

Question 1(a) [3 marks]

Give definition (Only) of Loudness, Fidelity and Reverberation

Answer:

- **Loudness:** The subjective perception of sound intensity by the human ear, measured in decibels (dB).
- **Fidelity:** The degree to which a system reproduces sound that is faithful to the original input signal.
- **Reverberation:** The persistence of sound after the original sound source has stopped, caused by multiple reflections within an enclosed space.

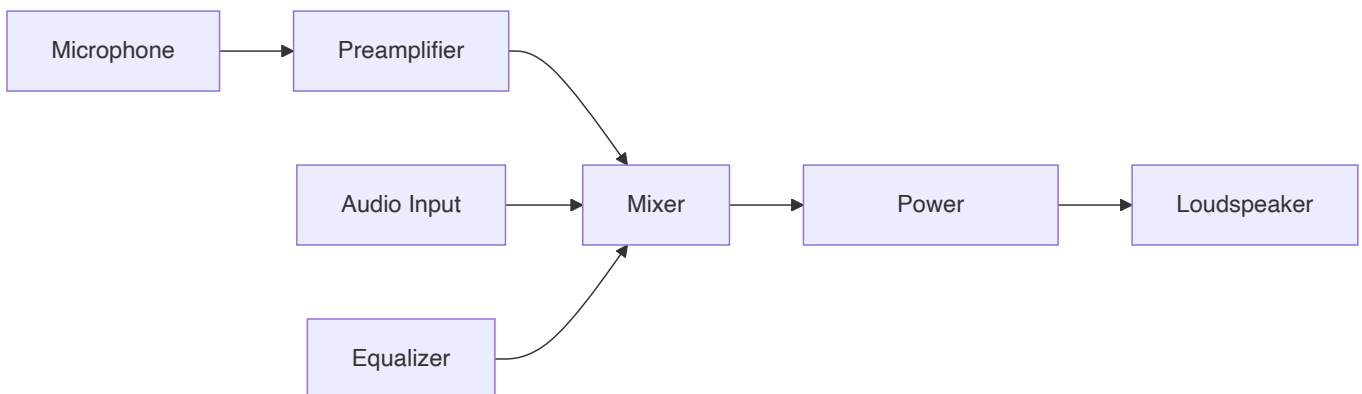
Mnemonic: "LFR: Listen Faithfully to Room echoes"

Question 1(b) [4 marks]

Draw and explain block diagram of PA system

Answer:

Diagram:



- **Microphone:** Converts sound waves into electrical signals
- **Preamplifier:** Boosts weak microphone signals to line level
- **Mixer:** Combines multiple audio signals and adjusts levels
- **Power Amplifier:** Increases signal power to drive loudspeakers
- **Loudspeaker:** Converts electrical signals back into sound waves

Mnemonic: "MPMEL: Many People Make Excellent Listeners"

Question 1(c) [7 marks]

Discuss any two characteristics of Microphone and Explain wireless microphone

Answer:

Microphone Characteristics:

Characteristic	Description
Sensitivity	Measures how efficiently microphone converts acoustic pressure to electrical output (mV/Pa)
Directional Pattern	Defines pickup area (omnidirectional, cardioid, hypercardioid, bidirectional)

Wireless Microphone:



- **Microphone Element:** Captures sound and converts to electrical signals
- **RF Transmitter:** Modulates audio onto radio frequency carrier
- **Transmission:** Typical frequency bands are UHF (470-698 MHz) or VHF (174-216 MHz)
- **RF Receiver:** Demodulates signal back to audio
- **Advantages:** Mobility, no cable restrictions, reduces stage clutter

Mnemonic: "SMART: Sensitivity Measures Audio Response Truly"

Question 1(c) OR [7 marks]

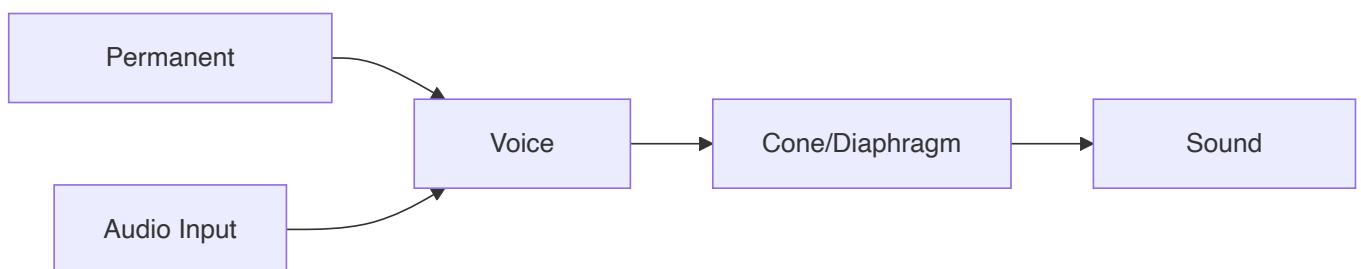
Discuss any two characteristics of loudspeaker and explain permanent magnet loudspeaker.

Answer:

Loudspeaker Characteristics:

Characteristic	Description
Frequency Response	Range of frequencies (Hz) speaker can reproduce (typically 20Hz-20kHz)
Impedance	Electrical resistance (ohms) that affects power transfer from amplifier (typically 4-8Ω)

Permanent Magnet Loudspeaker:



- **Permanent Magnet:** Creates fixed magnetic field (usually ferrite or neodymium)

- **Voice Coil:** Wire coil that carries audio current, creating variable magnetic field
- **Cone/Diaphragm:** Moves in response to voice coil movement
- **Working Principle:** Interaction between fixed magnetic field and varying field from voice coil creates mechanical movement
- **Advantages:** More efficient, no field coil power required, compact design

Mnemonic: "FIRM: Frequency Impedance Require Magnets"

Question 2(a) [3 marks]

Define only: Aspect ratio, Luminance and chrominance

Answer:

- **Aspect Ratio:** The ratio of width to height of a television screen (commonly 16:9 for HDTV, 4:3 for older TVs).
- **Luminance:** The brightness component of a video signal that carries intensity information (represented as Y).
- **Chrominance:** The color component of a video signal that carries color information (represented as U and V or Cb and Cr).

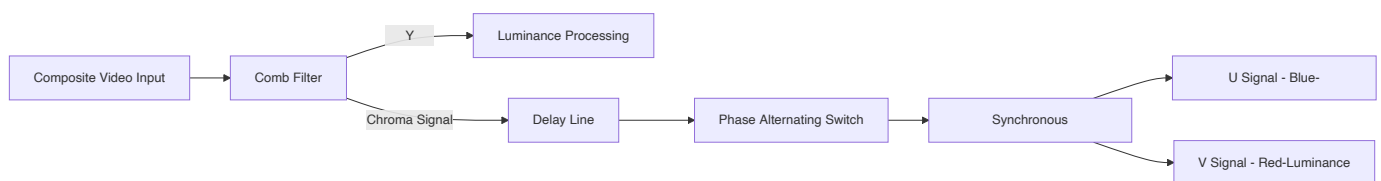
Mnemonic: "ALC: All Light Contains color"

Question 2(b) [4 marks]

Draw PAL-D decoder only and explain separation of U and V component of chroma signal.

Answer:

Diagram:



- **Comb Filter:** Separates luminance (Y) from chrominance signal
- **Delay Line:** Delays chroma signal by one line period (64μs)
- **Phase Alternating Switch:** Inverts V component on alternate lines
- **Synchronous Demodulator:** Uses subcarrier reference to extract U and V components
- **U Component:** Represents Blue-minus-Luminance (B-Y)
- **V Component:** Represents Red-minus-Luminance (R-Y)

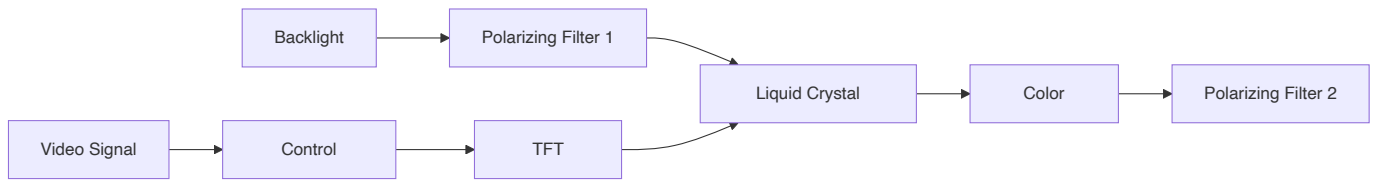
Mnemonic: "CODES: Chrominance Only Decodes Extracting Signals"

Question 2(c) [7 marks]

Explain in detail working of LCD television. Give any two technical specifications of it.

Answer:

LCD Television Working:



Working Process:

1. **Backlight:** CCFL or LED provides white light source
2. **TFT Matrix:** Thin-film transistors control voltage to each pixel
3. **Liquid Crystal Layer:** Molecules twist based on applied voltage
4. **Polarizers:** First filter aligns light, second passes only rotated light
5. **Color Filters:** RGB filters create colored pixels
6. **Image Formation:** Varying voltage controls light passage through each pixel

Technical Specifications:

- **Resolution:** 1920×1080 (Full HD) or 3840×2160 (4K UHD)
- **Refresh Rate:** 60Hz, 120Hz, or 240Hz

Mnemonic: "BALTIC: Backlight Activates Liquid To Illuminate Colors"

Question 2(a) OR [3 marks]

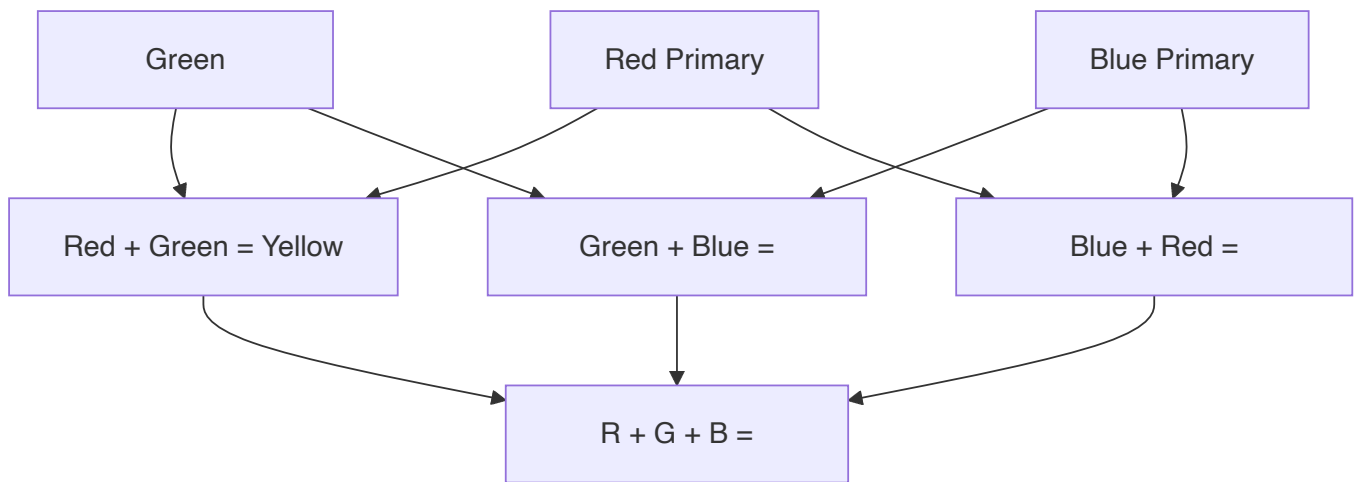
State Grassmens law & explain it with concept of additive mixing.

Answer:

Grassmann's Law:

Any color can be matched by a linear combination of three primary colors.

Additive Color Mixing Explanation:



- **Principle:** Adding light of different colors creates new colors
- **Primary Colors:** Red, Green, and Blue
- **Secondary Colors:** Yellow (R+G), Cyan (G+B), Magenta (B+R)
- **Example:** Equal intensities of RGB create white light

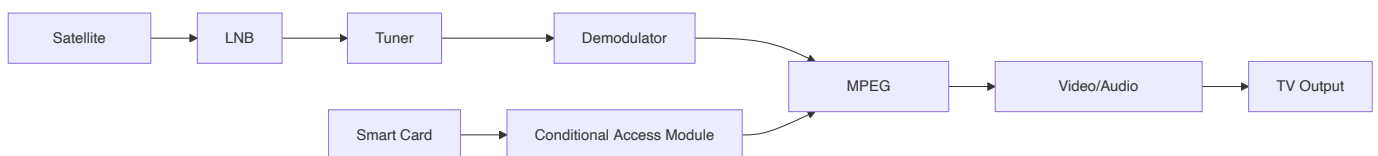
Mnemonic: "RGB-ACM: Red Green Blue - Additive Creates More"

Question 2(b) OR [4 marks]

Draw block diagram of DTH receiver and explain it.

Answer:

Diagram:



- **Satellite Dish:** Collects weak satellite signals (10.7-12.75 GHz)
- **LNB (Low Noise Block):** Amplifies and converts signal to lower frequency (950-2150 MHz)
- **Tuner:** Selects desired transponder frequency
- **Demodulator:** Extracts digital data from carrier signal
- **MPEG Decoder:** Decompresses audio/video data
- **CAM & Smart Card:** Provide decryption and subscription verification
- **Output:** Processes signals for display on television

Mnemonic: "SLTD-MCS: Satellites Link Through Decoders Making Clear Signals"

Question 2(c) OR [7 marks]

State following frequency/standard (used in color TV system)

Answer:

Parameter	Frequency/Standard
VIF (Video Intermediate Frequency)	38.9 MHz (PAL-B/G)
SIF (Sound Intermediate Frequency)	33.4 MHz (PAL-B/G)
Color Sub-carrier Frequency	4.43361875 MHz (PAL)
Vertical Blanking Frequency	50 Hz (PAL)
Horizontal Synchronizing Frequency	15.625 kHz (PAL)
Inter Carrier Sound Signal Frequency	5.5 MHz (PAL-B/G)
One Channel Bandwidth	7 MHz (VHF), 8 MHz (UHF)

Mnemonic: "Very Special Colors Vertically Harmonize In One Channel"

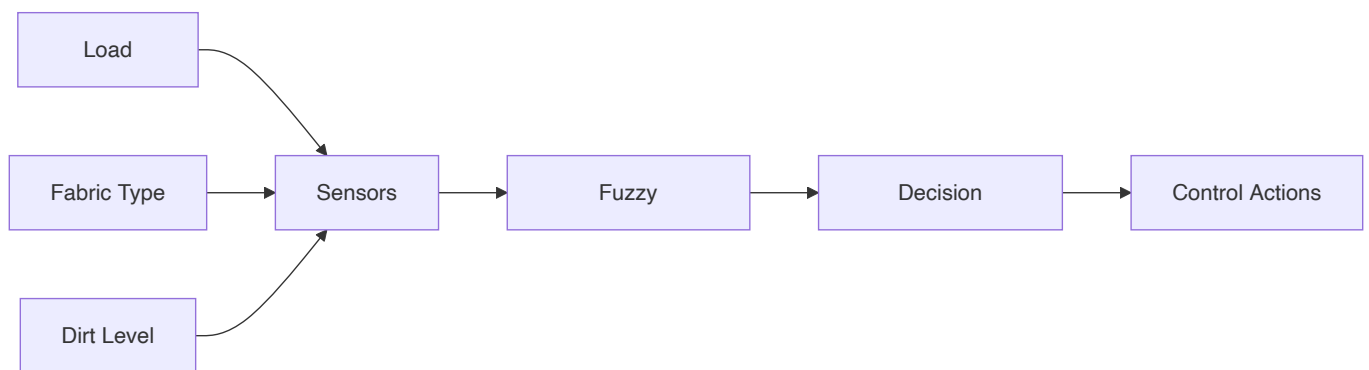
Question 3(a) [3 marks]

What is fuzzy logic? Explain its usage in washing machine.

Answer:

Fuzzy Logic: A mathematical approach that deals with approximate reasoning rather than fixed, binary logic, allowing for degrees of truth values between 0 and 1.

Usage in Washing Machine:



- **Input Variables:** Load weight, fabric type, water hardness, dirt level
- **Processing:** Controller evaluates multiple conditions simultaneously
- **Output:** Adjusts water level, wash time, rinse cycles, spin speed

Mnemonic: "FIND: Fuzzy Intelligence Navigates Decisions"

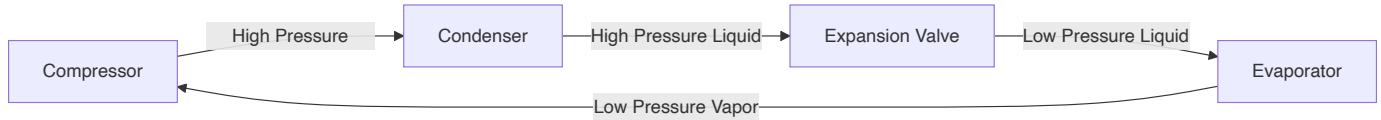
Question 3(b) [4 marks]

Define air conditioning. Explain working of fridge. State its technical specification.

Answer:

Air Conditioning: The process of removing heat and moisture from indoor air to improve comfort.

Refrigerator Working:



Working Cycle:

1. **Compressor:** Compresses refrigerant gas, raising temperature
2. **Condenser:** Hot gas releases heat to outside, becomes liquid
3. **Expansion Valve:** Liquid expands, cools rapidly
4. **Evaporator:** Cold refrigerant absorbs heat from inside cabinet

Technical Specifications:

- **Capacity:** 150-500 liters
- **Energy Rating:** 3-5 Star
- **Power Consumption:** 100-300 kWh/year

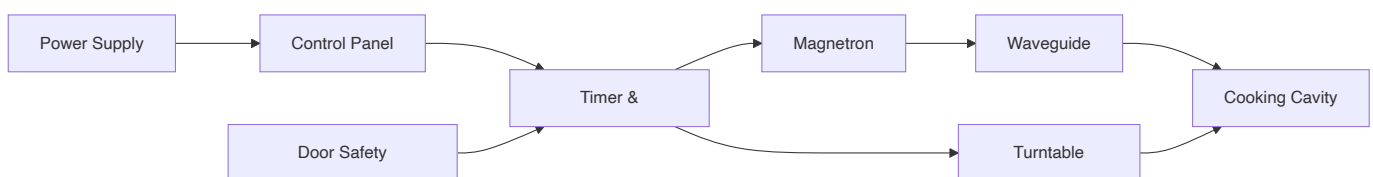
Mnemonic: "CEVA: Compress, Expel heat, Valve expands, Absorb heat"

Question 3(c) [7 marks]

Explain working principle of Microwave oven using functional block diagram. State its technical specifications.

Answer:

Microwave Oven Working:



Working Principle:

1. **Magnetron:** Generates microwaves at 2.45 GHz frequency
2. **Waveguide:** Directs microwaves into cooking cavity
3. **Water Molecules:** Microwaves cause water molecules to vibrate
4. **Heat Generation:** Molecular vibration creates friction and heat
5. **Turntable:** Rotates food for even cooking
6. **Safety Interlocks:** Prevent operation when door is open

Technical Specifications:

- **Power Output:** 700-1200 watts
- **Frequency:** 2.45 GHz
- **Capacity:** 20-40 liters
- **Cooking Modes:** Microwave, Grill, Convection, Combination

Mnemonic: "MICRO: Magnetron Initiates Cooking by Rotating Oscillations"

Question 3(a) OR [3 marks]

Give technical specification of solar panel. State advantages and disadvantages of solar roof top system

Answer:

Solar Panel Technical Specifications:

- **Power Rating:** 250-400 Wp (Watt peak)
- **Efficiency:** 15-22%
- **Cell Type:** Monocrystalline, Polycrystalline, or Thin Film

Advantages and Disadvantages:

Advantages	Disadvantages
Renewable Energy Source	High Initial Cost
Reduces Electricity Bills	Weather Dependent
Low Maintenance Cost	Requires Large Space
No Noise Pollution	Limited Nighttime Generation

Mnemonic: "SERLN: Solar Energy Reduces Long-term Numbers"

Question 3(b) OR [4 marks]

State various types of washing machine. Compare frontload and top load washing machine.

Answer:

Types of Washing Machines:

- Top Load (Agitator & Impeller)
- Front Load
- Semi-Automatic
- Fully Automatic

Comparison:

Parameter	Front Load	Top Load
Water Consumption	Lower (40-60 liters)	Higher (80-120 liters)
Energy Efficiency	Higher	Lower
Cleaning Performance	Better	Good
Space Requirement	Can be stacked	Needs top clearance
Cost	Higher	Lower
Cycle Duration	Longer (60-120 min)	Shorter (30-60 min)

Mnemonic: "FTEST: Front-loaders Take Extra Space but Triumph in efficiency"

Question 3(c) OR [7 marks]

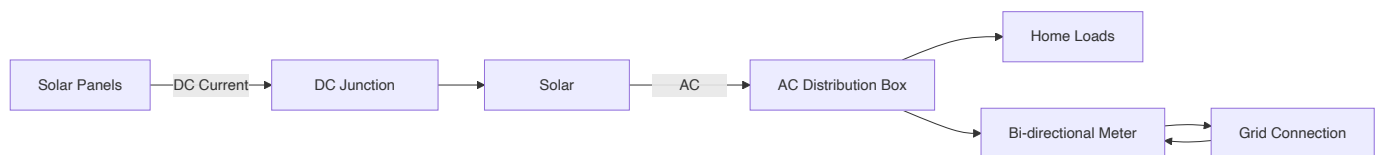
Give classification of solar rooftop system. Explain working of solar rooftop system (Grid connected online) with suitable diagram. State steps to maintain solar roof top system.

Answer:

Classification of Solar Rooftop Systems:

- **Grid-Connected** (On-grid)
- **Off-Grid** (Standalone)
- **Hybrid** (With battery backup)

Grid-Connected Solar System:



Working:

1. **Solar Panels:** Convert sunlight to DC electricity
2. **Junction Box:** Combines outputs, provides protection
3. **Inverter:** Converts DC to grid-compatible AC
4. **Distribution Box:** Distributes power to loads
5. **Bi-directional Meter:** Measures import/export of electricity
6. **Excess Generation:** Feeds back to grid (Net metering)

Maintenance Steps:

1. Regular cleaning of panels (dust, bird droppings)
2. Checking electrical connections for corrosion

3. Monitoring system performance via inverter data
4. Trimming nearby trees to prevent shading
5. Annual inspection by qualified technician

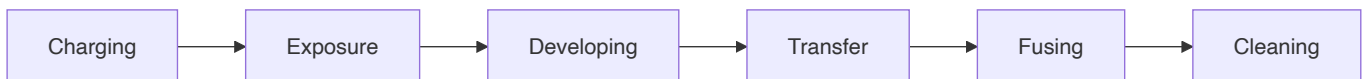
Mnemonic: "SPICED: Solar Panels Invert Current for Electrical Distribution"

Question 4(a) [3 marks]

Explain in brief working principle of photo copier machine with concept of latent image.

Answer:

Photocopier Working Principle:



Latent Image Concept:

- **Charging:** Photosensitive drum receives uniform positive charge
- **Exposure:** Light reflects from original document onto drum
- **Latent Image:** Light areas discharge drum creating invisible electrostatic image
- **Development:** Negatively charged toner particles attracted to positive areas
- **Transfer:** Toner transferred to paper through electrical attraction
- **Fusing:** Heat and pressure permanently bond toner to paper

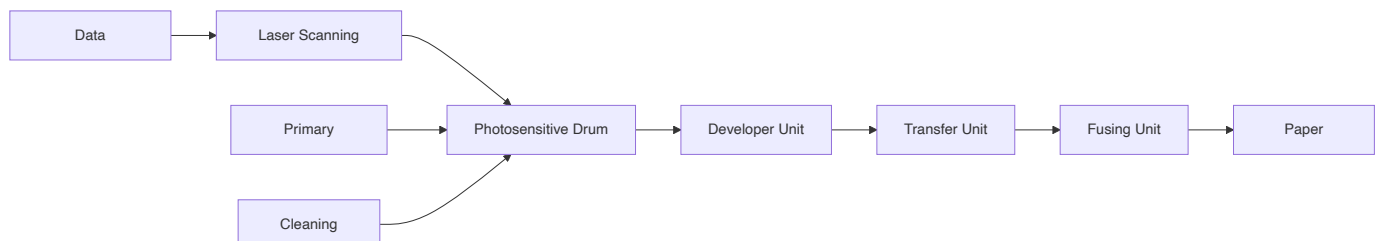
Mnemonic: "CEDTFC: Charging Exposure Develops The Final Copy"

Question 4(b) [4 marks]

Explain working of Laser printer with suitable diagram

Answer:

Laser Printer Working:



Working Process:

1. **Raster Image Processing:** Computer data converted to bitmap
2. **Charging:** Corona wire gives drum uniform negative charge
3. **Writing:** Laser beam neutralizes charge in pattern of image

4. **Developing:** Toner attracted to neutralized areas
5. **Transfer:** Paper given positive charge to attract toner
6. **Fusing:** Heat rollers melt toner permanently onto paper
7. **Cleaning:** Excess toner removed from drum for next cycle

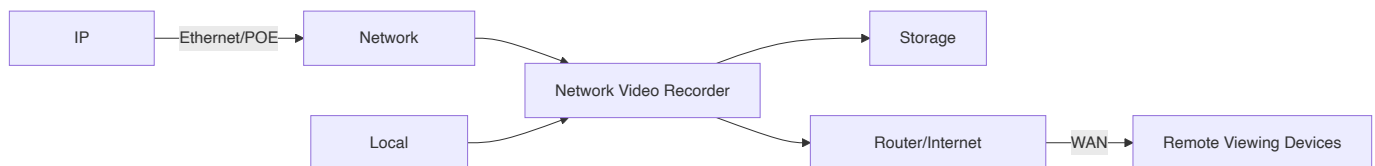
Mnemonic: "RASTER: Raster-image Attracts Static Toner, Electricity Releases"

Question 4(c) [7 marks]

Draw and explain block diagram of CCTV system using Digital IP camera connected with internet. List at least five different camera used in CCTV system. What is meaning of POE cable?

Answer:

IP CCTV System:



Working:

1. **IP Cameras:** Capture and digitize video
2. **Network Infrastructure:** Transmits data via TCP/IP protocols
3. **NVR:** Records, manages, and processes video streams
4. **Storage:** Hard drives store recorded footage
5. **Router:** Provides secure internet access for remote viewing

Camera Types:

1. **Dome Cameras:** Indoor ceiling-mounted, vandal-resistant
2. **Bullet Cameras:** Outdoor wall-mounted, long-range
3. **PTZ Cameras:** Pan, tilt, zoom capabilities for wide coverage
4. **Fisheye Cameras:** 360° panoramic view with single lens
5. **Thermal Cameras:** Detect heat signatures in darkness

POE Cable: Power Over Ethernet - A technology that carries both power and data over a single Ethernet cable, eliminating the need for separate power cables.

Mnemonic: "INSPIRE: Internet Networking Secures Places In Remote Environments"

Question 4(a) OR [3 marks]

Discuss pros and cons of internet based Digital IP camera CCTV system

Answer:

Pros and Cons of IP Camera CCTV Systems:

Pros	Cons
Higher Resolution (1080p to 4K)	Higher Initial Cost
Remote Viewing via internet	Bandwidth Requirements
Scalability & easy expansion	Cybersecurity Risks
Power Over Ethernet (POE)	Network Dependency
Advanced Analytics capabilities	Complex Configuration

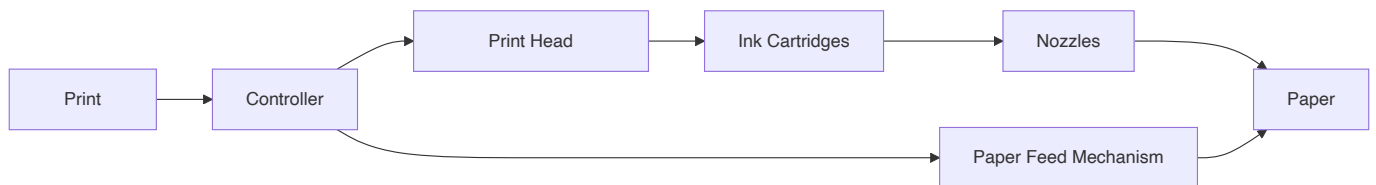
Mnemonic: "HIGHER: High-resolution Images Give Higher Evaluation Remotely"

Question 4(b) OR [4 marks]

Explain working of inkjet printer with suitable diagram

Answer:

Inkjet Printer Working:



Working Process:

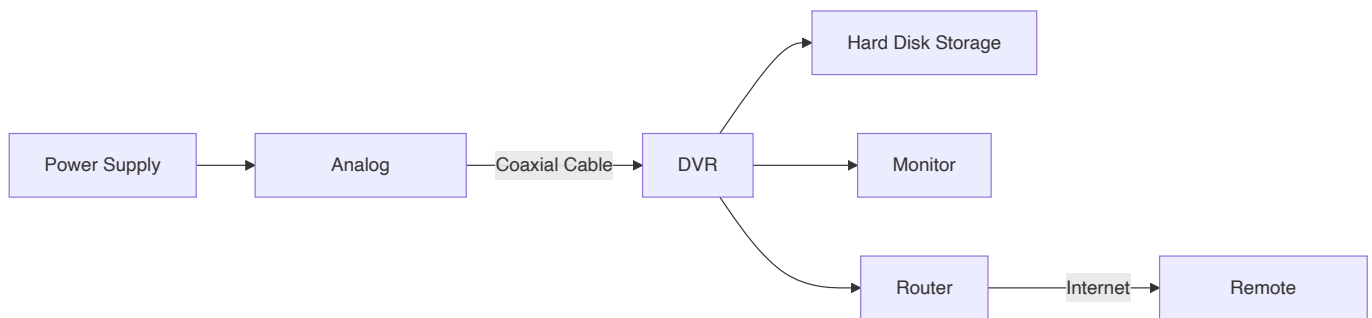
1. **Data Processing:** Controller converts digital data to nozzle instructions
2. **Paper Loading:** Feed rollers position paper correctly
3. **Print Head Movement:** Carriage moves printhead across paper
4. **Ink Ejection:** Two methods:
 - Thermal: Tiny resistors heat ink to create bubbles, forcing droplets
 - Piezoelectric: Crystal elements flex to push ink through nozzles
5. **Drying:** Ink adheres to paper surface

Mnemonic: "PRINT: Paper Receives Ink through Numerous Tiny-nozzles"

Question 4(c) OR [7 marks]

Draw and explain block diagram of CCTV system using simple analog camera and DVR. List types of cable used in CCTV system. Discuss at least four different categories of camera used in modern CCTV system.

Answer:

Analog CCTV System:**Working:**

1. **Analog Cameras:** Capture video as continuous analog signals
2. **DVR:** Converts analog signals to digital format for recording
3. **Storage:** Records footage on internal hard drives
4. **Viewing:** Local monitors and remote access options

Cable Types:

1. **Coaxial Cable** (RG59, RG6): Traditional analog camera connection
2. **Twisted Pair** (CAT5/6): For IP cameras or with baluns
3. **Power Cable:** Supplies electricity to cameras
4. **Fiber Optic:** For long-distance transmissions
5. **Siamese Cable:** Combined coaxial and power cable

Camera Categories:

1. **Fixed Cameras:** Constant view angle, no movement
2. **Varifocal Cameras:** Adjustable lens for different focal lengths
3. **Night Vision Cameras:** IR illuminators for low-light conditions
4. **High Dynamic Range (HDR):** Balanced exposure in mixed lighting

Mnemonic: "CARD: Coaxial Analog Recording Devices"

Question 5(a) [3 marks]

Define only: Maintenance, Preventive maintenance and Predictive maintenance.

Answer:

- **Maintenance:** The process of preserving equipment in proper operating condition through regular inspection, cleaning, and repair.
- **Preventive Maintenance:** Scheduled maintenance activities performed to prevent equipment failures before they occur.
- **Predictive Maintenance:** Condition-based maintenance approach that uses data analysis and monitoring techniques to predict when equipment failure might occur.

Mnemonic: "MPP: Maintain Proactively, Predict problems"

Question 5(b) [4 marks]

Discuss maintenance of public address system.

Answer:

PA System Maintenance:

Component	Maintenance Tasks
Microphones	• Clean windscreens and grilles • Check cables for damage • Test for proper sensitivity
Amplifiers	• Clean cooling vents • Check power connections • Inspect for overheating
Speakers	• Inspect mounting brackets • Test for distortion • Check wiring connections
Cables & Connections	• Test continuity • Replace damaged cables • Secure loose connections

Periodic Maintenance:

- Weekly: Basic operations check
- Monthly: Signal path testing
- Quarterly: Comprehensive inspection
- Annually: Professional service

Mnemonic: "MACS: Microphones, Amplifiers, Connections, Speakers"

Question 5(c) [7 marks]

State any three faults of washing machine. Discuss in general maintenance of washing machine.

Answer:

Common Washing Machine Faults:

1. **Water Not Filling:** Faulty inlet valve, clogged filter, water pressure issues
2. **Not Spinning:** Belt issues, motor problems, unbalanced load
3. **Excessive Vibration:** Uneven feet, suspension issues, drum damage

General Maintenance:

Component	Maintenance Procedure
Drum/Tub	• Clean monthly to remove residue • Check for foreign objects • Run cleaning cycle with white vinegar
Filters	• Clean lint filter after each use • Clean pump filter monthly • Check water inlet filters quarterly
Hoses	• Inspect for cracks or leaks • Replace every 3-5 years • Ensure proper connection
Door Seal	• Wipe after use to prevent mold • Check for tears • Keep door ajar when not in use
Dispensers	• Remove and clean monthly • Check for blockages • Remove detergent buildup

Mnemonic: "WATCH: Water And Tub Cleaning Helps"

Question 5(a) OR [3 marks]

Compare predictive and preventive maintenance.

Answer:

Comparison of Predictive vs. Preventive Maintenance:

Parameter	Predictive Maintenance	Preventive Maintenance
Approach	Condition-based	Time-based
Timing	When needed based on data	Fixed schedule regardless of condition
Techniques	Vibration analysis, thermal imaging, oil analysis	Visual inspection, cleaning, lubrication
Cost	Higher initial setup, lower long-term	Lower initial cost, potentially higher long-term
Downtime	Minimized, planned ahead	Regular scheduled downtime
Equipment Usage	Maximized lifespan	Some components replaced prematurely

Mnemonic: "TIMED: Testing Identifies Maintenance Exactly when Due"

Question 5(b) OR [4 marks]

Discuss maintenance and troubleshooting of LCD TV.

Answer:

LCD TV Maintenance:

Component	Maintenance Tasks
Screen	• Clean with microfiber cloth • Avoid liquid cleaners • Check for dead pixels
Ventilation	• Remove dust from vents • Ensure proper airflow • Check fan operation
Connections	• Verify cable connections • Check for corrosion • Test HDMI ports
Software	• Update firmware regularly • Reset settings if needed

Common Troubleshooting Issues:

Problem	Possible Solutions
No Power	Check power cord, outlet, internal fuse
No Picture	Verify input source, backlight failure, T-Con board
Lines on Screen	Check ribbon cables, screen damage, T-Con board
Audio Issues	Speaker connections, audio settings, amplifier board

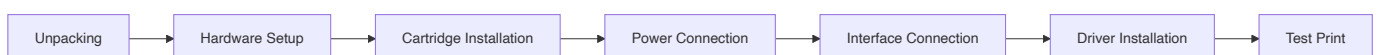
Mnemonic: "PVCS: Pixels, Ventilation, Connections, Software"

Question 5(c) OR [7 marks]

Explain installation of laser printers in your computer system. Discuss its maintenance and troubleshooting procedure.

Answer:

Laser Printer Installation:



Installation Steps:

1. **Setup Location:** Flat, stable surface with proper ventilation
2. **Remove Packaging:** Remove tape, protective films, shipping locks
3. **Install Consumables:** Toner cartridge, imaging drum if separate
4. **Connect Power:** Plug into grounded outlet
5. **Connect Interface:** USB, Ethernet, or Wi-Fi setup
6. **Install Driver:** From included CD or manufacturer website
7. **Configure Settings:** Network parameters, paper size, default tray

Maintenance:

Component	Maintenance Task
Paper Path	Clean with compressed air monthly
Toner Area	Vacuum carefully when replacing toner
Rollers	Clean with isopropyl alcohol quarterly
Exterior	Wipe with damp cloth as needed

Troubleshooting:

Problem	Solution
Paper Jams	Check paper path, clean rollers, verify paper specifications
Streaking	Clean corona wire, replace drum if worn
Light Printing	Adjust density settings, replace toner
Connection Issues	Check cables, reinstall drivers, reset printer

Mnemonic: "SECURE: Setup, Execute drivers, Clean Regularly, Update, Replace consumables, Examine problems"