Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (R), DECEMBER 2023
ELECTRONICS AND COMMUNICATION ENGINEERING
(2020 SCHEME)

Course Code : 20ECT491

Course Name: RF MEMS

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. List the key advantages of RF MEMS technology in the context of wireless applications.
2. Summarize the process of dry etching.
3. Explain the key factors to consider when critically assessing an RF MEMS switch.
4. Illustrate the schematic diagram of a series contact switch and provide its equivalent circuit representation.
5. List various types of MEMS capacitors.
6. Illustrate the working of folded inductors.
7. State the principle of operation of micromachined filter with neat diagram.
8. Summarize the fundamental operating principle of ferroelectric phase shifters in RF technology.
9. List three key functions of MEMS packages and their significance in enabling the effective use of MEMS devices in real-world applications.
10. Differentiate three common reliability issues associated with packaging materials used in electronic devices and how selecting the appropriate materials can mitigate these concerns.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. Compare and contrast surface micromachining and bulk micromachining techniques in the fabrication of microelectromechanical systems (MEMS) with neat diagrams. (14)

OR

12. a) Analyze the key steps and principles of the LIGA process with neat sketches. (7)
    b) Describe three actuation mechanisms commonly employed in (7)

MEMS piezoelectric devices with neat diagram.

MODULE II

13. a) Analyze the critical steps and considerations involved in the design of RF MEMS switches. (8)
    b) Compare the techniques for MEMS switch packaging with neat sketches. (6)

OR

14. a) Evaluate the advantages and disadvantages of capacitive shunt and series switches in RF applications. (7)
    b) Summarize various techniques employed in the fabrication of MEMS switches with neat diagram. (7)

MODULE III

15. a) Describe variable inductors and polymer-based inductors with neat sketches. (7)
    b) Differentiate gap tuning and area tuning capacitors. (7)

OR

16. a) Analyze the strategies and techniques employed for reducing stray capacitance in planar inductors. (6)
    b) Summarize different types of inductors used in MEMS and explain their distinct characteristics and applications in these microscale devices. (8)

MODULE IV

17. a) Outline the basic principle of operation of surface acoustic wave filters. (7)
    b) Illustrate the design considerations and challenges in developing micromachined filters for millimeter-wave frequencies with neat sketches. (7)

OR

18. a) Analyze the different types of MEMS phase shifters and their operational principles with neat diagram. (7)
    b) Illustrate, with clear diagrams, the operational principles of micromechanical filters that utilize comb drives for tuning and frequency selection. (7)

MODULE V

19. a) Describe a pattern reconfigurable patch antenna with RF MEMS switch. (7)
    b) Explain the selection criteria and performance considerations for packaging materials used in MEMS and compare the advantages and limitations of different materials. (7)

OR

20. a) List different types of packaging used for MEMS (Micro-Electro-Mechanical Systems) devices, highlighting their key features and applications in the context of MEMS technology. (8)

b) Explain the need for micro machined antennas with analytical justification. How can its performance be improved? (6)

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