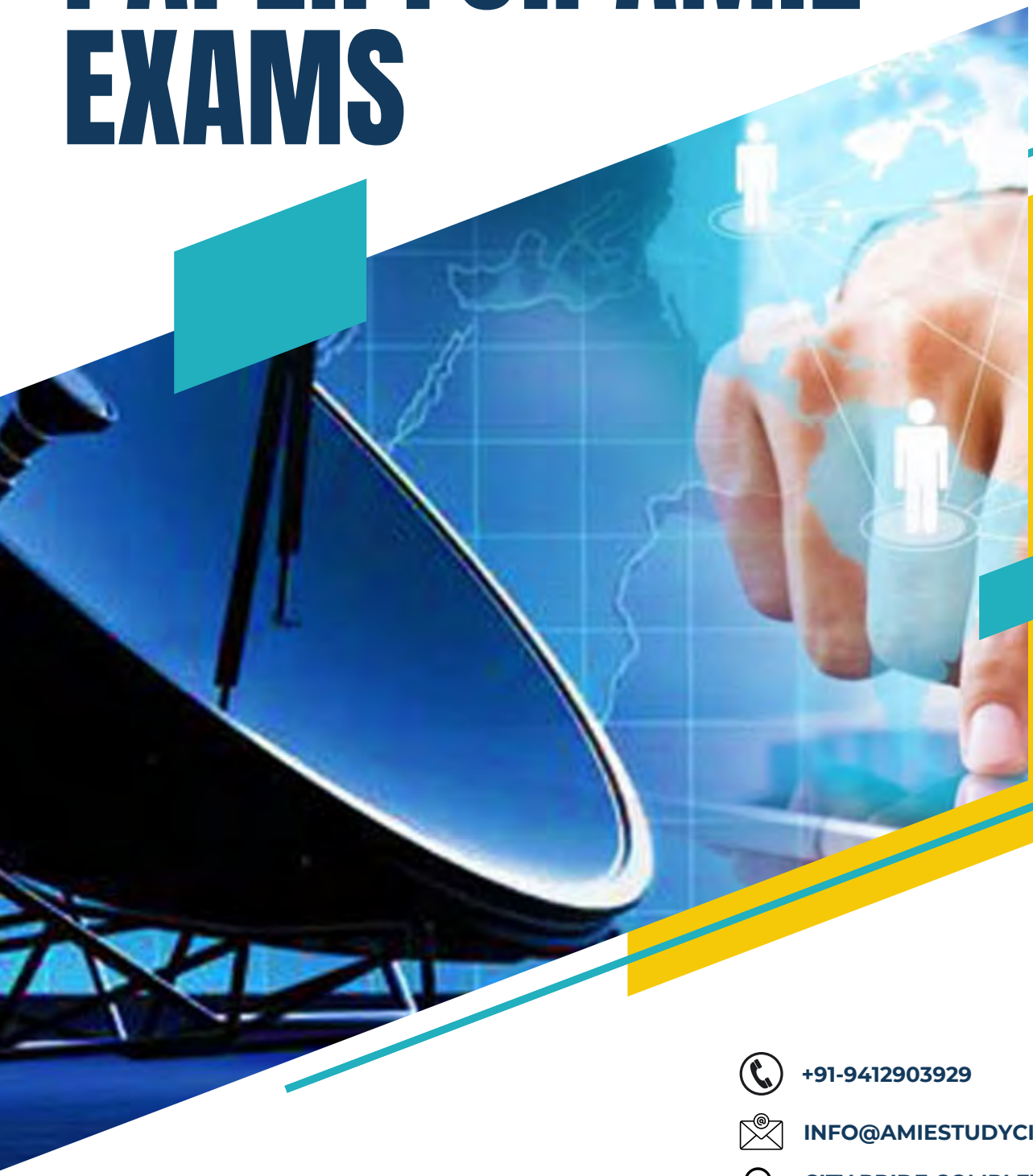
MODEL TEST PAPER FOR AMIE EXAMS



COMMUNICATION ENGINEERING

TEST PAPER 1

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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

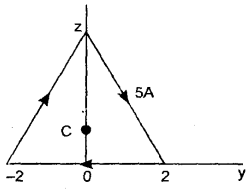
   (b) State and explain Poisson's equations and Laplace equation. 6

   (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 θ an independent random variable, the probability density functions of θ is 8

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

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 ∞

(d) $-\infty$ and ∞

(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)