Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2018

EC3CO04 Analog Communication

Programme: B.Tech. Branch/Specialisation: EC

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. In commercial TV transmission in India, picture and speech signals are modulated respectively by **1**

(a) VSB and VSB (b) VSB and SSB

(c) VSB and FM (d) FM and VSB

ii. In a double side-band (DSB) full carrier AM transmission system, if the modulation index is doubled, then the ratio of total sideband power to the carrier power increases by a factor of **1**

(a) 4 (b) 2 (c) 8 (d) None of these

iii. An AM signal and a narrow-band FM signal with identical carriers, modulating signals and modulation indices of 0.1 are added together. The resultant signal can be closely approximated by **1**

(a) Broadband FM (b) SSB with carrier

(c) DSB-SC (d) SSB without carrier

iv. A 10 MHz carrier is frequency modulated by a sinusoidal signal of 500 Hz, the maximum frequency deviation being 50 KHz. The bandwidth required as given by the Carson's rule is **1**

(a) 100 kHz (b) 101 kHz (c) 90 kHz (d) 10 kHz

v. What is the effect on the deviation of an FM signal when it is passed through a mixer? **1**

(a) Doubles (b) Reduces

(c) Becomes half (d) Remains unchanged

vi. A super heterodyne radio receiver with an intermediate frequency of 455 KHz is tuned to a station operating at 1200 KHz. The associated image frequency is **1**

(a) 910 kHz (b) 290 kHz (c) 2400 kHz (d) 2110 kHz

P.T.O.

vii. An amplifier having noise figure of 20 dB and available power gain of 15 dB is followed by a mixer circuit having noise figure of 9 dB. The overall noise figure as referred to input in dB is **1**
(a) 11.07 (b) 10.44 (c) 21.52 (d) 0.63

viii. If the resistance value is doubled and temperature maintained constant, the available thermal noise power per unit bandwidth will **1**
(a) Increase two-fold (b) Increase four-fold
(c) Remain unchanged (d) Decrease to half

ix. The Autocorrelation function of a rectangular pulse of duration T is **1**
(a) A rectangular pulse of duration T
(b) A rectangular pulse of duration 2T
(c) A triangular pulse of duration T
(d) A triangular pulse of duration 2T

x. A band limited signal is sampled at the Nyquist rate. The signal can be recovered by passing the samples through **1**
(a) RC filter
(b) An envelope detector
(c) PLL
(d) An ideal low-pass filter with the appropriate bandwidth

Q.2 i. With a block diagram, explain how SSB signal is generated using phase shift method. Also discuss why SSB is not used for video broadcasting. **4**

ii. Define demodulation. Explain the envelope detection method for amplitude modulation. Also justify the choice of time constant RC. **6**

OR iii. A single tone modulating signal $e_m = E_m \cos w_m t$ amplitude modulates a carrier $e_c = E_c \cos w_c t$. **6**
(a) Derive an expression for the AM wave e(t).
(b) Derive an expression for modulated power.
(c) Derive the AM waveform and its spectrum.

Q.3 i. An FM signal is given by $S(t) = 20 \sin(6*10^8 t + 7 \sin 1250t)$ Determine: **4**
(a) Maximum frequency deviation and bandwidth.
(b) Repeat the above if message signal frequency is doubled.

ii. Derive an expression of WBFM and discuss its various observations in terms of power, bandwidth, spectrum and transmission efficiency. **6**

OR iii. Explain the principle working of Ratio detector for FM detection. Also discuss its advantages and disadvantages. **6**

Q.4 i. What is image signal? Why is the local oscillator frequency always kept higher than the signal frequency in superhetrodyne receivers? **4**

ii. Explain the following terms: **6**
(a) Pre-emphasis and De-emphasis in FM system.
(b) Selectivity, sensitivity and fidelity.

OR iii. How super heterodyne receiver is an improvement over TRF receiver? Draw the block diagram of super heterodyne receiver and explain its working. **6**

Q.5 Attempt any two:

i. Explain the following term. **5**
(a) Noise temperature and write equation for equivalent noise temperature of cascade amplifier
(b) Power spectral density and its properties

ii. How noise can be classified. Explain internal and external noise in brief. **5**

iii. Prove that figure of merit for a DSB-SC system is unity. **5**

Q.6 Attempt any two:

i. Discuss the performance comparison of PAM, PWM and PPM analog pulse modulation techniques. **5**

ii. What is PAM. Discuss its generation and detection method? **5**

iii. Explain why a PPM system requires the transmission of a synchronizing signal, whereas a PAM or PDM system does not. Also discuss detection technique of PPM signal. **5**

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Marking Scheme
EC3CO04 Analog Communication

Q.1	i.	In commercial TV transmission in India, picture and speech signals are modulated respectively by (c) VSB and FM	**1**
	ii.	In a double side-band (DSB) full carrier AM transmission system, if the modulation index is doubled, then the ratio of total sideband power to the carrier power increases by a factor of (a) 4	**1**
	iii.	An AM signal and a narrow-band FM signal with identical carriers, modulating signals and modulation indices of 0.1 are added together. The resultant signal can be closely approximated by (b) SSB with carrier	**1**
	iv.	A 10 MHz carrier is frequency modulated by a sinusoidal signal of 500 Hz, the maximum frequency deviation being 50 KHz. The bandwidth required as given by the Carson's rule is (b) 101 kHz	**1**
	v.	What is the effect on the deviation of an FM signal when it is passed through a mixer? (d) Remains unchanged	**1**
	vi.	A super heterodyne radio receiver with an intermediate frequency of 455 KHz is tuned to a station operating at 1200 KHz. The associated image frequency is (d) 2110 kHz	**1**
	vii.	An amplifier having noise figure of 20 dB and available power gain of 15 dB is followed by a mixer circuit having noise figure of 9 dB. The overall noise figure as referred to input in dB is (c) 21.52	**1**
	viii.	If the resistance value is doubled and temperature maintained constant, the available thermal noise power per unit bandwidth will (a) Increase two-fold	**1**
	ix.	The Autocorrelation function of a rectangular pulse of duration T is (d) A triangular pulse of duration 2T	**1**
	x.	A band limited signal is sampled at the Nyquist rate. The signal can be recovered by passing the samples through (d) An ideal low-pass filter with the appropriate bandwidth	**1**

Q.2	i.	1 mark for circuit diagram, 2 marks for principle working 1 mark for reason not using in video broadcasting	**4**
	ii.	1 mark for defining demodulation, 1 mark for circuit diagram of envelope detector, 2 marks for principle working, 1 mark for time domain representation of input and output, and 1 mark for time constant	**6**
OR	iii.	2 marks for AM expression, 2 marks for power, 1 mark for waveform 1 mark for spectrum	**6**
Q.3	i.	(a) 2 marks for each, (b) 2 marks for each	**4**
	ii.	Expression of WBFM - 4 marks, 0.5 marks for each observation (0.5 * 4 = 2)	**6**
OR	iii.	1 mark for circuit diagram, 2 marks for principle working, 1 mark for output voltage and 1 mark for advantages (any 2 points) and 1 mark for disadvantages (any 2 point).	**6**
Q.4	i.	2 marks for image signal (definition - 1 mark, equation - 1 mark) 2 marks for reason.	**4**
	ii.	(a) Pre emphasis - 1.5 marks, de emphasis - 1.5 marks 3 marks (b) 1 mark for each term 3 marks	**6**
OR	iii.	2 marks for comparison & 4 marks for principle working with block diagram	**6**
Q.5		Attempt any two:	
	i.	(a) 1.5 marks for noise temperature and 1 mark for equation (b) 1.5 marks for PSD and 1 mark for properties (any 2)	**5**
	ii.	2.5 marks for each internal and external noise	**5**
	iii.	5 marks for prove.	**5**

Q.6 Attempt any two:

i. Comparison : any five points - 5 marks **5**

ii. Define PAM - 1 mark. **5**
2 marks for each Generation and detection

iii. 2 marks for reason and **5**
3 marks for detection technology with diagram

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