भारत मौसम विज्ञान विभाग
सूचना संचार एंव उपकरण प्रशिक्षण केंन्द्र, नई दिल्ली
(विश्व मौसम संगठन का क्षेत्रीय प्रशिक्षण केंन्द्र, नई दिल्ली)
Advance Training Course in Meteorological Instrumentation & Information System (Batch No – XIV)

Final Exam: Paper –I **Max. Marks -100**

Date: 24.02.2025 **Time: - 10:30-13:30**

COMMUNICATION & ANALOG MODULATION

1. (A) Fill in the blanks: (Answer any 5) **(1 × 5 = 5 Marks)**

i. A communication system consists of a transmitter, _____, and receiver. (router/ channel)
ii. The range of frequencies occupied by a signal is called its _____.(wavelength/bandwidth)
iii. The modulation index of an AM signal is given by the ratio of _____ amplitude to carrier amplitude.
iv. The presence of both upper and lower sidebands in AM transmission leads to _____ modulation.
v. The frequency deviation in an FM signal is proportional to the _____ of the modulating signal.(amplitude/frequency)
vi. The phenomenon where an FM receiver locks onto the stronger signal and ignores weaker ones is called _____ effect.(injection/capture)

1. (B) Write True or False with justification: (Answer any 5) **(1 × 5 = 5 Marks)**

i. The bandwidth of PM signals decreases with an increase in the modulation index. (True/ False)
ii. Vestigial side band is used for TV transmission because it increases bandwith while preserving information.(True/ False)
iii. The modulation technique used in AM radio broadcasting is DSB-FC.(True/ False)
iv. FM signals have better noise immunity than AM signals because they use constant frequency modulation.(True/ False)
v. A communication system consists of a transmitter, channel and receiver.(True/ False)
vi. The process of boosting high-frequency components before FM transmission is called pre emphasis.(True/ False)

DIGITAL COMMUNICATION SYSTEM

2. (A) Fill in the blanks: (Answer any 5) **(1 × 5 = 5 Marks)**

i. The range of frequencies for the commercial FM is _____.
ii. A 4 GHz carrier is DSB-SC modulated by a low-pass message signal with maximum frequency of 2 MHz. The resultant signal is to be ideally sampled. The minimum frequency of the sampling impulse train should be_____
iii. The maximum power efficiency of an AM modulator is_____.
iv. FM signal can be generated from PM by using a _____ prior to PM.
v. A DSB-SC signal is generated using the carrier cos(ωCt + 8) and modulating signal x(t). The envelop of the DSB-SC signal is_____.
vi. The range of frequencies for the commercial AM is _____.

2. (B) Write True or False with justification: (Answer any 5) (1 × 5 = 5 Marks)

i. Quadrature carrier multiplexing (QCM) enables two DSBSC modulated waves, resulting from two different message signals to occupy the same transmission bandwidth and two message signals can be separated at the receiver. (True/ False)
ii. The bit rate of digital communication system is R kbit/s. The modulation used is 32-QAM. The minimum bandwidth required for ISI free transmission is R/10 KHz. (True/ False)
iii. In AM the meaning of A3H is SSB. (True/ False)
iv. Under identical conditions FM will be always 4.75B better than PM for noise. (True/ False)
v. FM signal is having smaller bandwidth as compared to the AM system. (True/ False)
vi. In binary data transmission DPSK is preferred to PSK because a coherent carrier is not required to be generated at the receiver. (True/ False)

WIRELESS COMMUNICATION

3. (A) Fill in the blanks: (1 × 5 = 5 Marks)

i. Consider sinusoidal modulation in an AM system. Assuming no over modulation, the modulation index (μ) when the maximum and minimum values of the envelope, respectively, are 3V and 1V is_____.
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 _____.
iii. Consider sinusoidal modulation in an AM system. Assuming no over modulation, the modulation index (μ) when the maximum and minimum values of the envelope, respectively, are 3V and 1V is_____.
iv. FM signal is having _____ bandwidth as compared to the AM system. (smaller/larger)
v. Under identical conditions FM will be always _____ better than PM for noise. (4.75db/4.25db)

3. (B) Write True or False with justification: (Answer any 5) (1 × 5 = 5 Marks)

i. Wi-Fi operates only on the 2.4 GHz frequency band. (True/ False)
ii. Satellite communication is a type of wireless communication. (True/ False)
iii. The range of a wireless signal can be affected by physical obstacles like walls and buildings. (True/ False)
iv. MIMO (Multiple Input Multiple Output) improves wireless network performance. (True/ False)
v. Wireless networks are always more secure than wired networks. (True/ False)
vi. Infrared communication requires a direct line of sight between devices. (True/ False)

OPTICAL FIBRE COMMUNICATION

4. (A) Fill in the blanks: (Answer any 5) (1 × 5 = 5 Marks)

i. The receiver in an optical fibre system typically contains a _____ , which converts light signals back into electrical signals. (photodetector/light emitter)
ii. The use of _____ optical fibres in communication systems results in faster data transmission due to higher bandwidth. (Multimode/single mode)
iii. The _____ of an optical fibre control how much light can pass through and is a critical factor for signal quality. (diameter/core)
iv. A multimode step index fibre has a large core diameter of range _____
v. A fibre optic _____ is a device used to connect multiple fibre optic cables together in communication systems. (connectors/receiver)

vi. _____ light sources are used in fibre optic communication for their ability to provide coherent light. (Laser/coherent)

4. (B) Write True or False with justification: (Answer any 5) (1 × 5 = 5 Marks)

i. The attenuation in optical fibre increases as the wavelength of light used increases. (True/ False)
ii. Optical fibre communication is immune to electromagnetic interference. (True/ False)
iii. Fiber optic cables are lighter and more flexible compared to traditional copper cables.(True/ False)
iv. Optical fibre communication uses electrical signals to transmit data.(True / False)
v. The refractive index of the cladding in an optical fibre is higher than that of the core.(True/ False)
vi. Fibre optic cables are lighter and more flexible compared to traditional copper cables.(True/ False)

ANTENNA AND WAVE PROPAGATION

5. (A) Fill in the blanks: (Answer any 5) (1 × 5 = 5 Marks)

i. _____ is the feed radiator is placed at the vertex of the parabolic reflector instead of placing it at the focus. (coaxial feed system/Cassegrain feed system)
ii. In _____ and _____ frequency bands, the Earth, and the ionosphere act as a wave guide for electromagnetic wave propagation.
iii. An _____ is defined as one "having an essentially non-directional pattern in a given plane and a directional pattern in any orthogonal plane. (Yagi antenna/Omnidirectional antenna)
iv. Ground waves are always vertically polarized produced by _____..(Vertical antenna/ Omnidirectional antenna)
v. The _____ is defined as the angular measurement between the directions in which the antenna is radiating half of the maximum value.
vi. _____ is the ratio of the radiation intensity in a given direction from the antenna to the radiation intensity averaged over all directions. (sensitivity / directivity)

5. (B) Short Answer type Questions: (Answer any 5) (2 × 5 = 10 Marks)

i. Explain the Duct Prorogation.
ii. Explain the different types of FADING in Radio wave propagation
iii. Write shorts notes on Thevenin Equivalent of Antenna.
iv. Write Short notes on Friss Transmission.
v. Write Short notes on Radio Waves Frequency Spectrum.
vi. Write short note on folded Dipole Antenna.
vii. Define Critical Frequency. What is relation between Critical frequency and Maximum usable frequency?

CONCEPT OF NETWORKING AND IMD NETWORKS

6. (A) Fill in the blanks: (Answer any 5) (1 × 5 = 5 Marks)

i. The default HTTP and HTTP ports for the Web server are port _____ and _____.
ii. USB stands for _____.
iii. Circuit switching establishes a dedicated path between _____.
iv. _____ is the protocol used to send email messages.
v. Class E IP is reserved for _____ .(Experimental/large network)
vi. The speed of Cat 7 cable is _____ .(10 GBPS/1024 MBPS)

6. (B) Short Answer type Questions: (Answer any 5) (2 × 5 = 10 Marks)

i. What is NKN?
ii. What is the difference between a static IP address and a dynamic IP address?
iii. What is modem, and what are its type?
iv. What is the IP address range for private IP addresses?
v. What is subnetting, and what are its types?
vi. What is multiplexing, and what are its techniques?

NETWORKING DEVICES AND SECURITY SYSTEMS

7. (A) Fill in the blanks: (Answer any 5) (1 × 5 = 5 Marks)

i. In _____ switching a dedicated path between sender and receiver is established.
ii. Firewall operates at_____ Layer.(Second/Third)
iii. In a network, a machine is identified by unique address called_____.
iv. _____ is responsible for registering IP ranges and assigning them to organizations, such as ISPs.
v. Full form of DDOS _____
vi. Fibre optics cable works on _____ principle.

7. (B) Short Answer type Questions: (Answer any 5) (2 × 5 = 10 Marks)

i. Explain LAN, MAN, WAN.
ii. Short note on DNS and DHCP and their difference
iii. Write short Note on Server, how does it differs from an ordinary computer?
iv. An IP address 172.16.13.5 with a 255.255.255.128 subnet mask. What is the class, subnet address and broadcast address.
v. Write short note on Modem and Flow Control.
vi. Write short Note on Hub, Bridge and Switch.

METEOROLOGICAL COMMUNICATION SYSTEMS

8. (A) Fill in the blanks: (Answer any 5) (1 × 5 = 5 Marks)

i. KML stands for _____
ii. OLBS stands for _____
iii. VSAT stands for _____
iv. Metadata provides information about _____
v. WIS stands for _____
vi. AFTN stands for _____

8. (B) Short Answer type Questions: (Answer any 5) (2 × 5 = 10 Marks)

i. What are the main components of WIS?
ii. What is GTS?
iii. Name different types of data formats used in meteorological communication.
iv. What is AMSS?
v. What is the need of Metadata?
vi. What is XML?

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