

## COMMUNICATION ENGINEERING

*Time: Three Hours*

*Maximum Marks: 100*

*Answer five questions, taking ANY TWO from Group A, any two from Group B and all from Group C.*

*All parts of a question (a, b, etc. ) should be answered at one place.*

*Answer should be brief and to-the-point and be supplemented with neat sketches.*

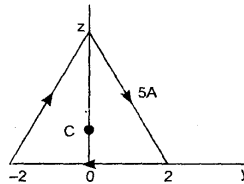
*Unnecessary long answer may result in loss of marks.*

*Any missing or wrong data may be assumed suitably giving proper justification.*

*Figures on the right-hand side margin indicate full marks.*

### Group A

1. (a) State and prove Stoke's theorem. 8
- (b) State and explain Poisson's equations and Laplace equation. 6
- (c) Obtain capacitance between two concentric conducting spheres. 6
  
2. (a) State and explain Biot Savart law for the magnetic flux density. 6
- (b) Derive Ampere's law using the concept of magnetic vector potential. 8
- (c) Find H at the centre C of an equilateral triangular loop of side 4 m carrying 5 A of current as shown in figure. 6



3. (a) State and explain Parseval's theorem for energy signals. 8
- (b) Define auto-correlation, convolution and power spectral density. 6
- (c) Explain stationary and non-stationary random process. 6

4. (a)  $x(t) = A \cos(2\pi ft + \theta)$ , where A is a constant and f and  $\theta$  an independent random variable, the probability density functions of  $\theta$  is 8

$$f_{\theta}(\theta) = \begin{cases} \frac{1}{2\pi} & 0 \leq \theta \leq 2\pi \\ 0 & \text{otherwise} \end{cases}$$

Find the power spectral density of x(t) in terms of probability density function of the frequency f.

- (b) Describe the following (i) Atmospheric noise (ii) thermal noise (iii) shot noise (iv) partition noise 6
- (c) What is importance of noise figure? Describe in brief the experimental determination of noise figure of an amplifier. 6

### **Group B**

5. (a) Define amplitude modulation and draw the wave shapes for following: 8  
(i) AM-DSB (ii) AM-DSB/SC (iii) AM-SSB  
Also establish a comparative study between all the classes of amplitude modulation.
- (b) Describe the principle of synchronous detection method for DSB-SC signals. 6
- (c) Describe the Armstrong method of producing frequency modulation and state its advantages and disadvantages. 6
6. (a) A frequency modulated signal which is modulated by a 3 kHz sine wave reaches a maximum frequency of 100.02 MHz and minimum frequency of 99.98 MHz. Determine (i) carrier swing (ii) carrier frequency (iii) frequency deviation of the signal (iv) modulation index of the signal. 8
- (b) What is Pulse Width Modulation? How is it demodulated? Explain with waveforms how pulse position modulation is derived from PWM? 6
- (c) Explain a PCM generation scheme with the aid of a neat sketch. 6
7. (a) Obtain the expressions for mean square value of error introduced by linear quantization process in a PCM system. 8
- (b) Explain with block diagram the transmission and reception of DPCM 6

- system. Explain the use of quantizer and prediction filter in such systems.
- (c) Define rate of information, joint entropy, conditional entropy, mutual information and redundancy. 6
8. (a) Define channel capacity? Derive an expression for the capacity of binary symmetric channel. 8
- (b) Define channel capacity. Draw the transition probability diagram of a binary symmetric channel and derive an expression for its capacity in terms of probability. 6
- (c) Write short notes on matched filter. Derive an expression for impulse response of matched filter. 6

***Group C***

9. Answer the following in brief: 20
- (i) Companding is used
- (a) to overcome quantizing noise in PCM.
  - (b) in PCM transmitters to allow amplitude limiting in receivers.
  - (c) to protect small signals in PCM from quantizing distortion.
  - (d) In PCM receivers to overcome impulse noise.
- (ii) Quantizing noise occurs in
- (a) TDM
  - (b) FDM
  - (c) PWM
  - (d) PCM
- (iii) The percentage saving in power in case of a 100% modulated AM signal transmitted as DSB-SC as compared to the one transmitted as DSB is
- (a) 50 %
  - (b) 33.33 %
  - (c) 66.66 %
  - (d) 75 %
- (iv) Major advantage of Armstrong modulator is that
- (a) It is capable of producing WBFM signals

- (b) The centre frequency (carrier frequency when unmodulated) is extremely stable
  - (c) A large depth of modulation can be achieved
  - (d) None of these
- (v) Which of the following is not the modulation type for modem specification ?
- (a) VSB
  - (b) FSK
  - (c) ASK
  - (d) PSK
- (vi) In an ergodic process ensemble and time averages are
- (a) opposite to each other
  - (b) different
  - (c) identical
  - (d) none of the above.
- (vii) In AM, the modulation index lies between
- (a) -1 and 1
  - (b) 0 and 1
  - (c) 1 and  $\infty$
  - (d)  $-\infty$  and  $\infty$
- (viii) Thermal noise power is proportional to
- (a) B
  - (b)  $\sqrt{B}$
  - (c)  $1/B^2$
  - (d)  $B^2$
- (ix) To separate channels in the FDM receiver, it is necessary to use
- (a) AND gates;
  - (b) BP filters
  - (c) differentiators;
  - (d) integrators.
- (x) A pre-emphasis circuit provides extra noise immunity by
- (a) boosting the base frequencies

- (b) amplifying the higher audio frequencies
- (c) pre-amplifying the whole audio band;
- (d) converting the phase modulation to FM.

*(Refer our course material for answers)*

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