

POSSESSION OF MOBILES IN EXAM IS UFM PRACTICE.

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Jaypee Institute of Information Technology, Noida
End Term Examination, Even Semester 2022-2023
B.Tech. 4th Semester

Course Title: Digital Systems
Course Code: 18B11EC213

Maximum Time: 2Hr.
Maximum Marks: 35

After pursuing the above mentioned course, the students will be able to

- CO1: Familiarize with fundamentals of number systems, Boolean algebra, and Boolean function minimization techniques.
- CO2: Analyze and design combinational circuits using logic gates.
- CO3: Analyze state diagram and design sequential logic circuits using flip flops.
- CO4: Understand the classification of signals & systems and learn basic signal operations & Fourier analysis.
- CO5: Understand various steps involved in digitization and transmission of a signal.

Note: Attempt all questions. All questions are compulsory.

- Q.1. Simplify the given Boolean function $f(A, B, C, D)$ using K-Map. Find all prime implicants and essential prime implicants also.

$$f(A, B, C, D) = BD + ACD + A'BC + ABC' + A'C'D$$

- Q.2. (a) Realize a 4 to 16 decoder using 2 to 4 decoder. [CO1, 5]

- (b) Implement the following Boolean function using 4×1 MUX and external logic gates. [CO2, 2]

$$f(x, y, z, w) = \sum m(1, 2, 3, 4, 5, 9, 11, 13, 14)$$

Use x and y variables as selection lines.

- Q.3. Design a decade down ripple counter which counts from 1001 to 0000. If counter is in any unwanted state, the next clock pulse will make the counter to go to its initial state. [CO2, 3]

- Q.4. (a) Find the energy and power of the given signal and check if it is energy signal, power signal or neither energy nor power signal. [CO3, 5]

$$x(t) = tu(t)$$

- (b) Check the given systems for linearity and causality properties. [CO4, 2]

$$(i) y(t) = x(t) + 3$$

$$(ii) y(t) = t^2 x(t/2)$$

- Q.5. (a) Consider a periodic signal given below [CO4, 3]

$$x(t) = 2 + \cos\left(\frac{2\pi}{3}\right) + 4 \sin\left(\frac{5\pi}{3}\right)$$

Find the Fourier series coefficients of the signal $x(t)$.

[CO4, 2]



(b) Find the Fourier transform of signal $x_1(t)$ defined as

$$x_1(t) = e^{\frac{j\pi t}{2}} x(t)$$

where $x(t)$ is given as follows

$$x(t) = \begin{cases} 1 & \text{for } |t| \leq 2 \\ 0 & \text{for } |t| > 2 \end{cases}$$

[CO4, 3]

Q.6. An AM wave is represented by the following expression:

$$s(t) = (5 + 3 \cos(2000\pi t)) \cos(672 \times 10^3 \pi t)$$

Find

- (i) Minimum and maximum amplitude of AM wave.
- (ii) Frequency components present in AM wave.
- (iii) Modulation Index.
- (iv) Total transmitted power.

[CO5, 4]

Q.7. (a) For the given digital modulation schemes, draw the output waveform of transmitter if input binary signal is 1001011.

- (i) BFSK
- (ii) BPSK

[CO5, 2]

(b) In a PCM system the message signal $m(t) = [6 \cos(100\pi t)]$ V is sampled at the rate 20% above Nyquist rate. The samples are processed by uniform quantizer with step size 0.024V. Determine

- (i) Number of bits required to encode each sample.
- (ii) Minimum data rate of PCM system.
- (iii) Minimum bandwidth required to transmit the signal.
- (iv) Output signal to quantization noise ratio in dB.

[CO5, 4]