(3 Hours) **Max Marks: 80**

Note:
1. **Question No. 1 is compulsory.**
2. **Out of remaining questions, attempt any three questions.**
3. **Assume suitable additional data if required.**
4. **Figures in brackets on the right hand side indicate full marks.**

1. (A) Explain Strong and weak law of large numbers. (05)
   (B) If A and B are two independent events then prove that $P(A \cap \overline{B}) = P(A).P(\overline{B})$. (05)
   (C) Define Power spectral density and prove any two properties. (05)
   (D) State and explain Bayes Theorem. (05)

2. (A) State and prove Chapman-Kolmogorov equation. (10)
   (B) In a factory, four machines A_1, A_2, A_3 and A_4 produce 35%, 10%, 25% and 30% of the items respectively. The percentage of defective items produced by them is 3%, 5%, 4% and 2%, respectively. An item is selected at random. (10)
   (i) What is the probability that the selected item will be defective?
   (ii) Given that the item is defective what is the probability that it was produced by machine A_4?

3. (A) Suppose *X* and *Y* are two random variables. Define covariance and correlation of *X* and *Y*. When do we say that *X* and *Y* are (10)
   (i) Orthogonal,
   (ii) Independent, and
   (iii) Uncorrelated?
   Are uncorrelated variables independent?
   (B) Prove that if input to LTI system is w.s.s. then the output is also w.s.s. (10)

4. (A) A random variable has the following exponential probability density function: $f(x) = Ke^{-|x|}$. Determine the value of *K* and the corresponding distribution function. (10)
   (B) State Central limit theorem and give its significance. (05)
   (C) If $Z=X/Y$, determine $f_Z(Z)$. (05)

5. (A) Write short notes on the following special distributions. (10)
   i) Uniform distribution.
   ii) Gaussian distribution.
   (B) The transition probability matrix of Markov Chain is given by , (10)

$$P = \begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} 0.5 & 0.4 & 0.1 \\ 0.3 & 0.4 & 0.3 \\ 0.2 & 0.3 & 0.5 \end{bmatrix} \end{array}$$

   Find the limiting probabilities?

6. (A) Explain (i) M/G/1 Queuing system. (10)
   (ii) M/M/1/∞ Queuing system.
   (B) Explain Ergodicity in Random Process. (10)
   A Random process is given by $X(t) = 10cos(50t + Y)$
   where ω is constant and *Y* is a Random variable that is Uniformly distributed in the interval $(0, 2\pi)$. Show that $X(t)$ is a WSS process and it is Correlation ergodic.

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[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 remaining
3. Assume suitable data if required and mention it in answer sheet

Q.1
a) Explain SCON Register of 8051 Microcontroller **4**
b) Explain TxD, EA, ALE and PSEN pins of 8051 Microcontroller **4**
c) List and Explain design metrics of Embedded Systems **4**
d) Write short notes on CPSR of ARM7 **4**
e) Explain concept of Cortex-A, the Cortex-R and the Cortex-M **4**

Q.2
a) Explain Internal RAM Organization of 8051 Microcontroller **10**
b) Explain following instructions of ARM7 **10**

```
ADD r0, r1, r1, LSL # 1
ORR r0, r1, r2
LDR r0, [r1, #2]
AND r1, r1, #3
CMP r0,r1,LSR #3
```

Q.3
a) Interface DAC0808 with 8051 microcontroller. Write Assembly language Program to generate triangular waveform **10**
b) Write a program for 8051 microcontroller to generate rectangular waveform of 1kHz and 70% duty cycle at pin P1.1. Assume 8051 is operating at frequency 12MHz. **10**

Q.4
a) Draw and Explain dataflow model of ARM7 **10**
b) Explain Addressing modes of ARM7 Processor with example in each. **10**

Q.5
a) Explain the Memory Interfacing of 8051 with 16K*8 Data RAM and 16K* 8Data ROM **10**
b) Discuss Digital camera as an Embedded System **10**

Q.6 Write short notes on (**Any Two**)
1) 8051 Addressing modes with example **10**
2) Interrupts in 8051 **10**
3) 8051 Timer operating modes **10**

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QP CODE : 22615

(3 Hours) **Marks : 80**

N.B. : (1) Question **No. 1** is **compulsory.**
(2) Solve **any three** questions from the remaining **five.**
(3) Figures to the right indicate full marks
(4) Assume suitable data if necessary and mention the same in answer sheet.

Q.1 Attempt **any four** out of the remaining **five** [20]
a) Compare striplines and Microstrip lines.
b) Explain how Richard's transformation and unit elements are useful in RF filter designing.
c) Explain near field and far field radiation related to antenna.
d) Write briefly about antenna array.
e) What are characteristics of Horn antenna ?

Q.2 a) Explain with equivalent circuits the RF behaviour of resistor, capacitor and inductor. [10]
b) Design a low pass composite filter with cut-off frequency 3 MHz and impedance of 75 Ω. Place infinite attenuation pole at 3.08 MHz. [10]

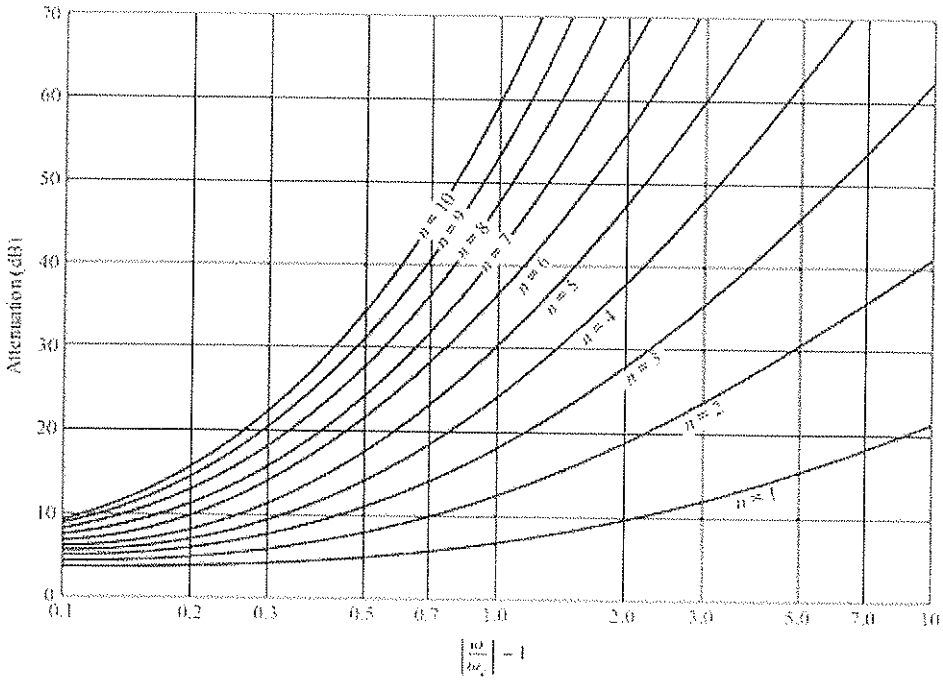
Q.3 a) Design a maximally flat low pass filter with a cut-off frequency of 2 GHz, impedance of 50 Ω, and at least 15 dB insertion loss at 3 GHz with discrete LC components. [10]
b) Explain the following terms related to basic antenna concepts with relevant equations. [10]
[i] Gain and Directivity
[ii] Radiation Pattern
[iii] Radiation Resistance
[iv] Antenna Efficiency
[v] Effective aperture

Q.4 a) Derive radiation resistance of infinitesimal dipole. [10]

b) Find the radiation pattern of an array of 2 isotropic point sources fed with same amplitude and opposite phase and spaced λ/2 apart. Find its HPBW and FNBW. [10]

Q.5 a) Explain working principle of Yagi-Uda antenna and draw its radiation pattern. Mention its applications. [10]
b) Draw the structure of microstrip antenna. Discuss its characteristics, limitations and applications. [10]

Q.6 Write short notes on the following : [20]
a) Hazards of electromagnetic radiation
b) Friss transmission formula
c) Loop antenna
d) Principle of parabolic reflector antenna



Attenuation versus normalized frequency for maximally flat filter prototypes.

Adapted from G. L. Matthaei, L. Young, and E. M. T. Jones, *Microwave Filters, Impedance-Matching Networks, and Coupling Structures*, Artech House, Dedham, Mass., 1980, with permission.

Element Values for Maximally Flat Low-Pass Filter Prototypes ($g_0 = 1$, $\omega_c = 1$, $N = 1$ to 10)

N	$g1$	$g2$	$g3$	$g4$	$g5$	$g6$	$g7$	$g8$	$g9$	$g10$	$g11$
1	2.0000	1.0000									
2	1.4142	1.4142	1.0000								
3	1.0000	2.0000	1.0000	1.0000							
4	0.7654	1.8478	1.8478	0.7654	1.0000						
5	0.6180	1.6180	2.0000	1.6180	0.6180	1.0000					
6	0.5176	1.4142	1.9318	1.9318	1.4142	0.5176	1.0000				
7	0.4450	1.2470	1.8019	2.0000	1.8019	1.2470	0.4450	1.0000			
8	0.3902	1.1111	1.6629	1.9615	1.9615	1.6629	1.1111	0.3902	1.0000		
9	0.3473	1.0000	1.5321	1.8794	2.0000	1.8794	1.5321	1.0000	0.3473	1.0000	
10	0.3129	0.9080	1.4142	1.7820	1.9754	1.9754	1.7820	1.4142	0.9080	0.3129	1.0000

Source: Reprinted from G. L. Matthaei, L. Young, and E. M. T. Jones, *Microwave Filters, Impedance-Matching Networks, and Coupling Structures*, Artech House, Dedham, Mass., 1980, with permission.

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Time: 3 hours **Marks: 80**

N.B: 1. Questions.no.1 is compulsory.
2. Attempt any three questions out of remaining five.
3. Figures to the right indicate full marks.
4. Assume suitable data if required and mention the same in answer sheet.

Q.1 Solve **any four**. 20

a) Explain the difference between wideband FM and narrowband FM.
b) With the help of circuit diagram explain Delayed AGC.
c) Define Thermal Noise and describe its relationship with temperature and bandwidth.
d) What are the major factors influencing the choice of the intermediate frequency?
e) Explain Time Division Multiplexing.

Q.2 a) Draw the block diagram for an AM super-heterodyne receiverand describe its operation and primary functions of each stage with waveforms. 10

b) With the help of block diagram explain Phase Shift method of SSB generation. 10

Q.3 a) Explain generation and detection of Delta Modulation with the help of suitable block diagram also explain slope overload and granular noise. 10

b) Derive the relationship between total transmitted power and carrier power of AM signal. Calculate its transmission power efficiency. 10

Q.4 a) What are different methods of FM generation? Sketch the circuit and explain the principle of reactance modulator. 10

b) Explain generation and demodulation of PWM signal with the help of suitable diagrams and waveforms. 10

Q.5 a) With the help of circuit diagram and characteristics curve explain Balanced slope FM detector. 10

b) Explain in detail vestigial side band (VSB) system. Mention its applications. 10

Q.6 Solve **any four.** 20

a) Explain the difference between correlated and uncorrelated noise.
b) Explain sensitivity and selectivity.
c) Justify why FM is more immune to noise.
d) Compare FDM and TDM.
e) Explain Aliasing error and Aperture effect.

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

N.B.: (1) Question No. 1 is **compulsory**.
(2) Solve any **three** questions from the remaining **five**
(3) **Figures** to the **right** indicate **full** marks
(4) Assume suitable data if necessary and mention the same in answer sheet.

Q.1 Attempt **any 4** questions

(a) What is the need of negative feedback in op-amp based circuit? **[05]**

(b) What is input offset voltage and output offset voltage of an op-amp? How to measure it practically? **[05]**

(c) With the help of a neat circuit diagram explain the working of Multiplier 534. **[05]**

(d) Give the working principle of switching regulator. **[05]**

(e) Draw mod-10 ripple counter using IC 7490. **[05]**

Q.2 (a) Draw the circuit diagram of a square and triangular waveform generator using op-amps and explain its working with the help of waveforms. For variation in duty cycle what is the modification needed in the circuit. **[10]**

(b) Explain IC 555 as astable multivibrator and hence design an astable multivibrator using IC 555 to obtain 50% duty cycle. **[10]**

Q.3 (a) Design a second order Butterworth high pass filter for cut off frequency of 1 kHz and pass-band gain of AF=2. **[10]**

(b) With the help of a neat circuit diagram explain the working of IC 74163 synchronous 4 bit binary counter. **[10]**

Q.4 (a) Design a voltage regulator using IC 723 to give output voltage V_o = 5 V to 15 V and output current of 2 A. **[10]**

(b) With a neat circuit explain the working of window detector using op-amp. Give its application. **[10]**

Q.5 (a) Draw a neat circuit diagram of *RC* phase shift oscillator using op-amp. Derive its frequency of oscillation. What are the values of *R* and *C* if its frequency of oscillation is 2 kHz? **[10]**

(b) Draw a mod-10 counter using IC 7493. Draw its timing diagram. **[10]**

Q.6 Write a note on: **(Attempt any two)**

a) Instrumentation amplifier. **[10]**

b) Full wave precision rectifier. **[10]**

c) 74181 ALU. **[10]**

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