ME- SEM. I (CBGS) DEC-2013 3/12/13
EXTC S.S.A.

14-11-13-DTP28-NK-8

Con. 8331-13. **BB-12934**

(3 Hours) **[Total Marks : 80**

N.B. : (1) Attempt any **four** questions out of **six**.
(2) **All** questions carry **equal** marks.
(3) Assume suitable **data**, if **required** and state it **clearly**.

1. (a) Demonstrate that the defination of conditional probability satisfies the three Axioms of probability. **5**
(b) Let the random variable Y be defined by $Y = X^2$ where X is continious Random Variable. Find the CDF and PDF of X. **5**
(c) Consider a random sinusoidal process of the form $x(t) = A \cos(2\pi fot + \theta)$, where θ is uniformly distributed in the Interval $(0, 2\pi)$. Find power spectral density of x(t). **5**
(d) If the input to a time invariant, stable, linear system is WSS process, prove that the output will also be a WSS process. **5**

2. (a) The received signal in an AM system is $y(t) = A(t) \cos(2\pi fct + \theta) + N(t)$. where N(t) is bandlimited while Noise Process with spectral density **10**

$$S_N(f) = \begin{cases} \frac{No}{2} & \text{If } \pm fcl < w \\ 0 & \text{elsewhere} \end{cases}$$

Find signal to Noise ratio of recored signal.
(b) State and prove CENTRAL LIMIT Theorem.

3. (a) Inquires arrive at a recorded message device according to a Poisson process of rate 15 inquires per minute. Find the probability that in a 1-min period, 3 inquiries arrive during the first 10 seconds and 2 inquiries arrive during the last 15 seconds. Find the mean and variance of the time until the arrival of tenth inquiry. **10**
(b) Let X_n be an iid random process. Show that X_n is a Markov process and give it's one-step Transition probability matrix. **10**

4. (a) Consider a random process $x(t) = A \cos(wt + \theta)$, where w is constant, A is random variable with mean zero and variance one and θ is a random variable that is uniformly distributed between 0 and 2π. Assume that the random variables A and θ are independent. **10**
IS x(t) a mean - Ergodic process and correlation Ergodic process.
(b) Show that the Brownian motion process is a Markov process. Find the state transition pdf. **10**

[TURN OVER

5. (a) A company has a system with four private telephone lines connecting two of it's sites. Suppose that requests for these lines arrive according to a Poisson process at a rate of one call every 2 minutes, and suppose that call durations are exponentially distributed with mean 4 minutes. When all lines are busy, the system delays (ie queues) the call request until a line becomes available. Find the probability of having to wait for line. **10**

   (b) A queueing system alternates between two states. In state 0, the system is Idle and waiting for a customer to arrive. This Idle time is an exponential random variable with mean $1/\alpha$. In state 1, the system is busy serving a customer. The time is busy state is an exponential Random variable with mean $1/\beta$. Find the state probabilities $P_0(t)$ and $P_1(t)$ in terms of the initial state probabilities $P_0(0)$ and $P_1(0)$. Also find the state transition probability matrix. **10**

6. Write short notes on the following :- **20**
   (a) Continious and Discrete random process.
   (b) The Kalman filter.
   (c) Little's formula.
   (d) M/G/1 queueing systems.

9/12/13

M.E. (ExTc) Sem I
CBGS
Optical Fiber Comm

3 : 2nd half.13-Avi(be)

Con. 10177-13. **BB-14827**

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** from the **remaining** questions.
(3) **All** questions carry **equal** marks.

Q1(a) . What do you understand by dispersion in optical fiber communication?

(b) Explain the significance of chromatic dispersion compensation fiber in optical fiber communication.

(c) Explain the method to mitigate the effect of FWM in optical fiber communication.

(d) State the principle of RAMAN amplifier. (20)

Q2.(a) A GIF has a parabolic refractive index profile(α=2)and a core diameter of 50μm. Estimate the insertion loss due to a 3μm lateral misalignment at a fiber joint when there is an index matching and assuming that there is uniform illumination of all guided modes. (10)

(b) State the principle of EDFA and state its application. Draw neat labeled diagram. (10)

Q3(a)Explain the principle of resonant cavity enhancement detector. Compare RCE schottky photodiode and RCE avalanche photodiode . (10)

(b)Explain the different losses in the optical fiber communication. Compare linear scattering and non-linear scattering losses. (10)

Q4 (a) Explain the non-linearities in fiber due to intensity dependent variations in refractive index in the fiber. (10)

(b).A lithium Niobate modulator designed for operation at wavelength of 1.3μm is 2cm long with a distance between the electrode of 25 μm. Determine the voltage required to provide a phase change of π radians given that the electro optic coefficient for lithium Niobate is $30.8 \times 10^{-12} mv^{-2}$ and its Refractive index is 2.1 at 1.3μm. (10)

Q5(a) Derive the expression for the largest distance power budget in optical network with proper diagram. (10)

(b) What is Soliton? How is it useful for optical signal communication? (10)

Q6. Write short notes on any three (1) Optical switch (2) Optical multiplexer (3) Optical Modulators (4)optical computing. (20)

ME (EXTC) Sem I CGS 13/12/13

2nd Half-13(11)-PKL-38

Con. 9511-13. Digital Signal Processing & Its Application **BB-12940**

(3 Hours) **[Total Marks : 80**

N. B. : (1) Attempt any **four** questions.
(2) Assume data if **necessary**.

1. (a) How is fast computation achieved in digital signal processors? What is pipelining? **5**
(b) Obtain the polyphase decomposition of the IIR systems with transfer function **5**

$$H(z) = \frac{1-3z^{-1}}{1+4z^{-1}}$$

(c) Explain Periodogram. **5**
(d) Explain Von Neumann and Harward architecture. Why Von Neumann architecture is not suitable for DSP operations. **5**

2. (a) Consider a signal $x(n) = (0{\cdot}8)^n\, u(n)$. Determine the spectrum x(w). The signal x(n) is applied to a decimator that reduces the rate by a factor of 2. Determine the output spectrum and decimated signal. **10**
(b) Determine DFT for a sequence, **10**

$$x(n) = 2\cos\left(\frac{\pi}{4}n\right) - 4\sin\left(\frac{\pi}{2}n\right)$$

Using 8 point DIT–FFT algorithm.

3. (a) Explain power spectrum estimation using Welch method. **10**
(b) Design a linear phase low pass filter with the following specifications:– **10**

$H(K) = 1, \quad K = 0, 1, 2, 3$
$= 0{\cdot}4, \quad K = 4$
$= 0 \quad K = 5, 6, 7$

4. (a) Explain sampling rate conversion. **10**
(b) A digital system is characterized by the difference equation **10**

$y(n) = 0{\cdot}95\, y(n-1) + x(n)$

Dtermine the dead band of the system when $x(n) = 0$ and $y(-1) = 13$

5. (a) Discuss application of DSP for preprocessing of ECG signal. **10**
(b) Explain how single Instruction Multiple Data (SIMP) and Very Large Instruction Word (VLIW) are used for parallel processing in DSP processors. **10**

6. (a) Design a high pass filter using Hanning window with a cut-off frequency 1·2 rad/sec. Length of filter is 9. **10**
(b) Design a Butterworth filter with the following specifications:– **10**

$0{\cdot}7 \le |H(e^{jw})| \le 1 \quad 0 \le |w| \le \pi/2$

$|H(e^{jw})| \le 0{\cdot}2 \qquad \left(\frac{3\pi}{4}\right) \le |w| \le \pi$

Use Bilinear Transformation.

ME|EXTC|I CBGS|9|12|13
VMSCS

Ash9-D:\Data-10

Con. 10327-13. **BB-12949**

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from **remaining** questions.
(3) Assume **suitable** data if **necessary.**
(4) **Figures** to the **right** indicate **full** marks.

1. Solve any **four** :– **20**
   (a) Implement 1-bit adder using static CMOS logic.
   (b) Explain problems associated with MOS switches.
   (c) Draw circuit diagram of MOSFET based two transistor simple current mirror and explain its working.
   (d) For NMOS transistor with $\mu n\, cox = 150\,\mu A/V^2$, $V_{TO} = 1{\cdot}5V$, $V_{DD} = V_{GS} = 5V$. If transconductance 'gm' of MOSFET is 5 ms, then calculate $\left(\frac{W}{L}\right)$ of the MOSFET.
   (e) Explain Hot carrier effect in short channel MOSFET.

2. (a) What are advantages and disadvantages of pass transistor logic in design of VLSI circuits ? How disadvantages of pass transistor logic are overcome ? Explain with the help of suitable example. **10**
   (b) Explain in detail power management and packaging issues in AMS design. **10**

3. (a) Explain advantages and disadvantages of dynamic CMOS logic over standard static CMOS logic. Explain various techniques to overcome these disadvantages. **10**
   (b) What are different performance parameters of Voltage Controlled Oscillator (VCO) ? Explain the same. **10**

4. (a) Explain the importance of MOSFET models like Level-1, Level-2, Level-3 in design of VLSI circuits. Also compare Level-1, Level-2 and Level-3, MOSFET models. **10**
   (b) Draw circuit diagram of CMOS inverter. Explain its static response (Voltage transfer characteristics) and dynamic response (Transient characteristics). Also explain effect of supply voltage on static and dynamic performance of CMOS inverter. **10**

[TURN OVER

5. Design two stage Operational Transconductance Amplifier (OTA) to meet the following specification :– **20**

$A_V > 5000\ {}^{V}/_{V}$, $V_{DD} = 3V$, $V_{SS} = -3V$, phase margin = 60°,

Gain Bandwidth (GB) = 10 MHz, $C_L = 10PF$, Slew Rate > $10\ {}^{V}/_{\mu s}$, V_{out} range = $\pm 2{\cdot}5V$,

ICMR = –1 to 2V. Power dissipation ≤ 2mW.

Calculate voltage gain and power dissipation of designed circuit.

Use following table for material and device parameters. Assume COX $2{\cdot}47\ {}^{fF}/_{\mu m^2}$.

Parameter Symbol	**Description**	**h-channel**	**p-channel**	**Units**
V_{TO}	Threshold voltage (VSB = 0)	$0{\cdot}7 \pm 0{\cdot}15$	$-0{\cdot}7 \pm 0{\cdot}15$	V
K^1	Transconductance (in saturation)	$110 \pm 10\%$	$50 \pm 10\%$	$\mu A/V^2$
γ	Bulk threshold parameter	0·4	0·57	$V^{1/2}$
λ	Channel length modulation	0·04 (L=1μm) 0·01 (L=2μm)	0·05 (L=1μm) 0·01 (L=2μm)	V^{-1}

6. Write short notes on any **three** :– **20**
   (a) PLL Dynamics.
   (b) Analog layout techniques.
   (c) Sources of power dissipation and its reduction in CMOS logic.
   (d) MOSFET scaling.

ME / EXTC / I CBGS 23/12/2013
Embedded Systems (Ele)

Ash8-D:\Data-78

Con. 10202-13. **BB-12961**

(3 Hours) **[Total Marks : 80**

N.B. :(1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions out of remaining **five** questions.
(3) Assume **suitable** data wherever **required** with **justification.**
(4) **Figures** to the **right** indicate **full** marks.

1. For an automatic toll system draw the system diagram and data flow diagram. Explain the system requirements :– **20**
   (a) Hardware requirements
   (b) Software requirements
   (c) Task partition
   (d) Need and type of scheduler
   (e) Release time, deadline and execution time of tasks.

2. (a) Explain how MSP controller can be used for low power applications. **10**
   (b) Explain various components of RTOS. **10**

3. (a) Classify the Real–time spectrum of embedded systems. Give one example. **10**
   (b) Explain 5–stage pipeline of ARM and compare with 3–stage pipeline mechanism. **10**

4. (a) For Task–1: Period = deadline = 3, Execution time = 1, for Task–2: Period = deadline = 5, Execution time = 3. Explain schedule, and utilization factor for a fixed priorities scheduler. **10**
   (b) Explain the mechanism and need of signature generation using interrupt vector table of ARM processor. **10**

5. (a) For the following ARM code explain the data and control flow structure **10**

```
BL   sub 1
...
...
STMFD r13!, {r0–r12, r14}
BL   sub 2
...
...
sub 2 ...
LDMFD r13!, {r0 – r12, Pc}
```

   (b) Explain ARM processor on–chip Flash and RAM interface, performance issues and IVT mapping. **10**

[TURN OVER

6. Explain any **four** of the following:– **20**
   (a) Code density and performance of ARM and THUMB mode.
   (b) Explain various task states.
   (c) I2C bus.
   (d) RTOS design challenges.
   (e) Compare SOC, GPP and DSP.
