JHARKHAND UNIVERSITY OF TECHNOLOGY

Diploma 3rd Semester Examination

COMMUNICATION SYSTEMS (ECE 303)

Time: 3 Hours **Full Marks: 70** **SET: 1**

INSTRUCTIONS:

1. Question No. 1 is Compulsory.
2. Answer any **FOUR** questions from the remaining (Q.2 to Q.7).
3. Figures in the margin indicate full marks.

Q.1. Multiple Choice Questions [2 × 7 = 14]

(i) The process of impressing information signal onto a high-frequency carrier is:

(a) Demodulation (b) Modulation

(c) Multiplexing (d) Detection

(ii) In Amplitude Modulation, the bandwidth is equal to:

(a) f_m (b) $2f_m$

(c) $3f_m$ (d) f_c

(iii) Which layer of the ionosphere exists only during the daytime?

(a) D Layer (b) F2 Layer

(c) E Layer (d) F1 Layer

(iv) The standard intermediate frequency (IF) for AM broadcasting is:

(a) 10.7 MHz (b) 455 kHz

(c) 88 MHz (d) 100 kHz

(v) In FM, the amplitude of the modulated wave:

(a) Increases (b) Decreases

(c) Remains Constant (d) Varies with signal

(vi) Which pulse modulation technique has constant amplitude and pulse width?

(a) PWM (b) PAM

(c) PPM (d) PCM

(vii) The main advantage of Superheterodyne receiver over TRF is:

(a) High Fidelity (b) Improved Selectivity

(c) Low Cost (d) Simple Circuit

SECTION B (LONG ANSWER TYPE)

Q.2. (a) What is **Modulation**? Explain the **need for modulation** in communication systems with at least three points (Antenna height, Multiplexing, Range). **[7]**

Q.2. (b) Draw the block diagram of a **Superheterodyne Receiver** and explain the function of each block (Mixer, Local Oscillator, IF Amplifier). **[7]**

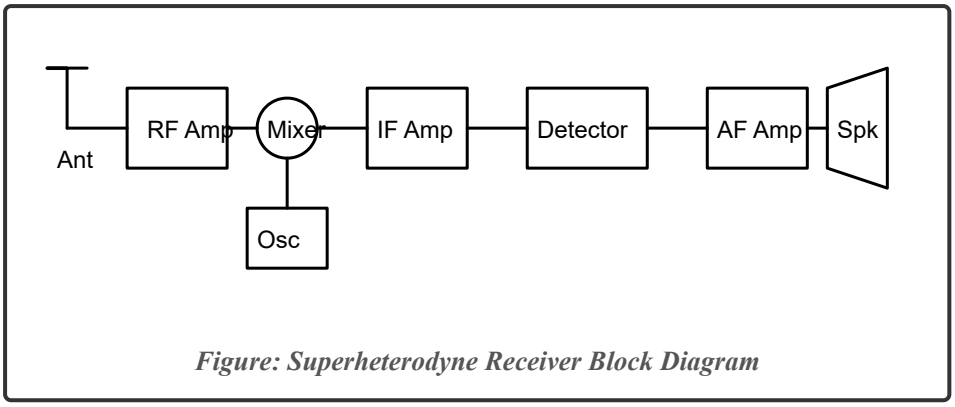

Figure: Superheterodyne Receiver Block Diagram

Q.3. (a) Derive the mathematical expression for an **Amplitude Modulated (AM)** wave. Draw its time-domain waveform. **[7]**

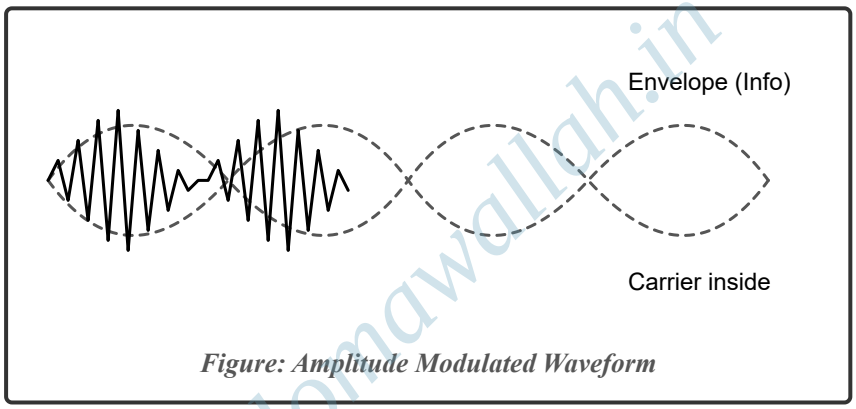

Figure: Amplitude Modulated Waveform

Q.3. (b) Explain **Sky Wave Propagation**. Describe the different layers of the Ionosphere (D, E, F1, F2). **[7]**

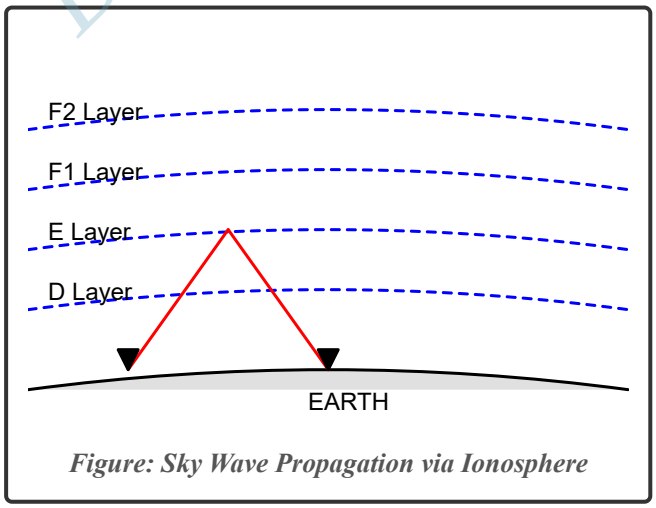

Figure: Sky Wave Propagation via Ionosphere

Q.4. (a) Differentiate between **Amplitude Modulation (AM)** and **Frequency Modulation (FM)** on the basis of Bandwidth, Noise, and Application. **[7]**

Q.4. (b) Define **Pulse Code Modulation (PCM)**. Draw its block diagram and explain the steps: Sampling, Quantization, and Encoding. **[7]**

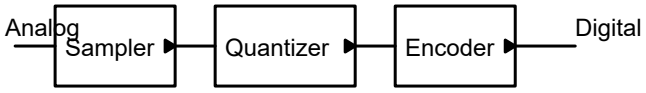

Figure: PCM Transmitter Block Diagram

Q.5. (a) Explain the operation of a **Diode Detector** (Envelope Detector) for AM demodulation with a neat circuit diagram. **[7]**

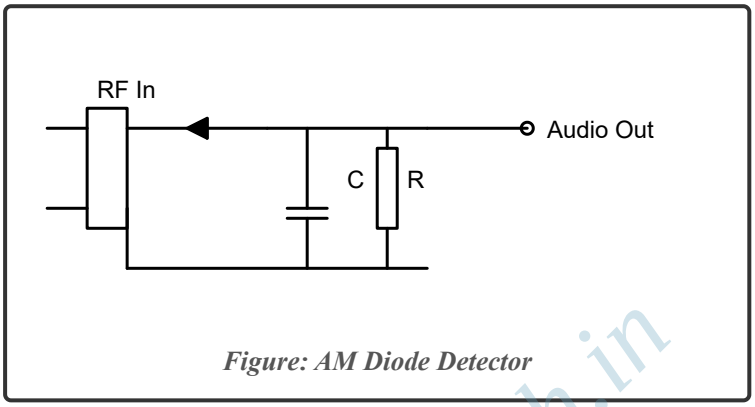

Figure: AM Diode Detector

Q.5. (b) Define **Modulation Index** for AM. Derive the expression for Total Power (P_t) in terms of Carrier Power (P_c) and Modulation Index (μ). **[7]**

Q.6. (a) What is **Multiplexing**? Explain the difference between **TDM (Time Division Multiplexing)** and **FDM (Frequency Division Multiplexing)**. **[7]**

Q.6. (b) Explain the terms **Selectivity**, **Sensitivity**, and **Fidelity** in the context of a radio receiver. **[7]**

Q.7. Write Short Notes on (Any FOUR): [3.5 × 4 = 14]

a. Pre-emphasis and De-emphasis

b. Ground Wave Propagation

c. AGC (Automatic Gain Control)

d. Sampling Theorem

e. VSB (Vestigial Sideband)

✅ Diploma Wallah: Solution Key

MCQ: (i) b, (ii) b, (iii) a, (iv) b, (v) c, (vi) c, (vii) b.

Q2(b) Hint: Superheterodyne converts incoming RF to a fixed IF (455 kHz) for better selectivity.

Q3(b) Hint: D layer absorbs LF, reflects HF. Exists only in day. F layer is main reflecting layer for night.

Q5(b) Formula: $Pt = Pc\ (1 + \mu^2/2)$

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