laws of natural science to an engineering problem
1.6 Demonstrate competence in engineering fundamentals	1.6.1 Apply engineering fundamentals
1.7 Demonstrate competence in specialized engineering knowledge to the program	1.7.1 Apply theory and principles of computer science and engineering to solve an engineering problem
PO 2: Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems, reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.	
Competency	Indicators
2.1 Demonstrate an ability to identify and formulate complex engineering problems	2.5.1 Evaluate problem statements and identify objectives 2.5.2 Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem 2.5.3 Identify mathematical algorithmic knowledge that applies to a given problem

2.6 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.6.1 Reframe the computer-based system into interconnected subsystems 2.6.2 Identify functionalities and computing resources. 2.6.3 Identify existing solutions/methods to solve the problem, including forming justified approximations and assumptions 2.6.4 Compare and contrast alternative solutions/methods to select the best methods 2.6.5 Compare and contrast alternative solution processes to select the best process.
2.7 Demonstrate an ability to formulate and interpret a model	2.7.1 Applying computer engineering principles to formulate system modules with required applicability and performance. 2.7.2 Identify design constraints for required performance criteria.
2.8 Demonstrate an ability to execute a solution process and analyze results	2.8.1 Applies engineering mathematics to implement the solution. 2.8.2 Analyze and interpret the results using contemporary tools. 2.8.3 Identify the limitations of the solution and sources/causes. 2.8.4 Arrive at conclusions concerning the objectives.

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, as well as cultural, societal, and environmental considerations.	
Competency	Indicators

3.5 Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.5.1 Able to define a precise problem statement with objectives and scope. 3.5.2 Able to identify and document system requirements from stakeholders. 3.5.3 Able to review state-of-the-art literature to synthesize system requirements. 3.5.4 Able to choose appropriate quality attributes as defined by ISO/IEC/IEEE standards. 3.5.5 Explore and synthesize system requirements from more significant social and professional concerns. 3.5.6 Able to develop software requirement specifications (SRS).
3.6 Demonstrate an ability to generate a diverse set of alternative design solutions	3.6.1 To explore design alternatives. 3.6.2 Able to produce various potential design solutions suited to meet functional requirements. 3.6.3 Identify suitable non-functional requirements for evaluation of alternate design solutions.
3.7 Demonstrate an ability to select optimal design schemes for further development	3.7.1 Able to systematically evaluate the degree to which several design concepts meet the criteria. 3.7.2 Consult with domain experts and stakeholders to select candidate engineering design solutions for further development
3.8 Demonstrate an ability to advance an engineering design to a defined end-state	3.8.1 Able to refine architecture design into a detailed design within the existing constraints. 3.8.2 Able to implement and integrate the modules. 3.8.3 Able to verify the functionalities and validate the design.
PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	
Competency	Indicators

4.4 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.4.1 Define a problem for purposes of investigation, its scope, and importance 4.4.2 To choose the appropriate procedure/algorithm, dataset, and test cases. 4.4.3 Able to choose appropriate hardware/software tools to experiment with.
4.5 Demonstrate an ability to design experiments to solve open-ended problems	4.5.1 Design and develop appropriate procedures/methodologies based on the study objectives
4.6 Demonstrate an ability to analyze data and reach a valid conclusion	4.6.1 Use appropriate procedures, tools, and techniques to collect and analyze data 4.6.2 Critically analyze data for trends and correlations, stating possible errors and limitations 4.6.3 Represent data (in tabular and/or graphical forms) to facilitate analysis and explanation of the data and drawing of conclusions 4.6.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.	
Competency	Indicators
5.4 Demonstrate an ability to identify/create modern engineering tools, techniques, and resources	5.4.1 Identify modern engineering tools, techniques, and resources for engineering activities 5.4.2 Create/adapt/modify/extend tools and techniques to solve engineering problems
5.5 Demonstrate an ability to select and apply discipline-specific tools, techniques, and resources	5.5.1 Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs. 5.5.2 Demonstrate proficiency in using discipline-specific

	tools
5.6 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.6.1 Discuss limitations and validate tools, techniques, and resources 5.6.2 Verify the credibility of results from tool use concerning the accuracy, limitations, and assumptions inherent in their use.
PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	
Competency	Indicators
6.3 Demonstrate an ability to describe engineering roles in a broader context, e.g., about the environment, health, safety, legal and public welfare	6.3.1 Identify and describe various engineering roles, particularly as they pertain to the protection of the public and public interest at the global, regional, and local level
6.4 Demonstrate an understanding of professional engineering regulations, legislation, and standards	6.4.1 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public
PO 7: Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and the need for sustainable development.	
Competency	Indicators
7.3 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental, and economic contexts	7.3.1 Identify risks/impacts in the life-cycle of an engineering product or activity 7.3.2 Understand the relationship between the technical, socio-economic, and environmental dimensions of sustainability

7.4 Demonstrate an ability to apply principles of sustainable design and development	7.4.1 Describe management techniques for sustainable development 7.4.2 Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
PO 8: Ethics: Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.	
Competency	Indicators
8.3 Demonstrate an ability to recognize ethical dilemmas	8.3.1 Identify situations of unethical professional conduct and propose ethical alternatives

8.4 Demonstrate an ability to apply the Code of Ethics	8.4.1 Identify tenets of the ASME professional code of ethics 8.4.2 Examine and apply moral and ethical principles to known case studies
PO 9: Individual and team work: Function effectively as an individual, member, or leader in diverse teams and multidisciplinary settings.	
Competency	Indicators
9.4 Demonstrate an ability to form a team and define a role for each member	9.4.1 Recognize a variety of working and learning preferences; appreciate the value of diversity on a team 9.4.2 Implement the norms of practice (e.g., rules, roles, charters, agendas, etc.) of effective teamwork to accomplish a goal.
9.5 Demonstrate effective individual and team operations-- communication, problem-solving, conflict resolution, and leadership skills	9.5.1 Demonstrate effective communication, problem-solving, conflict resolution, and leadership skills 9.5.2 Treat other team members respectfully 9.5.3 Listen to other members 9.5.4 Maintain composure in difficult situations
9.6 Demonstrate success in a team-based project	9.6.1 Present results as a team, with smooth integration of contributions from all individual efforts

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	
Competency	Indicators
10.4 Demonstrate an ability to comprehend technical literature and document project work	10.4.1 Read, understand, and interpret technical and non-technical information 10.4.2 Produce clear, well-constructed, and well-supported written engineering documents 10.4.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.5 Demonstrate competence in listening, speaking, and presentation	10.5.1 Listen to and comprehend information, instructions, and viewpoints of others 10.5.2 Deliver effective oral presentations to technical and non-technical audiences
10.6 Demonstrate the ability to integrate different modes of communication	10.6.1 Create engineering-standard figures, reports, and drawings to complement writing and presentations 10.6.2 Use a variety of media effectively to convey a message in a document or a presentation
PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work as a member and leader in a team to manage projects and in multidisciplinary environments.	
Competency	Indicators
11.4 Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.4.1 Describe various economic and financial costs/benefits of an engineering activity 11.4.2 Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.5 Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.5.1 Analyze and select the most appropriate proposal based on economic and financial considerations.

11.6 Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.6.1 Identify the tasks required to complete an engineering activity and the resources required to complete the tasks. 11.6.2 Use project management tools to schedule an engineering project so it is completed on time and within budget.
PO 12: Life-long learning: Recognise the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	
Competency	Indicators
12.4 Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.4.1 Describe the rationale for the requirement for continuing professional development 12.4.2 Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.5 Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.5.1 Identify historical points of technological advance in engineering that required practitioners to seek education to stay current 12.5.2 Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.6 Demonstrate an ability to identify and access sources for new information	12.6.1 Source and comprehend technical literature and other credible sources of information 12.6.2 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

APPENDIX B

Revised Bloom's taxonomy

Revised Bloom's taxonomy in the cognitive domain includes thinking, knowledge, and application of knowledge. It is a popular framework in engineering education to structure the assessment as it characterizes complexity and higher-order abilities. It identifies six competencies within the cognitive domain that are appropriate for engineering educators.

According to revised Bloom's taxonomy, the levels in the cognitive domain are as follows:

Level	Descriptor	Level of attainment
1	Applying	Using the information in another familiar situation
2	Analyzing	Breaking information into parts to explore understandings and relationships
3	Evaluating	Justifying a decision or course of action
4	Creating	Generating new ideas, products, or new ways of viewing things

MAPPING OF COURSE LEVELS TO BLOOM TAXONOMY LEVELS:

Blooms Level	Descriptor	Course Level
1	Applying	400
2	Analyzing	400,500
3	Evaluating	400, 500
4	Creating	400, 500

APPENDIX C

SAMPLE QUESTIONS FOR BLOOM'S TAXONOMY LEVELS:

1. APPLY

Skill Demonstrated	Question Ques / Verbs for tests
• use information • use methods, concepts, laws, and theories in new situations • solve problems using the required skills or knowledge • Demonstrating correct usage of a method or procedure	act, administer, apply, articulate, calculate, change chart, choose, collect, complete, compute, construct, demonstrate, determine, develop, discover, dramatize, employ, establish, examine, experiment, explain, illustrate, interpret, interview, judge, list, manipulate modify, operate, paint, practice, predict, prepare produce, record, relate, report, schedule, show, sketch, solve, stimulate, teach, transfer, use, write

Sample Questions:

1. Model and realize the following behaviors using diodes with minimum digital inputs.
    I. Turning on a burglar alarm only when the locker door is opened at night.
    II. Providing access to an account if either date of birth, registered mobile number, or both are correct.
    III. Updating the parking slot empty light in the basement of a shopping mall.
2. One of the resource persons needs to address a vast crowd (nearly 400 members) in the auditorium. A system is to be designed in such a way that everybody attending the session should be able to hear correctly and clearly without any disturbance. Identify the suitable circuit to boost the voice signal and briefly explain its functionality.
3. A ladder 5.0 m long rests on the horizontal ground and leans against a smooth vertical wall at an angle of 200 with the vertical. The ladder's weight is 900 N and acts in its middle. The ladder is at the point of sliding when a man weighing 750 N stands on a rung 1.5 m from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor.

2. ANALYZE

Skill Demonstrated	Question Ques / Verbs for tests
• break down a complex problem into parts. • Identify the relationships and interactions between the different parts of a complex problem.	advertise, analyze, appraise, break down. Calculate, categorize, classify, compare, conclude, connect, contrast, correlate, criticize, deduce, devise, diagram, differentiate, discriminate, dissect, distinguish, divide, estimate, evaluate experiment, explain, focus, illustrate, infer, order, organize, outline, plan, point out prioritize, question, select, separate subdivide, survey, test.

Sample Questions:

1. A class of ten students consists of five males and five females. We intend to train a model based on their past scores to predict the future score. The average score of females is 60, whereas that of males is 80. The overall average of the class is 70. Give two ways of predicting the score and analyze them to fit a model.

2. Suppose we want to select between two prediction models, M1 and M2. We have performed 10 rounds of 10-fold cross-validation on each model, whereas the same data partitioning in round one is used for M1 and M2. The error rates obtained for M1 are 30.5, 32.2, 20.7, 20.6, 31.0, 41.0, 27.7, 26.0, 21.5, 26.0. The error rates for M2 are 22.4, 14.5, 22.4, 19.6, 20.7, 20.4, 22.1, 19.4, 16.2, 35.0. Comment on whether one model is significantly better than the other, considering a significance level of 1%.

3. Return statements can only be used to return a single value. Can multiple values be returned from a function? Justify your answer.

3. EVALUATE

Skill Demonstrated	Question Ques / Verbs for tests
• compare and discriminate between ideas • assess the value of theories, presentations • make choices based on reasoned argument • verify the value of the evidence • recognize subjectivity • use of definite criteria for judgments	appraise, argue, assess, choose, compare, conclude, consider, convince, criticize, critic, debate, decide, defend, discriminate, distinguish, editorialize, estimate, evaluate, find errors, grade, judge, justify, measure, order, persuade, predict, rank, rate, recommend, reframe, score, select, summarize, support, test, weigh

4. CREATE

Skill Demonstrated	Question Ques / Verbs for tests
• use old ideas to create new ones • Combine parts to make (new) whole, • generalize from given facts • relate knowledge from several areas • predict, draw conclusions	adapt, anticipate, arrange, assemble, choose, collaborate, collect, combine, compile, compose, construct, create, design, develop, express, facilitate, formulate, generalize, hypothesize, imagine, infer, integrate, intervene, invent, justify, make, manage, modify, negotiate, organize, plan, prepare, produce, propose, rearrange, reorganize, report, revise, rewrite, role-play, schematize, simulate, solve, speculate, structure, substitute, support, test, valid, write

Higher-order cognitive skills, 'Evaluate' and 'Create', are difficult to assess in time-limited examinations. These must be evaluated in various student works like projects, open-ended problem-solving exercises, etc. Typical examples of problem statements or need statements that need higher-order problem-solving abilities are given below.

Sample Problem / Need statements:

1. Automatic tethering of a milking machine to a cow's udder. A milk diary wants to automate the milking process. The milking process involves attaching the milking cups to the teats. Design a system for the same.

2. An electric vehicle uses LIoN batteries. The batteries have to be charged and discharged during use. The batteries require continuous monitoring during charging and discharging to remain healthy and yield a long life. Design a system to monitor and manage the health of the batteries.

3. Microwave Doppler radar with a range of 9m is available for motion detection. Design a surround view monitoring system for a 3-wheeler to detect human obstacles while the vehicle is in motion.

Exam structure

Level	FOUNDATIONAL KNOWLEDGE OF THE SUBJECT (% marks)	CONCEPTUAL UNDERSTANDING OF THE SUBJECT (% marks)	CRITICAL THINKING ON THE SUBJECT (% marks)
400	10	60	30
500	10	60	30

Mappings

Each question needs to be mapped to CLO

Section	**No. of CLO**	**Performance Indicators (PO measures)**
FOUNDATIONAL KNOWLEDGE	Single CLO per question	1-2
CONCEPTUAL UNDERSTANDING	2 CLO per question	2-4
CRITICAL THINKING	2-4 CLO per question	4-8

APPENDIX D

EXAMPLE RUBRICS FOR COMMUNICATION (WRITTEN & ORAL)

Component	Proficient (100%)	Acceptable (70%)	Needs Improvements (40%)
Written Communication	The report is well-organized and written. The underlying logic is articulated and easy to follow. Words are chosen that precisely express the intended meaning and support reader comprehension. Diagrams or analyses enhance and clarify the presentation of ideas. Sentences are grammatical and free from spelling errors.	The report is organized and written for the most part. In some areas, the logic or flow of ideas could be more straightforward. Words are well chosen, with some minor exceptions. Diagrams are consistent with the text. Sentences are primarily grammatical, and only a few spelling errors are present, but they do not hinder the reader.	The report needs an overall organization. The reader has to make a considerable effort to understand the underlying logic and flow of ideas. Diagrams are absent or inconsistent with the text. Grammatical and spelling errors make it difficult for the reader to interpret the text in places.
Presentation Visual Aids	Slides are error-free and logically present the main components of the process and recommendations. The material is readable, and the graphics highlight and support the main ideas.	Slides are error-free and logically present the main components of the process and recommendations. The material is primarily readable, and the graphics reiterate the main ideas.	Slides contain errors and lack a logical progression. Significant aspects of the analysis or recommendations need to be included. Diagrams or graphics need to be present or clarified for the audience.
Oral Presentation	Speakers are audible and fluent on their topic and do not rely on notes to present or respond. Speakers respond accurately and appropriately to audience questions and comments.	Speakers are primarily audible and fluent on their topic and require minimal referral to notes. Speakers respond to most questions accurately and appropriately.	Speakers are often inaudible or hesitant, often speaking in incomplete sentences. Speakers rely heavily on notes. Speakers need help responding clearly and accurately to audience questions.
Body Language	Body language, as indicated by appropriate and meaningful gestures (e.g., drawing hands inward to convey contraction, moving arms up to convey lift, etc.), eye contact with the audience, and movement, demonstrates a high level of comfort and connection with the audience.	Body language, as indicated by a slight tendency to repetitive and distracting gestures (e.g., tapping a pen, wringing hands, waving arms, clenching fists, etc.) and breaking eye contact with the audience, demonstrates a slight discomfort with the audience.	Body language, as indicated by frequent, repetitive, and distracting gestures, little or no audience eye- contact, and /or stiff posture and movement, indicates a high degree of discomfort interacting with the audience.

APPENDIX E

EXAMPLE RUBRICS FOR ASSESSMENT OF DESIGN PROJECTS

Category	Proficient (100%)	Acceptable (70%)	Needs Improvements (40%)
Purpose of the Project	Does not clearly explain the intended outcome of the project or provides little information about the problem that was being solved, the need being met, or why the project was selected	Provides a description of the intended outcome of the project, which includes information about the problem that was being solved or the need being met and why the project was selected	Provides a detailed intended outcome of the project, which includes information about the problem that was being solved or the need being met, and clearly articulates the reasons and decision-making process used to select the project
Research	Lacks awareness of similar work done by others in an unacceptable literary form	Reflects awareness of similar work done by others and presents it in an acceptable literary format	Reflects a thorough understanding of similar work done by others and presents it in an acceptable literary format
Choices	Lacks justification of choices with little or no references to functional, aesthetic, social, economic, or environmental considerations	Justifies choices made with reference to functional, aesthetic, social, economic, or environmental considerations	Demonstrates sophisticated justification of choices with reference to functional, aesthetic, social, economic, or environmental consideration
Alternative Designs	Only one design was presented, or a clearly infeasible alternative was given. Serious deficiencies in exploring and identifying alternative designs.	Alternative approaches were identified to some degree.	Final design achieved after review of reasonable alternatives.
Application of Engineering Principles	No erroneous application of engineering principles yielding unreasonable solutions. Serious deficiencies in proper selection and use of engineering principles.	Effective application of engineering principles resulting in reasonable solutions.	Critical selection and application of engineering principles ensuring reasonable results.
Final Design	Not capable of achieving desired objectives.	Design meets desired objectives.	Design meets or exceeds desired objectives.
Interpretation of Results	No erroneous conclusions based on achieved results. Serious deficiencies in support of stated conclusions.	Sound conclusions are reached based on achieved results.	Insightful, supported conclusions and recommendations.

APPENDIX F

MINI PROJECT

EXAMPLE RUBRICS FOR REVIEW

RUBRICS FOR REVIEW – I

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
2.1.1	Articulate problem statements and identify objectives - GA	02	Problem statement and objectives are not identified	Problem statement and objectives are not clear	The problem statement is clear, and the objectives are not in line with the problem statement	Problem statements are clear, and objectives are not completely defined.	The problem statement is clear, and the objectives are completely defined
2.1.2	Identify engineering systems, variables, and parameters to solve the problems - IA	02	Engineering systems are not identified. Variables and parameters to solve the problems are not defined	Engineering systems are identified but not clear. Variables and parameters to solve the problems are not defined	Engineering systems are clear, variables and parameters to solve the problems are not defined	Engineering systems are identified. Variables and parameters to solve the problems are partially defined	Engineering systems are identified. Variables and parameters to solve the problems are completely defined
2.2.3	Identify existing processes/ solution methods for solving the problem, including forming justified approximations and assumptions - GA	02	Not able to identify existing solutions for solving the problem. The assumptions, approximations, and justifications are also not identified.	Not able to identify existing solutions for solving the problem. The assumptions, approximations, and justifications are identified but not clear	Not able to identify existing solutions for solving the problem. However, assumptions and approximations are aligned with the objectives.	Able to identify existing solutions for solving the problem. Assumptions and approximations are clear	Able to identify existing solutions for solving the problem. But assumptions, approximations, and justifications are clear

2.2.4	Compare and contrast alternative solution processes to select the best process - GA	02	Not able to identify alternative solution processes	Not able to compare alternative solution processes	Able to compare alternative solution processes but could not contrast clearly	Able to compare alternative solution processes and contrast clearly but not able to select the best process	Able to compare alternative solution processes, contrast it and also able to select the best process
10.1.1	Read, understand and interpret technical and non-technical information - GA	02	Not able to identify technical and non-technical information	Able to identify non-technical information	Able to read technical and non-technical information but could not understand and interpret	Able to read and understand technical and non-technical information but could not interpret	Able to read, understand, and interpret technical and non-technical information

GA – Group Assessment IA – Individual Assessment

EXAMPLE RUBRICS FOR REVIEW – II

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
3.2.1	Apply formal idea generation tools to develop multiple engineering design solutions - GA	02	Not able to identify tools to develop solutions	Able to identify but not able to use it effectively	Able to use the tool but not able to generate engineering designs	Able to generate engineering designs but not able to justify	Able to generate engineering designs with justification
3.2.3	Identify suitable criteria for evaluation of alternate design solutions - GA	02	Not able to identify criteria	Able to identify criteria but not able to use them	Able to use criteria but not able to compare alternatives	Not able to justify the comparison with criteria	Able to justify the comparison with criteria
3.3.1	Apply formal decision-making tools to select optimal engineering design solutions for further development - GA	02	Not able to identify decision-making tools	Able to identify but not able to choose the optimum one	Able to identify the optimum one but not able to use it	Able to use optimum one but not able to justify	Able to use optimum one with justification

3.2.2	Build models/ prototypes to develop a diverse set of design solutions - IA	02	Not able to identify tool to build model/ prototype	Able to choose the tool but not able to use it effectively	Able to use the tool but not able to generate alternatives but not able to justify the best solution	Able to generate alternatives but not able to justify the best solution	Able to generate and justify the best solution
13.1.1	Develop 2D drawings of components/ systems using modern CAD tools - IA	02	Not able to identify CAD tools	Able to identify but not able to use CAD tool	Able to use CAD tools but not able to generate drawings	Able to generate drawings but not able to follow drawing standards	Able to generate drawings with standards
13.1.2	Develop 3D models of components/systems using modern CAD tools - IA	03	Not able to identify CAD tools	Able to identify but not able to use CAD tool	Able to use CAD tools but not able to generate 3D models	Able to generate models but not able to follow standards	Able to generate models with standards
13.1.3	Apply GD&T principles as per ASME standards to manufacturing drawings, with all relevant data like material, hardness, surface finish, and tolerances - IA	02	Not able to extract GD&T principles from ASME standards	Able to extract but not able to understand them	Able to understand but not able to apply GD&T standards	Able to apply GD&T standards to drawings but not able to justify	Able to apply and justify GD&T standards to drawings

GA – Group Assessment IA – Individual Assessment

EXAMPLE RUBRICS FOR REVIEW – III

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
3.4.2	Generate information through appropriate tests to improve or revise design - GA	02	Not able to identify suitable tests to be done	Able to identify but not able to follow testing procedure	Able to follow testing procedures but not able to collect information	Able to collect information but not able to apply it for improvement	Able to apply information for the improvement

4.3.1	Use appropriate procedures, tools, and techniques to conduct experiments and collect data - GA	04	Not able to identify tools, techniques, and procedures	Able to identify but not able to conduct experiments	Able to conduct experiments but not able to follow the procedure	Able to follow procedure but not able to collect data	Able to collect data as per the standards
4.3.2	Analyze data for trends and correlations, stating possible errors and limitations - GA	03	Not able to understand the data	Able to understand but not able to analyze data	Able to analyze data but not able to correlate them	Able to correlate but not able to identify errors and limitations	Able to identify errors and limitations
10.2.2	Deliver effective oral presentations to technical and non-technical audiences - IA	03	Could not deliver effective presentations.	Could not deliver a presentation, but the presentation was prepared and attempted.	Able to deliver fair presentation but not able to answer the audiences	Deliver effective presentations but able to answer partially the audience's queries.	Deliver effective presentation and able to answer all queries of the audience.
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts – GA + IA	03	No Contribution from an individual to a team	Contributions from an individual to a team are minimal	Contributions from an individual to a team are moderate	A contribution from an individual to a team is good, but not well groomed in a team.	Contribution from an individual to a team is good and results in an integrated team presentation.

GA – Group Assessment IA – Individual Assessment

APPENDIX G

MODEL QUESTION PAPER FOR END-SEMESTER EXAMINATION

KERALA UNIVERSITY OF DIGITAL SCIENCES, INNOVATION AND TECHNOLOGY

DIGITAL UNIVERSITY KERALA

Curating a responsible digital world

END SEMESTER EXAMINATION

SCHOOL OF ELECTRONIC SYSTEMS AND AUTOMATION

YEAR 2024, DECEMBER

COURSE NAME
COURSE CODE
COURSE LEVEL: 400

Register Number:	TOTAL DURATION: 3 hours TOTAL MARKS: 100

COURSE LEARNING OUTCOMES

CLO 1: _____
CLO 2: _____
CLO 3: _____
CLO 4: _____

COURSE LEARNING OUTCOMES TESTED IN THIS EXAMINATION

Course Learning Outcomes	Questions
CLO 1	Q1, Q2, Q3, Q4
CLO 2	Q5, Q7, Q8, Q9
CLO 3	Q5, Q6, Q7, Q9
CLO 4	Q5, Q6, Q7, Q8, Q9

INSTRUCTIONS TO STUDENTS

1. Attempt five questions, selecting ONE from each section.
2. Question 9 (Section C) is compulsory.
3. All the questions carry equal marks.
4. Draw neat diagrams wherever applicable.

FORMULA, CHEAT SHEETS AND HINTS

****

QUESTIONS

Q. No	Question	Marks	BL	CO	PO	PI Code
Section-A **FOUNDATIONAL KNOWLEDGE ON THE SUBJECT (20%)** These questions should probe the subject's basic knowledge, such as defining an idea or applying a formula to solve the problem. The questions should be straightforward. Each question here shall be mapped to only one CLO.						
1.	a. What is an algorithm? Explain the characteristics of an algorithm.	2+6	1,2	2	1	1.4.1
	b. Write an algorithm to find the angle between a clock's hour and minute hands at a given time.	7	3	3	1	1.4.1
	c. Is it mandatory to declare the main () function with the return type as void or int? What will be the effect if no return type is declared for the main () function?	3+2	4	3	1	1.4.1
OR						
2.	a. What is the difference between definition and declaration in C? When a user writes “int x,” is it treated as a declaration or definition in C?	3+2	2,4	3	1	1.4.1
	b. Write a program in C to find the largest of 3 positive integer numbers using conditional operators.	7	3	3	1,2	1.4.1, 2.2.4
	c. What is meant by iterative statements? What are the different types of iterative statements in C?	8	1,2	3	1	1.4.1
Section-A **FOUNDATIONAL KNOWLEDGE ON THE SUBJECT (20%)**						

These questions should probe the basic knowledge of the subject, such as defining an idea or applying a formula to solve the problem. The questions should be straightforward. Each question here shall be mapped to only one CLO.						
3.	a. Bob has placed N objects in a row which are marked with a number equal to their weight in Kg. He wants to check whether the objects are in increasing order of their weights or not. Write a C program to help Bob.	12	3	3,6,7	1,2	1.4.1, 2.2.4
	b. Differentiate between Big-O and Big-Omega notation.	4	2	3	1	1.4.1
	c. What is the role of the index in an array? How are the elements of a 2D array accessed in C?	2+2	2	3	1	1.4.1
OR						
4.	a. Ram is conducting a study which is based on counting the number of cars crossing the highway. Every hour, he generates a random string containing a sequence of characters <rbwbwr...>, where r represents red color, w denotes white color, and b denotes blue color cars. The string is forwarded to Shyam for analysis, which computes the number of red, blue, and white color cars crossing Ram every hour. Assume that Ram works for 5 hours a day. Help Shyam generate a daily report containing the following: i. Total number of different color cars crossing Ram in an hour. ii. Total number of different color cars crossing Ram in a day. iii. Total number of cars crossing Ram in a day.	4+4+4	3	3,6,7	1,2	1.4.1, 2.2.4
	b. What is a variable? Explain the ways to declare the scope of a variable.	2+6	1,2	3	1	1.4.1

Section-B **CONCEPTUAL UNDERSTANDING ON THE SUBJECT (20%)** These questions should probe the conceptual understanding of the topic through problems and applications. The questions should require the student to understand the concept thoroughly. Each question here shall be mapped to multiple CLOs.						
5.	a. Write a program that will read positive integer numbers from the users and compute the sum if the number can be expressed as a power of 2. The test of whether a number can be expressed as a power of 2 will be done using the function power_of_two (int a).	12	3	3,6,7	1,2	1.4.1
	b. What is recursion? Differentiate between homogeneous and heterogeneous recursion with the help of an example.	2+3+3	2	3	1	1.4.1
OR						
6.	a. What are the different ways to pass parameters to a function? Explain with the help of a suitable example.	4+4	2	3,5	1	1.4.1

	b. Is it possible to return multiple values from a function? Justify the statement with the help of an example.	4+8	3	3,6,7	1,2	1.4.1
Section-B **CONCEPTUAL UNDERSTANDING ON THE SUBJECT (20%)** These questions should probe the conceptual understanding of the topic through problems and applications. The questions should require the student to understand the concept thoroughly. Each question here shall be mapped to multiple CLOs.						
7.	a. What is a structure? What is the benefit offered by using a structure over multiple arrays?	2+6	2	5	1	1.4.1
	b. Ram is working on a project which requires returning multiple values from a function. He observed that a return statement can only be used to return a single value from a function. How should the function be implemented so that Ram can return multiple values?	12	4	5	1	1.4.1
OR						
8.	a. Write a program that reads a number as input from the user. The entered number is written to a file "even.txt.". If the input is even else, it is written to "odd.txt.". Write a C code to perform the desired task.	12	3	5	1	1.4.1
	b. What are the different methods to open a file? Explain each with the help of a C program.	3+5	2	5	1	1.4.1
Section-C (Compulsory Question) **CRITICAL THINKING (20%)** These questions should probe the in-depth understanding of the topic through open-ended questions. The questions should require the student to demonstrate exploratory thinking ability often. Each question here shall be mapped to multiple CLOs.						
9.	a. What is a compiler? List the names of any 2 compilers and how they can be efficiently designed.	2½	1	1,2	1	1.4.1
	b. What are the benefits of designing a flowchart as opposed to using a state diagram to solve a problem? Explain an application where flowcharts are not useful.	2½	4	2,3,4	1	1.4.1

	c. What is the output of the following code?
	int main () {
	int x=10;
	int y=size of(x/2);
	print ("%d", y);}
		2½	3	4	1	1.4.1

	d. What is the difference between creating a constant using the #define macro and const keyword? What is its implication in a practical application?	2½	3	3, 4	1	1.4.1
	e. What is the role of the function prototype? When is it required in C?	2½	2	3	1	1.4.1
	f. Which of the following are unary operators in C? State the reason for your answer. a.! b. size of c. ~ d. &&	2½	2	3	1	1.4.1

	g. Which of the following special symbols is allowed in a variable name? State the reason for your answer. a. * (asterisk) b. | (pipeline) c. - (hyphen) d. _ (underscore)	21⁄2	2	3	1	1.4.1
	h. In which header file is the NULL macro defined? State the reason for your answer. a. stdio.h b. stddef.h c. stdio.h and stddef.h d. math.h	21⁄2	2	3	1	1.4.1

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating)

CO – Course Outcomes

PO – Program Outcomes; PI Code – Performance Indicator Code

APPENDIX H

FINAL EXAM INTERNAL QA FORM

SESSION AND YEAR	
COURSE CODE	
COURSE TITLE	
COURSE COORDINATOR	
QA ASSESSOR	

1 Completeness of Submission	
Final Exam	Answer Key with marking scheme
Any Retake Exams	
Course specifications (outlines, syllabus, outcome mapping, session plans)	Previous Exam

2 Conformity with Exam Template
3 Alignment of questions with course aims and learning outcomes

4 Appropriateness of coverage

5 Appropriateness of difficulty level
6 Clarity of questions and instructions
7 Appropriateness of answer key
8 Appropriateness of length of exam for allocated time
9 Appropriateness of marking scheme

DATE SUBMITTED TO QA ASSESSOR:	

DATE SUBMITTED TO SCHOOL CHAIR:	

COURSE COORDINATOR

Date:

QA ASSESSOR

Date:

APPENDIX I

COURSE REPORT PROFORMA

Code		**Title**	
Course coordinator			

Any additional information should be submitted on a separate sheet quoting the number and section heading.

1. Results for Each Component of the Assessment and Overall Grades

Course Marks Spreadsheet to be attached

2. Mapping for Marks to Grades

Is mapping of marks to grades in any way unusual? Yes No

Standard O, A+, A, B+, C, P, F, Ab

If yes, please briefly explain why:

Insert the numbers of students with O, A+, A, B+, C, D, F, Ab Marks

O			A+			A			B+			B			C	
Total			Total			Total			Total			Total			Total	

P			F			Ab		
Total			Total			Total		

3. Commentary on Student Performance

Is student performance satisfactory? Yes No
If not, please briefly explain why:

4. Commentary on Failure Rate

Is the failure rate high? Yes No
Is the failure rate higher than in previous years? Yes No
If not, please briefly explain why:
This course was introduced for the first time at the School of Engineering.

5. Commentary on Course Content, Teaching and Assessment

Is the course satisfactory regarding content, teaching and assessment? Yes No
If no, please briefly explain why and include a short statement on recommended action:

6. Feedback

Were feedback sheets completed for this course? Yes No
If **Yes or Not**, please summarize and state any action to be taken:

7. Further Comments

Please add any further comments

Signature_____ Date _____

Course Coordinator

Signature _____ **Date** _____

Second Marker

Signature _____ **Date** _____

SCHOOL CHAIR

Appendix J

Challenge Examination Request

Student Name:	Reg Number:						
Gender (Male/Female/…):	Program of study:						
Name of the School:							
Specialization:	Year of Joining DUK:						
Mobile Number:	Email:						
Current Academic Year:	Semester:						
Course Code:	Course Title:					Credits:	
Type of the Course (Core/Elective)							
Previous Challenge Exams Appeared	Course Code	Course Title	Year and semester	Passed/ Failed	Credits earned		School Offering the Course

Briefly describe how your prior learning applies to the course (max 100 words*): Provide certificates, a description of your knowledge, or other documents to support the skill(s). * *Please attach a separate sheet*

Declaration

I..... hereby declare that:

ü I have not previously taken or attempted the course at DUK.

ü I am not presently registered for the course.

ü If I fail the challenge examination, I will immediately enroll in the course as a regular student.

ü I have not applied for more than two challenge examinations this semester.

ü The total number of credits earned through challenge exams, including those from this course, will not exceed 12.

Date: Signature of the student

Recommendation of Prior Learning Assessment done by the School Committee (please tick the appropriate box):

	The School recommends the application since the student has sufficient prior knowledge of the course.
	The student lacks sufficient course knowledge and is therefore not recommended.

Course Coordinator School Chair

CoE

Dean (Academic)

Appendix K: Example of Grade Adjustment

To illustrate the process of scaling up student marks for uniform grading, consider the following example. This example demonstrates how raw scores are adjusted to align with the University's grade boundaries, ensuring fairness and consistency across all courses.

Scenario: Scaling Up Student Marks by 10

Course Details:

- **Total Marks:** 100
- **Scaling Up Percentage:** 10
- **Grade Boundaries:**
  - **O (Outstanding):** 90 and above
  - **A+ (Excellent):** [80–90)
  - **A (Very Good):** [70–80)
  - **B+ (Good):** [60–70)
  - **B (Above Average):** [50–60)
  - **C (Average):** [45–50)
  - **P (Pass):** [40–45)
  - **F (Fail):** Below 40

Raw Scores and Scaling:

Student	Raw Score (%)	Scaled Up (%)	Final Grade
Student A	65	65 + 10 = 75	A (Very Good)
Student B	58	58 + 10) = 68	B+ (Good)
Student C	72	72 + 10 = 82	A+ (Very Good)
Student D	88	88 + 10 = 98	O (Outstanding)
Student E	39	35 + 10 = 45	P (Pass)

Key Points:

- **Maximum Scaling:** Marks are increased by a maximum of 20% to align with grade boundaries.
- **No Scaling Down:** No scaling is applied if a student's raw score already meets or exceeds the grade boundary.
- **Uniform Application:** All students' marks are scaled uniformly by the same percentage (10% in this example).
- **Documentation:** All adjustments are recorded and reported to the School Pass Board for oversight.

Scenario: No Scaling Required

Course Details:

- **Total Marks:** 100
- **Grade Boundaries:** As defined above.

Raw Scores and Final Grades:

Student	Raw Score (%)	Final Grade
Student F	85	A+ (Excellent)
Student G	78	A (Very Good)
Student H	62	B+ (Good)
Student I	55	B (Above Average)
Student J	44	P (Pass)

Key Points:

- **Assessment Alignment:** The raw scores already align with the grade boundaries.
- **No Scaling Applied:** Since all students meet the grade criteria without adjustments, scaling is unnecessary.
- **Maintaining Integrity:** This ensures that students' grades accurately reflect their performance without artificial inflation.

Conclusion

Scaling up student marks is a strategic tool to ensure that grading standards remain consistent and fair across all courses. By applying a uniform scaling percentage, the University can adjust for variations in assessment difficulty and maintain alignment with predefined grade boundaries. However, it is crucial to apply scaling judiciously to prevent grade inflation and ensure that the final grades genuinely reflect students' academic achievements.

Recommendations:

- **Apply Scaling Only When Necessary:** Use scaling to adjust grades only when there is a justified need, such as unusually difficult assessments.
- **Limit Scaling Percentage:** Adhere to the maximum allowed scaling percentage (20%) to maintain grade integrity.
- **Ensure Transparency:** Clearly communicate the scaling process to students to uphold transparency and trust in the grading system.
- **Regular Review:** Periodically assess the effectiveness of scaling practices and adjust grading policies as needed to uphold academic standards.

By following these guidelines, the University can ensure a fair and equitable grading system that accurately represents student performance.