

Q.P. Code :08592

[Time: 2.30 Hours]

[Marks:80]

Please check whether you have got the right question paper.

N.B:

1. Q.1 is compulsory
2. Attempt any three out of remaining question
3. Assume any suitable data wherever required but justify the same

- Q.1 a) List three silicon compound materials used in MEMS and explain their roles in microsystems. 20
b) What is Annealing?
c) Compare wet and dry etching techniques.
d) Explain principle of digital Mirror device.
- Q.2 a) Discuss selection of material based on application and explain “silicon use as ideal substrate material in MEMS”. 10
b) What are the applications of polymers in MEMS and explain methods to make polymers electrical conductive. 10
- Q.3 a) Differentiate between bulk and surface micromachining. Explain the role of sacrificial layer in fabrication of MEMS devices. 10
b) Draw and explain working principle of cantilever. Show basic quantitative behavior of cantilever. Also discuss process steps for fabrication of cantilever. 10
- Q.4 a) State various deposition techniques. Explain in brief the technique of PVD for MEMS device Fabrication. Also define step coverage and shadowing. 10
b) List types of lithography. Explain in detail X-ray lithography with its major features. 10
- Q.5 a) Explain operating principle of pressure sensor. Describe the representation process flow for fabricating pressure sensors. 10
b) Describe in detail inkjet printer head and its fabrication process flow in detail. 10
- Q6 Write short note on:- 20
a) MEMS sensors in internet of things
b) MEMS reliability
c) Wafer bonding and its types
d) TCR & stiffness

(3 Hours)

- N.B. (1) Question No. 1 is compulsory.**
(2) Attempt any three questions from remaining.
(3) All questions carry equal marks.
(4) Assume suitable data wherever necessary.

1. Answer any **four** of the following:

- (a) Explain why inverse kinematic solution is not unique for generic robots. 5
 (b) Define joint and link parameters. 5
 (c) Differentiate between the robots direct and inverse dynamics problem. 5
 (d) Explain Reach and Stroke of a robot. 5
 (e) Define pixel function, shrink operator and swell operator. 5

2. a) Find the position of the tool tip of the Adept one robot when the joint variables are 10

$$q = \left[\frac{\pi}{4}, -\frac{\pi}{3}, 120, \frac{\pi}{2} \right]^T$$

$$\text{Given } d = [877, 0.0, d_3, 200]^T \text{ mm and } a = [425, 375, 0.0, 0.0]^T \text{ mm.}$$

b) Obtain the inverse kinematics analysis of a 3 axis planar articulated robot 10

3. a) Formulate the dynamic model of a simple one axis robot. 10

b) Consider a 3 axis planar articulated robot. The tool configuration function 10

of this robot is as follows:

$$W(q) = \begin{bmatrix} a_1c_1 + a_2c_{12} \\ a_1s_1 + a_2s_{12} \\ d_3 \\ 0 \\ 0 \\ \exp\left(\frac{q_3}{\pi}\right) \end{bmatrix}$$

Find the tool configuration Jacobian matrix $V(q)$.

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4. a) Explain robot motion planning using Bug 1 and Bug 2 algorithm. 10
b) What is a GVD? Sketch all the GVD's resulting due to the basic interactions of the obstacle .Derive the necessary equations. 10
5. a) What are moments of an image? How the moments are used in the shape analysis of objects? 10
b) Explain the 4 point minimal PNP trajectory for pick and place of objects by using a robot manipulator. 10
- 6 . Write short notes on any **four** of the following: 20
- (a) Potential functions.
 - (b) Wave front planner.
 - (c)Template matching.
 - (d)Cartesian space trajectory
 - (e)Edge detection

Time: 3 Hours

Max Marks: 80

- N.B. 1) Question No.1 is compulsory
 2) Solve any three questions from the remaining questions.
 3) Assume suitable data if necessary.

- 1 Solve any four of the following.
- (a) Explain behavior of g_m as function of below parameters 5
 - i. Overdrive voltage with W/L constant.
 - ii. Overdrive voltage with I_D constant
 - (b) What are different second order effects in NMOS? 5
 - (c) Explain the concept of switched capacitor circuit 5
 - (d) Compare performance of various op-amp topologies 5
 - (e) Explain active current mirror circuit 5
- 2 (a) For $W/L=50/0.5$ and $I_D=0.5\text{mA}$, calculate the transconductance and output impedance of both NMOS and PMOS device. Also find the intrinsic gain. 10
- (b) What is a bandgap reference? Describe methods of implementation of band gap references. 10
- 3 (a) For common source stage with diode connected load, if the variation of $\eta = g_{mb}/g_m$ with the output voltage is neglected. Prove that the gain is independent of bias current and voltages. 10
- (b) Derive equation of differential gain, common mode gain and CMRR of differential amplifier. 10
- 4 (a) Explain the concept of clock feed through in charge pump. Charge injection, charge sharing in charge pump. 10
- (b) Derive expression for voltage gain A_V and output resistance R_o of source follower stage. 10
- 5 Design two stage operational amplifiers that meet the following specifications 20
 with a phase margin of 60. Assume the channel length is to be $1\mu\text{m}$,
 $K_N=100\mu\text{A}/\text{V}^2$, $K_P=20\mu\text{A}/\text{V}^2$, $V_{TN} = |V_{TP}| = 0.5\text{V}$, $\lambda_N = 0.06\text{V}^{-1}$, and $\lambda_P = 0.08\text{V}^{-1}$
 $A_V > 5000\text{v/v}$, $V_{dd}=2.5\text{V}$, $V_{SS}= -2.5\text{V}$, $GB=5\text{MHz}$, $CL=10\text{pf}$,
 $SR > 10\text{v}/\mu\text{sec}$, V_{out} range = $\pm 2\text{V}$, $ICMR = -1$ to 2V , $P_{diss} \leq 2\text{mw}$.
- 6 Write short note on any four
- (a) Types of Noise of CS stage 5
 - (b) Cascode current mirror circuit. 5
 - (c) Advantage and disadvantages of DLL 5
 - (d) Comparison of full custom design and semi custom design 5
 - (e) Performance parameters of VCO 5

[Time: 3 Hours]

[Marks: 80]

Please check whether you have got the right question paper.

- N.B: 1. Question.No.1 is compulsory.
2. Attempt any three questions from the remaining five questions.

- Q.1 Answer the following: **20**
- What is meant by frequency reuse? What is its effect on the co-channel interference?
 - State the radio specifications of GSM.
 - Compare GSM and CDMA technologies.
 - Explain the terms of soft, softer and soft-softer handoffs.
- Q.2 a) Draw a well labelled diagram and explain in detail the architecture of GSM. **10**
- b) Explain GSM frame and time slot structure with the required figures. **10**
- Q.3 a) Explain CDMA reverse channel processing **10**
- b) Discuss mobility and resource management in CDMA. **10**
- Q.4 a) Explain 4G-LTE architecture with a neat block diagram in detail. **10**
- b) Explain cell splitting. **04**
If the radius of each new microcell is half that of the original cell, show that **06**
- Traffic load increases four times
 - Transmit power must be reduced by 12dB to maintain the S/N requirement with a path loss exponent of 4.
- Q.5 a) Describe UMTS architecture with a neat diagram and interfaces. **10**
- b) Compare 3G and 4G technologies. **05**
- c) Write a detailed note on mobile IP. **05**
- Q.6 Write short notes on: **20**
- WiMax
 - GPRS
 - RFID
 - MANET

N. B. 1. Question No 1 is compulsory. 2. Solve any three from remaining.

- Q 1 Solve **any four** 20
- (a) Draw and explain Bluetooth Protocol Stack
 - (b) Explain SNAT in detail.
 - (c) What is the role of VPI and VCI in ATM?
 - (d) Draw and explain Frame format SONET.
 - (e) Explain RMON with respect to network management.
- Q 2 (a) Draw and explain IEEE 802.15.4 LR –WPAN Device architecture. 10
- (b) Explain different network security safe guards in detail. 10
- Q 3 (a) Explain ATM protocol architecture in detail. 10
- (b) Draw and explain frame format of Frame relay. Which bits from format contributes to avoid network congestion? Mention the bits and explain those bits in detail. 10
- Q 4 (a) What is the need of DWDM? Explain working principal of DWDM along with advantages and disadvantages. 10
- (b) Explain OAMP with respect to network management. 10
- Q 5 (a) Explain the steps for completing access layer design in detail. 10
- (b) Why firewall is required in network security? Discuss any two types of firewall. Discuss the limitations of firewall. 10
- Q6 Write a short note on **any four**. 20
- (a) SNMP.
 - (b) Comparison between Ubiquitous and hierarchical access in access network design.
 - (c) Draw and explain cell format of ATM.
 - (d) Wireless sensor network.
 - (e) DMZ.
