CS/M.TECH (MDC)/SEM-2/MEC-1003/09
RF-IC AND RF-MEMS (SEMESTER - 2)

1. ....
   Signature of Invigilator

2. ....
   Signature of the Officer-in-Charge

Reg. No.

Roll No. of the Candidate

- -

CS/M.TECH (MDC)/SEM-2/MEC-1003/09
ENGINEERING & MANAGEMENT EXAMINATIONS, JULY – 2009
RF-IC AND RF-MEMS (SEMESTER - 2)

Time : 3 Hours]　　　　　　　　　　　　　　　　　　　　[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.

2. You have to answer the questions in the space provided marked 'Answer Sheet'. Write on both sides of the paper.

3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.

4. Read the instructions given inside carefully before answering.

5. You should not forget to write the corresponding question numbers while answering.

6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.

7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**

8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.

9. Rough work, if necessary is to be done in this booklet only and cross it through.

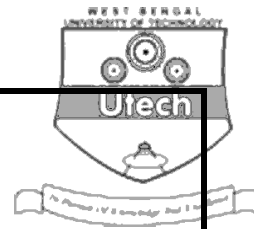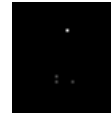**No additional sheets are to be used and no loose paper will be provided**

FOR OFFICE USE / EVALUATION ONLY
Marks Obtained

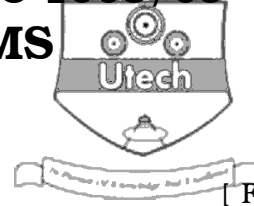| Question Number										Total Marks	Examiner's Signature
Marks Obtained											

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Head-Examiner/Co-Ordinator/Scrutineer

41004 (07/07)

DO NOT WRITE ON THIS PAGE

CS/M.TECH (MDC)/SEM-2/MEC-1003/09
RF-IC AND RF-MEMS
SEMESTER - 2

Time : 3 Hours]   [Full Marks : 70

The figures in the margin indicate full marks.
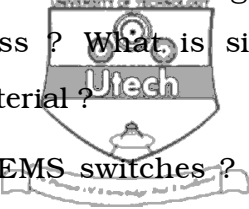
Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* of the following.   5 × 14 =

1. What are the circuit design issues in the frequency range of 100 MHz – 10 GHz ? What is an RF Design Octagon ? What are the different types of noises associated with an RF circuit ? Show that the noise figure of a lossy circuit is equivalent to loss.

    5 + 2 + 4 + 3

2. What are the linearity issues in RFIC Design ? Derive an expression for the inter-modulation distortion of a nonlinear system. What are Sensitivity *r* Dynamic Range ? What are the different classifications of Inductors in RFIC Design ? Mention the advantages and disadvantages of an active Inductor.   3 + 3 + 2 + 3 + 3

3. What is RF-MEMS ? How are they categorized ? Derive a model for the electrostatic actuation in the capacitive switches.   3 + 3 + 8

4. Derive an expression for the electromagnetic modelling of MEMS switches. How electromechanical mobility analogies are done for electromechanical modelling of MEMS devices ? Develop a model of a Cantilever Bimorph and explain its different layers of materials.   6 + 3 + 5

5. Explain the process of sputtering for depositing materials in metal MEMS. How is it different from the process of evaporation ? Explain with necessary equations. How EGS is yielded from the melt ?   6 + 3 + 5
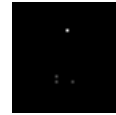
6. Explain the process of Isotropic and Orientation dependent wet-etching. What are its disadvantages as compared to the dry-etching process ? What is silicon-to-silicon anodic bending ? What is silicon-on-insulator (SOI) material ?   5 + 3 + 4 + 2

7. What are different on-water hermetic packaging of MEMS switches ? What are the problems with these techniques, when applied to RFMEMS ? Discuss with necessary diagrams the Indent Reflow Sealing technique for hermetic packaging of MEMS switches. With RF feed troughs for on-water hermetic packages, discuss the packaging of an SPDT MEMS switch with via-hole access at the top for RF and DC/control.   2 + 3 + 5 + 4

8. Explain the different failure mechanisms of MEMS capacitive switches. Explain how the bipolar actuation helps the di-electric charging problem in an MEMS capacitor. What are the contact material issues regarding the failure of DC-contact switches ? Why rhodium can be considered having similar behaviour with gold in a plastic deformation switch ? What are the contact and release forces range for Rockwell, Motorola and Sumsung MEMS switches ?   3 + 3 + 3 + 3 + 2

9. What are the testing conditions and criteria for Raytheon Corporation Capacitive Switches for low and medium power reliability and what is the acceptance criteria ? Describe the precess of fabrication of the MEMS varacterly the University of California, Berkeley using a 2 × 2 capacitor array with necessary diagrams. What is the tunable range of the capacitor in this case ? Describe the process of development of a cantilever based varactor on a glass substrate by Seoul National University, with necessary diagrams. What is the control voltage range in this case ? What is the sacrificial layer used in this case and how is it removed ?   3 + 4 + 1 + 4 + 1 + 1

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END