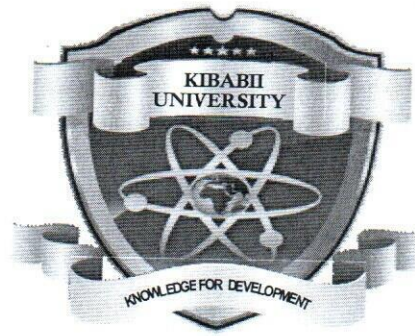


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(Knowledge for development)
KIBABII UNIVERSITY
(KIBU)

UNIVERSITY EXAMINATIONS
2024/2025 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS
YEAR ONE SEMESTER ONE EXAMINATIONS

FOR THE DEGREE OF
MASTER OF SCIENCE
(COMPUTER SCIENCE)

COURSE CODE : MCS 811
COURSE TITLE : ADVANCED SOFTWARE
ENGINEERING

DATE: 29/04/2025

TIME: 08:00HRS-10:00HRS

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE [20 MARKS]

An automobile manufacturer is developing a real-time collision avoidance system for self-driving cars. The system must detect obstacles, calculate safe stopping distances, and trigger automatic braking within milliseconds to prevent accidents. Any delay or system failure could result in fatal consequences.

- i. Explain the importance of real-time software design in this scenario. How does it differ from traditional software design? [4 Marks]
- ii. What type of real-time system (hard, soft, or firm) does this application belong to? Justify your answer. [4 Marks]
- iii. Identify and describe key design principles and techniques that should be used to ensure the system meets strict timing constraints. [8 Marks]
- iv. Discuss potential challenges in designing and testing this real-time system and propose solutions to overcome them [4 Marks]

QUESTION TWO [20 MARKS]

A company is developing an automated traffic control system that involves hardware components (sensors, cameras, traffic lights) and software (AI-based traffic flow optimization algorithms). The project manager is confused about whether to focus on Software Engineering or System Engineering for the project.

- i. Explain the key differences between Software Engineering and System Engineering in the context of this project. [7 Marks]
- ii. Discuss how both disciplines work together in the development of complex systems. [10 Marks]
- iii. Which engineering discipline would be more dominant in this project, and why? [3 Marks]

QUESTION THREE [20 MARKS]

A government agency is developing a national identity management system that will store and manage citizen records, including biometrics, personal details, and digital signatures. During the development process, the team encounters several challenges, such as unclear stakeholder needs, changing regulations, and security concerns.

- i. Explain the key phases of Requirements Engineering and how each phase contributes to the success of the identity management system. [6 Marks]
- ii. What techniques would you use for requirements elicitation in this project, considering multiple stakeholders (citizens, government officials, and security experts)? [4 Marks]

- iii. Discuss how requirement validation and verification ensure that the final system meets stakeholder needs and regulatory compliance. **[6 Marks]**
- iv. How can the development team handle changing requirements without significantly affecting project timelines and budget **[4 Marks]**

QUESTION FOUR [20 MARKS]

- a) A smart home automation system collects data from IoT devices (such as thermostats, cameras, and motion sensors) and processes it in real-time to automate household functions. The system needs to respond instantly to events like detecting motion or temperature changes.
Would a layered architecture or an event-driven architecture be more suitable for this system? Explain your reasoning and discuss how your choice improves responsiveness and scalability **[10 Marks]**
- b) A startup is building a cloud storage service where users can upload, store, and share files. The team is debating between a client-server model and a peer-to-peer (P2P) model for handling file distribution. Which architecture—client-server or P2P—would be more suitable for this service? Discuss the advantages and disadvantages of both approaches, considering scalability, fault tolerance, and network bandwidth usage **[10 Marks]**

QUESTION FIVE [20 MARKS]

- a) A fintech application that processes real-time stock Market transactions is suffering from high latency. Users experience delays in receiving updates on stock prices. What techniques would you use to optimize performance? Discuss strategies like load balancing, caching, database optimization, and asynchronous processing. **[10 Marks]**
- b) A banking application that was recently launched has multiple defects in production. Customers are reporting transaction failures and UI bugs. Design a comprehensive testing strategy that includes unit testing, integration testing, system testing, and user acceptance testing (UAT) to improve software quality before deployment. **[10 Marks]**