QP Code : 30052

Duration 03 Hours   Total Marks assigned to the paper 80

Marks assigned to each question should be stated against each question.

Instructions to the candidates, if any:-

N.B.:

    1) Attempt any **Four** questions from the **Six** questions
    2) Assumptions made should be clearly stated.
    3) Figures to the right indicate full marks.
    4) Illustrate answer with sketches wherever required.
    5) Use of **Normal** table is permitted.

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1   (a)   If X_1, X_2, ..., X_n are the Poisson variates with parameter $\lambda = 2$, use the central limit   10
        theorem to estimate $P(120 \leq S_n \leq 160)$ where $S_n = X_1 + X_2 + \ldots + X_n$ and $n = 75$.

    (b)   Define random process and give a detailed classification of random process with   10
        examples of discrete and continuous random process.

2   (a)   Let $X = N(\mu; \sigma^2)$. Find μ_X and σ_X^2 10

    (b)   Consider the random process $X(t)$ defined by   10
           $X(t) = Y \cos(\omega t) \qquad t \geq 0$
        where ω is a constant and Y is a uniform r.v. over $(0, 1)$.
           i.   Find $E(X(t))$
           ii. Find the autocorrelation function of $X(t)$.
           iii. Find the autocovariance function of $X(t)$.

3   (a)   Let $X(t) = a \cos(2\pi f_0 t + \Theta)$ where Θ is uniformly distributed in the interval $(0, 2\pi)$. Find   10
        $S_X(f)$.

    (b)   Write a detailed note on Kalman filter.   10

4   (a)   The time elapsed between the claims processed is modeled such that T_k represents the   10
        time elapsed between processing the $(k\text{-}1)^{\text{th}}$ and k^{th} claim where T_1 is the time until the
        first claim is processed, etc.
         You are given
           I. T_1, T_2, ... are mutually independent; and
           II.   The pdf of each T_k is $f(t) = 0.1\, e^{-0.1t}$, for $t > 0$
                where t is measured in half-hours.
        i.   Calculate the probability that at least one claim will be processed in the next 5 hrs?
        ii.   What is the probability that at least 3 claims processed within 5 hrs?
    (b)   Find the optimum causal filter for estimating a signal $Z(t)$ from the observation   10
        $X(t) = Z(t) + N(t)$

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where $Z(t)$ and $N(t)$ are independent random processes, $N(t)$ is a zero-mean white noise with noise density 1 and $Z(t)$ has power spectral density

$\quad S_Z(f) = 2/(1 + 4\pi^2 f^2)$.

Find the Wiener optimum filter.

5　(a)　Describe each of the following random walks with corresponding transition matrix:　10
General 1-D random walk, random walk with absorbing barriers, random walk with reflecting barriers, and cyclic random walk.

　　(b)　State and explain Bayes' theorem.　　　　　　　　　　　　　　　　05

　　(c)　Give the classification of Markov states.　　　　　　　　　　　　05

6　(a)　Explain the concept of a typical queueing system with a suitable block diagram.　05

　　(b)　State and explain Little's formula.　　　　　　　　　　　　　　05

　　(c)　Explain in detail M/M/1 queueing system.　　　　　　　　　　　10

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QP Code : **30055**

(3 Hours) [Total Marks : 80

N.B. : (1) Attempt any **four** questions out of **six** questions.
(2) All questions carry **equal** marks.

1. (a) State the difference between dispersion shifted and dispersion compensated fibers. 5
   (b) Explain SONET. 5
   (c) Explain the concept of Electrical bandwith versus Optical bandwith with necessary equation. 5
   (d) Describe Fiber Bragg Grating. 5

2. (a) Explain the different phenomena responsible for signal degradation as the light wave propagates through an optical fiber. 10
   (b) Explain any one fiber fabrication process with neat diagram and state its advantages. 10

3. (a) Explain the principle of Resonant cavity enhancement detector. Compare RCE schottky Photodiode and RCE avalanche photodiode. 10
   (b) Explain the working of semiconductor optical amplifier and compare it with erbium doped laser amplifier and Raman amplifier. 10

4. (a) What are the different netwrok topoligies ? Explain in detail. 10
   (b) Describe in detail Optical Modulators. 10

5. (a) What is Soliton ? How is it useful for optical signal communication ? 10
   (b) Discuss various types of nonlinearities in optical communication ? 10
   A long single-mode optical fiber has a attenuation of 0.5 dBkm⁻¹ when operating at a wavelength of 1.3 μm. The fiber core diameter is 6·μm and the laser source bandwith is 600 GHz. Compare the threshold optical power for stimulated Brillouin and Raman scattering withing the fiber at the wavelength specified.

6. Write Short notes on any two :— 20
   (a) Four wave mixing.
   (b) Photonic crystal fibers.
   (c) Optical MEMS.

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(3 Hours) [Total Marks : 80

N.B.: (1) Attempt any **four** questions
(2) Assume suitable data wherever necessary, justify the same
(3) Figures to the **right** indicate **full marks**

1. a. Explain in brief real time DSP system. 5
    b. Explain sampling rate conversion by non-integer factors 5
    c. Explain very long instruction word (VLIW) architecture used for P-DSPs. 5
    d. Explain how power spectral density of a given 5 volts and 1000Hz 5
       sinusoidal discrete time sequence of 1024 data points, sampled at
       5000Hz is calculated using FFT.

2. a. Compute 8-point DFT of sequence $x(n) = \{1, 2, 3, 4, 1, 2, 3, 4\}$ using DIF- 10
       FFT algorithm
    b. A cascade realisation of the two first order digital filter is shown below. 10
       The system functions of the individual sections are

    $$H_1(z) = \frac{1}{1 - 0.9z^{-1}} \text{ and } H_1(z) = \frac{1}{1 - 0.8z^{-1}}$$
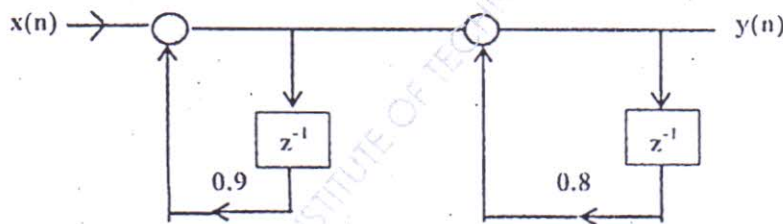

    Draw product quantisation noise model of the system and determine
    the overall output noise power.

3. a. Design a band pass FIR filter for the following specifications 10
       Cutoff frequencies = 400 Hz to 800 Hz
       Sampling frequency = 2000Hz
       Filter length = 11
       Use rectangular window
    b. Design IIR digital Butterworth filter to satisfy the constraints 10
       $0.707 \le |H(e^{j\omega})| \le 1$ $\quad 0 \le \omega \le 0.5\pi$ and
       $|H(e^{j\omega})| \le 0.2$ $\quad 0.75\pi \le \omega \le \pi$
       With T = 1sec. Apply Bilinear transformation.

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4. a. Implement a two stage decimator for the following specifications — 12
        Sampling Frequency   =   20KHz
        Decimation factor 'D'   =   100
        Passband   =   0 Hz to 40 Hz
        Transitionband   =   40 Hz to 50 Hz
        Passband ripple   =   0.02
        Stopband ripple   =   0.002

    b. The spectrum of discrete time signal is as shown in figure B. Sketch — 8
        the spectrum of
        i)

Fig B
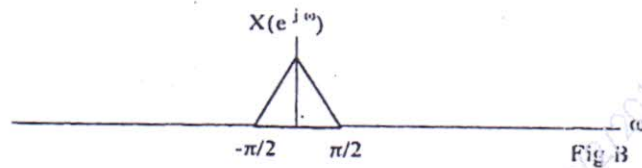
5. a. Define periodogram and explain how DFT and FFT are useful in power — 6
        spectral estimation
    b. What are limitation of non-parametric methods in spectral estimation — 6
    c. Discuss powet spectrum estimation using Welch method — 8

6. Write short notes on **any Four** — 20
    i)   Audio applications of DSP
    ii)   Telecommunication applications of DSP
    iii) Biomedical applications of DSP
    iv)   General purpose digital signal processors
    v)   Polyphase implementation of Decimator and Interpolator
    vi)   Effect of finite word length in digital filters

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Q.P. Code : **30069**

(3 Hours) | Total Marks :80

N.B. : (1) Attempt any Four questions out of Six question.
(2) Assume suitable data if necessary. But justify the same.

1. (a) What parameters govern the lower and upper limit of frequency at which a satellite can operate? What are the various services offered by satellite communication system. **10**

(b) How a transparent repeater is different from regenerative repeater. Explain regenerative repeater with the help of a block diagram. **10**

2. (a) What is the significance of link budget? Why back off is considered in multicarrier satellite communication link budget equation. Derive an expression of uplink received power in terms of transmitted power Gain of transmitted and received antenna and other suitable parameters. **10**

(b) A receiving system consists of an antenna with noise temple of 60K. Its output is fed to a LNA having gain of 30 dB and noise temperature of 100K The coaxial line connecting LNA and main receives has a loss of 2dB and noise figure of 10 dB. Calculate system noise temperature referred to input. **10**

3. (a) What are Kepler's law. Why a satellite's orbit deviate from the prediction of kepler's law. What is the effect of atmospheric drag and non-spherical shape of earth on keplerian orbit? **12**

(b) What do you understand by cross polar discrimination and polarization isolation. **8**

4. (a) How a satellite is launched into geostationary orbit from the earth. Why a launching site should be located close to the equator. **10**

(b) Explain with the help of diagram working of a cassegrain parabolic reflector antenna. What are advantages of this antenna over a front feed parabolic reflector antenna. **10**

5. (a) Telemetry tracking and command plays an important rale in satellite communication system. Justify it. Explain its working with help of a block diagram. **10**

(b) Draw a typical block diagram of transmit receive earth station. Explain its working. Explain and compare heavy, medium and thin runte traffic. **10**

6. (a) What do you understand by reliability. How reliability of a satellite communication system can be increased. **10**

(b) Explain what is meant by satellite attitude and briefly describe two forms of attitude control. **10**

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BB-Con. 9812-15.

Q.P. Code : **30082**

(3 Hours) [Total Marks : 80

N.B. : 1) Question No. 1 is compulsory.
2) Solve any three out of remaining questions
3) Figures to the right indicate full marks.

1. A What is effect of NGN on the market definition and failure?   5
   B Explain the concept of "5C and 5 any" of ubiquitous networking.   5
   C What are the general requirements of NGN IPv6 based networks?   5
   D What are the benefits to the customers with NGN?   5

2. A How are NGN QOS classified? What are the factors affecting the classes of   10
      service?
   B Explain the functional architecture of GSI-NGN.   10

3. A Write a note on control and signaling protocol for NGN.   10
   B Explain the various naming, numbering and addressing scheme in NGN.   10

4. A How NGN influences on overall economic growth?   10
   B Write a note on IP Multimedia Subsystem for NGN.   10

5. A What are various next generation mobile service? Explain.   10
   B How IP-based networks are classified? Compare IPV4 and IPV6 based   10
      NGN.

6. Attempt any two :   20
   A Session Initiation Protocol
   B Threats and vulnerability in security mechanism in NGN
   C Mobile IPTV service with challenges and application
   D Location Based Services (LBS) and Content Based Services (CBS)

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