N.B.:

1. Question No.1 is compulsory

2. Solve ANY THREE questions from Q2 to Q6

3. Assume suitable data wherever necessary and state it clearly.

Q.1. Answer ANY FIVE

(a) An Analog Signal is band limited to 8 Hz sampled at Nyquist rate and Quantized at 5 levels with probabilities 0·5, 0·125, 0·0625, 0·25 and 0·0625. Calculate entropy and information. (4)

(b)Explain with neat block diagram the Matched filter. (4)

(c) What is optimum receiver? Explain in detail. (4)

(d) Explain Lempel-Ziv Coding in detail (4)

(e)What is EYE PATEERN? Explain its significance. (4)

(f) Differentiate between Source Coding and Channel Coding. (4)

(g) State and explain central limit theorem. (4)

(h)State and explain Shannon's theorem. (4)

(i)Why MSK is called shaped QPSK? (4)

Q2. (a) A discrete memory less source has an alphabet of five symbols with the probabilities-

Symbol	S1	S2	S3	S4	S5
Probability	0.40	0.19	0.16	0.10	0.15

(I)Construct Huffman code

(II)Calculate code efficiency and the redundancy of the code. (10)

(b) What is Pseudo-noise (PN) Sequence in spread spectrum technology? Why they are used in spread spectrum modulation system? (06)

(c) State and explain Inter channel and Inter symbol interference (04)

Q3. (a) Show that for an input signal which is a sequence of rectangular positive and negative pulses, the integrator is the matched filter. (10)

(b) Explain 4-ary PSK along with the following line:- (10)

(I)Modulation and demodulation block diagram of offset QPSK.

(II) Plot the Power Spectral density with relevant frequencies and hence Bandwidth.

(III) Signal space representation hence Euclidian distance.

Q.4. (a) Compare between slow frequency hopping and fast frequency hopping.Assume the data and PN sequence for the same. (10)

(b) Define antijam characteristics of spread spectrum system. If the direct sequence spread spectrum system has the following parameters. (10)

Data sequence bit duration Tb=6.125 ms

PN chip duration Tc=1.5 microseconds

The probability of error is less than 10^{-5} (Eb/No=10)

Then calculate processing gain and gain margin

Q.5. **(a) With the help of neat block diagram and waveform, explain how a message transmitted in BFSK? What type of receiver is used for BFSK reception?** **(10)**

(b) Prove that for the 16-ary QASK digital modulation technique, the Euclidean distance is given by: $d = 2\sqrt{0 \cdot 4}\, Eb$
Where Eb is normalized energy per bit also draw signal constellation diagram for 16-ary QPSK and Compare with 16-ary QASK. **(10)**

Q.6. **Answer ANY FOUR of the following**

(a) Explain significance of AWGN channel. **(5)**

(b)Explain Line codes and their desirable properties **(5)**

(c) Differentiate between BPSK, DPSK and DEPSK. **(5)**

(d)Define Hamming codes. Show that the Hamming Code corrects only single bit error. **(5)**

(e)Decoding of Convolutional codes using Viterbi algorithm **(5)**

(f) explain with suitable example the cyclic codes. **(5)**

EEM (ETRX) V (CBGS)

T3225 / T0492 ELECTROMAGNETIC ENGINEERING

Q. P. Code : 13677

REVISED COURSE

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

N. B. (1) Question no 1 is compulsory

(2) Solve any 3 questions from remaining 5 questions

(3) Draw a neat and clean diagram whenever necessary

(4) Assume suitable data if required

Q 1. Answer the following (Any 4) **(20)**

a) Compare MOM, FDM, and FEM.

b) State and explain Biot Savart's Law.

c) Derive wave equations for time varying harmonic fields.

d) Define: Critical frequency, Virtual height.

e) Define skin depth and derive depth of penetration in good conductors.

Q2. a) Derive Maxwell equations for time varying fields in point and integral form. **(10)**

b) State pointing theorem .Derive an expression for pointing vector with significance of each term. **(10)**

Q3. a) A 10 GHz plane wave travelling in free space has amplitude of $E_x = 10$ V/m. Find V, λ, β, η and the amplitude and direction of **H**. **(10)**

b) Derive the expression for the reflection and transmission coefficient in case of reflection from Perfect dielectrics at a) Normal Incidence b) Oblique incidence. **(10)**

Q4. a) Explain method of moments (MOM). Also state its advantages and drawbacks. **(10)**

b) Define directivity and gain of an antenna. An antenna has a loss resistance of 10 ohm, power gain of 20 and directivity of 22. Calculate the radiation resistance. **(10)**

Q5. a) Explain principle modes of operation of a helical antenna and draw its radiation pattern. **(10)**

b) Derive boundary conditions for electric field at a boundary between 2 dielectrics. **(10)**

Q6. a) Explain factors affecting field strength of a space wave signal. **(10)**

b) Define critical frequency and MUF. Also derive an expression for MUF. **(10)**

Q. P. Code: 25077

[Time: 3 hours] **[Marks: 80]**

Note:-1. Q.1 is compulsory

2. Out of remaining 5 solve any 3

3. Figures to the right indicate full marks

Q.1 **Solve any 4**

a. Explain any 5 addressing modes of 8051 with 1 example. 5

b. Explain how Thumb mode improves code density .Give 2 instructions to switch between ARM and thumb mode. 5

c. Connect 2 LED's to p1.1 and p1.2 of 8051 µc respectively .show interfacing diagram and write a program to blink the two led's alternately with a delay of 1 msec. 5

d. Write a program for 8051µc to find factorial of number 05H 5

e. Explain following instructions of 8051 µc 5

i) MOV A,@R0 ii) SETB bit iii) JNC rel iv) MOVCA, @A+DPTR v) CPL C

f. Explain operation of barrel shifter in ARM 7 TDMI 5

Q.2 a. Draw and explain memory organization of 8051 µc 10

b. Explain various modes of operation of ARM7 TDMI with associated registers. 10

Q.3 a .Write a program to generate a square wave of frequency 50 HZ on port pin P2.3 of 8051 µc. Show count calculations clearly and the required TMOD settings. 10

b. Explain the structure of I/O ports of 8051 µc with neat diagram. 10

Q.4 a. Interface an 8 bit ADC to 8015 µc and explain its working in detail. 10

b. Write an assembly language program for sending message "BEST" serially at 9600 baud continuously using 8051 . 10

Q.5 a. Explain following ARM instructions 10

i) ADD R3, R2, R1 ii) CMP R8, R2 iii) TST R2, R5 iv) STMFD R13 [R0- R2, R14] v) CMN R1, R2

b. Design 8051 based system with following specifications 10

i) 16 Kb RAM using 8 Kb devices

ii) 16 Kb ROM using 8 Kb devices

show detailed memory map and chip select logic .Draw interfacing diagram.

Q.6 Write short notes on **any 4** 20

a. Power saving modes of 8051

b. DC motor interfacing with 8051 µc

c. Key architectural features of ARM7TDMI

d. Interrupt structure of 8051

e. Interfacing 16x8 LCD to 8051µc

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Time: 3 Hrs. **Total Marks: 80**

NOTE: - 1) Question number 1 is compulsory.
2) Attempt any three questions from the remaining five questions.
3) Assume suitable data wherever necessary.

Q1	a	Verify periodicity of the following continuous time signals. If Periodic, find the Fundamental period. (i)$x(t)= 3 \cos (5t+\pi/6)$ (ii) $x(t)=e^{-j2\pi t/7}$	5
	b	Prove that, Fourier transform of convolution of two signals is the product of the Fourier transform of the individual signals.	5
	c	What is the general condition for stability of a discrete time LTI system in z-domain?	5
	d	Find the convolution of following signals using Laplace Transform. X(t)=cos(t).u(t), y(t)=t.u(t)	5
Q2	a	Show that for LTI discrete time system, the inverse z-transform of transfer function is the impulse response of the system	4
	b	Determine power or energy of the following continuous time signal: (i) $x(t)=e^{-2t}.u(t)$ (ii) x(t)=3 cos(5mt)	4
	c	Determine whether the following systems are linear/nonlinear, time variant/invariant, causal/noncausal, and stable/unstable. (i) y (t) = 3 X(t) +5 (ii) y (t) = sin(t). x(t)	12
Q3	a	Determine inverse Z transform for the following functions: 1) $x(z) = \frac{1}{1-15z^{-1}+0.5z^{-2}}$ 2) $x(z) = \frac{1}{(1+z^{-1})(1-z^{-1})^2}$	10
	b	Determine the impulse response sequence of the discrete time LTI system defined by Y(n) – 3y(n-1) -4y(n-2) = x(n) + 2x(n-1)	10

Turn Over

Q4 a State the sampling theorem. Consider an analog signal x (t) = 10 cos 100πt. If the sampling frequency is 75 Hz, find the discrete time signal x (n). 10

Also find an alias frequency corresponding to the sampling frequency of 75 Hz.

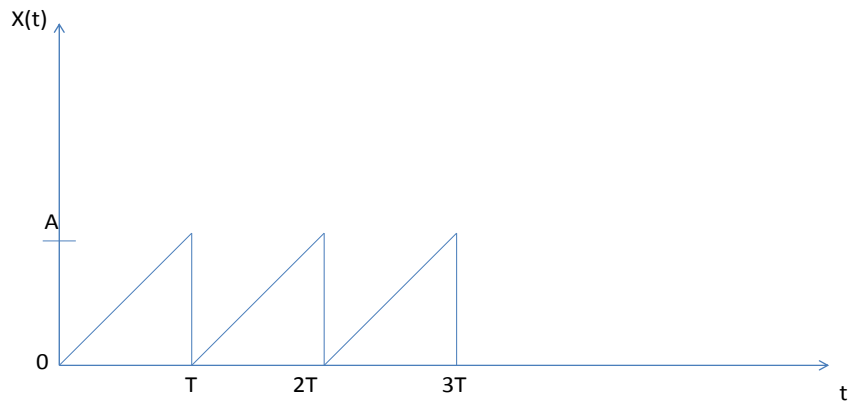
b Determine the complete response of the system described by the equation : 10

$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$;

y (0) = 0 ; $\frac{dy(t)}{dt} = 1 \; at \; t = 0$

For the input, $x(t) = e^{-2t}u(t)$

Q5 a Determine the trigonometric form of Fourier series for the ramp signal shown in figure:- 10



Turn Over

	b	Obtain inverse Laplace transform of $X(s) = \frac{2s^2+5s+5}{(s+2)(s+1)^2}$ for all possible ROC conditions.	10
Q6	a	Perform convolution of the following signals, by graphical method and sketch the resultant signal. $X1(t) = e^{-3t}u(t)$ and $X2(t) = t\,u(t)$	10
Q6	b	Determine the Fourier transform of the periodic impulse function shown in figure:-	10