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 – XV)

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

Date: 25.08.2025 **Time: - 10:30-13:30**

COMMUNICATION & ANALOG MODULATION

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

i. In AM, the total bandwidth required is equal to _____ times the Baseband frequency.
ii. In frequency modulation, the _____ of the carrier wave is varied in accordance with the message signal.
iii. PM and FM are closely related because phase modulation can be achieved by differentiating the _____ signal.
iv. The phenomenon where an FM receiver locks onto the stronger signal and ignores weaker ones is called _____ effect.
v. _____ is used for TV transmission because it reduces bandwidth while preserving information.
vi. Coherent detection requires a _____ signal that matches the carrier frequency and phase.

1. (B) Write True or False with justification: (Answer any 3) **(2 × 3 = 6 Marks)**

i. FM signals have better noise immunity than AM signals because they use constant frequency modulation.
ii. In amplitude modulation (AM), the amplitude of the carrier varies according to the instantaneous value of the message signal.
iii. The modulation technique used in AM radio broadcasting is DSB-FC.
iv. The Carson's Rule is used to estimate the bandwidth of FM signals.
v. A communication system consists of a transmitter, channel and receiver.

DIGITAL COMMUNICATION SYSTEM

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

i. Greater the uncertainty _____ is the information.
ii. _____ is the measure of average information content.
iii. The _____ is the part of the element of digital communication system where signal get maximum affected by noise.
iv. The sampling is the process of converting a continuous-time signal into a _____ signal.
v. The discrete amplitudes of the quantized output are called _____ levels.
vi. Full form of QAM is _____

2. (B) Write True or False with justification: (Answer any 3) **(2 × 3 = 6 Marks)**

i. The upper limit capacity called Shannon's limit is 3.44 S/N.
ii. If an event is certain with probability one (1) eg. "Sun rises in the East", then its information value is one (1).
iii. The spacing between the two adjacent representation levels is called guard band.
iv. The sampling frequency (fs) is directly proportional to the sampling period (Ts).
v. A signal can be exactly reproduced if it is sampled at the rate fs which is less than twice the maximum frequency (fmax).

WIRELESS COMMUNICATION

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

i. The _____Layer is the first layer of the OSI model and is responsible for the physical transmission of data bits over a communication channel.
ii. The multiple access technique _____ divides a single frequency channel into different time slots, and each user is allocated a specific time slot for transmission.
iii. A _____ is the geographical area of radio coverage provided by a base station in a cellular network.
iv. A major security challenge in wireless networks is _____attacks, where an attacker secretly relays and alters the communication between two parties.
v. _____ is a wireless technology that uses radio waves to provide internet connectivity to devices in a local area.
vi. In the GSM network, the acronym GPRS stands for _____, which provides mobile data services.

3. (B) Write True or False with justification: (Answer any 3) (2 × 3 = 6 Marks)

i. A Denial of Service (DoS) attack in a wireless network that prevents legitimate users from accessing network resources by flooding the network with excessive traffic.
ii. The "cellular concept" was developed to allow for a single large transmitter to cover an entire city without interference.
iii. In Code Division Multiple Access (CDMA), all users on a channel transmit at the same time and on the same frequency, but each uses a unique code to distinguish their signal.
iv. The MAC layer controls how multiple devices on a network gain access to and share the same physical medium, like the airwaves in a wireless network.
v. One of the primary goals of 5G technology is to provide extremely low latency, which is crucial for applications like autonomous vehicles and remote surgery.

OPTICAL FIBRE COMMUNICATION

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

i. Optical fiber communication has advantages over copper wire communication, such as higher _____ and lower _____.
ii. The _____of an optical fiber is a measure of its ability to collect and accept light.
iii. In a _____ fiber, the refractive index of the core is uniform and has a sharp change at the core-cladding boundary.
iv. _____is a signal degradation mechanism that occurs in multi-mode fibers due to different modes traveling at different speeds.
v. Losses in optical fibers due to impurities in the glass material are known as _____ losses.
vi. Signal degradation caused by small variations in the fiber's refractive index is called _____.

4. (B) Write True or False with justification: (Answer any 3) (2 × 3 = 6 Marks)

i. Fusion splicing uses a mechanical device to physically join two fiber ends, while a mechanical splice uses heat to melt and fuse them together.
ii. Single-mode fibers are typically used for short-distance communication because they allow multiple light paths, which leads to less dispersion.
iii. Optical fiber communication uses electrical signals to transmit data over long distances.
iv. For total internal reflection to occur, the refractive index of the core must be lower than the refractive index of the cladding.
v. International standards for optical communications, such as those from the ITU-T, ensure that equipments from different manufacturers are not compatible.

ANTENNA AND WAVE PROPAGATION

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

i. The _____ is defined as the angular measurement between the directions in which the antenna is radiating half of the maximum value.
ii. An _____ is defined as one "having an essentially non directional pattern in a given plane and a directional pattern in any orthogonal plane.
iii. _____ is the ratio of the radiation intensity in a given direction from the antenna to the radiation intensity averaged over all directions.
iv. _____ is the suitable antenna for various applications in microwave frequency range where moderate gains are sufficient.
v. _____ is the feed radiator is placed at the vertex of the parabolic reflector instead of placing it at the focus.
vi. The waves, which while traveling, glide over the earth's surface are called _____.
vii. The _____ acts like a reflecting surface and reflect back the electromagnetic waves of frequencies between 2 MHz to 30 MHz.
viii. _____ is defined as the limiting maximum frequency that can be reflected back to the earth by the ionospheric layer for a specific angle of incidence other than the angle of incidence for vertical incidence.

5. (B) Short Answer type Questions: (Answer any 3) (3 × 3 = 9 Marks)

i. Write Short notes on Radio Waves Frequency Spectrum.
ii. Salient Features of Ground Wave Propagation.
iii. Write a short note on friss transmission.
iv. If the critical frequency is 9MHz and angle of incidence is 45 degrees then calculate maximum usable frequency.
v. Write shorts notes on Thevenin Equivalent of Antenna.
vi. Explain the different types of polarization.

CONCEPT OF NETWORKING AND IMD NETWORKS

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

i. WAN stands for _____
ii. OSI stands for _____
iii. Layer 5 in OSI model is _____
iv. In a network a machine is identified by unique address called _____
v. DNS denotes _____
vi. VLAN stands for _____
vii. Ipv4 address is _____bits long.
viii. Firewall operates at _____ Layer.

6. (B) Write True or False with justification: (Answer any 3) (2 × 3 = 6 Marks)

vi. IP address is a sequence of four-digit numbers separated by coma.
vii. A LAN is connected to large geographical area.
viii. MAC address is 32-bit physical address of machine.
ix. Speed of LAN is less than WAN.
x. Router and switch both operates on data link layer and network layer only.

6. (C) Short Answer type Questions: (Answer any 1) (1 × 3 = 3 Marks)

i. What is MPLS VPN?
ii. Explain the difference between CREX and BUFR Data format.

NETWORKING DEVICES AND SECURITY SYSTEMS

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

i. Full form of WAF_____
ii. Full form of VAPT _____
iii. Full form of DDOS _____
iv. Firewall operates at Layer_____
v. Phishing is generally done by _____ .
vi. HSRP stands for _____
vii. Full form of HDPE is _____
viii. LC and SC connectors are connected at the end of _____ cable.

7. (B) Write True or False with justification: (Answer any 3) **(2 × 3 = 6 Marks)**

i. A website cannot be hosted on a laptop.
ii. WAF is placed on the perimeter of the organization.
iii. DDOS is a kind of Malware
iv. Spyware is kind of Malware
v. Load balancer is used for organization network security

7. (C) Short Answer type Questions: (Answer any 1) **(1 × 3 = 3 Marks)**

i. Difference between DOS attack and Brute Force Attack
ii. Difference between Authentication and Authorization.

METEOROLOGICAL COMMUNICATION SYSTEMS

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

i. XML stands for _____
ii. AMSS stands for _____
iii. GTS stands for _____
iv. RTH stands for _____
v. WIS stands for _____
vi. GISC stands for _____
vii. VSAT stands for _____
viii. DCPC stands for _____

8. (B) Write True or False with justification: (Answer any 3) **(2 × 3 = 6 Marks)**

i. Data format for Satellite is GRIB .
ii. CSV file uses space to separate values.
iii. YZYX facility data refers to Met Data Bank.
iv. SIGMET is issued by AMO.
v. GRIB record consists of 6 section.

8. (C) Short Answer type Questions: (Answer any 1) **(1 × 3 = 3 Marks)**

i. What is OLBS?
ii. What is KML?

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