

RADIOGRAPHY TRANSFORMER PUZZLE

UNIT - 8

TOPIC – TRANSFORMER

TOTAL MARKS - 10 MARKS

Puzzle: Technical Coliseum: The Hidden Fault Arena

You are a radiology technician on duty when the X-ray machine in the ER fails during a busy shift. The machine, a 5-year-old model, has a history of intermittent power fluctuations over the past month, with recent exposure to a brief electrical surge from unstable hospital grid. Operators report a 2-week progression of issues: initial humming noise during operation, followed by inconsistent image quality, and now complete failure to produce X-rays despite powering on. Visual inspection reveals warmth around the high-voltage generator area, a faint burning smell, and no visible damage to the tube. Diagnostic tests show input voltage stable at 220V, but output kVp readings erratic (dropping below set 80 kVp to 50-60 kVp), mA overload alerts, and multimeter indicating increased resistance in secondary windings. Oscilloscope confirms distorted waveform output.

Options for next steps

- Diagnosis A: X-ray tube filament burnout – Proceed to tube replacement and calibration.
- Diagnosis B: High-voltage transformer failure – Isolate unit, inspect windings for insulation breakdown, and plan transformer replacement.

- Diagnosis C: Capacitor bank malfunction – Test and replace faulty capacitors in the circuit.
- Diagnosis D: Rectifier diode issue – Diagnose and replace the rectifier assembly.

Clues to ponder:

- Buzzing or humming often indicates loose laminations or winding issues in transformers, while erratic kVp suggests voltage step-up failure. History of power surges hints at insulation degradation.
- No tube arcing noted, but progressive overload with heat suggests core component strain.
- Risks: Untreated transformer fault can lead to electrical fire, complete system shutdown, or shock hazard; repair needed if waveform distortion or resistance >10% nominal.

What is your choice, and why? Consider etiology, complications and prognosis.

RUBRICS

Criterion	Marks (out of 10)
Accuracy	4
Logical reasoning / Applying	3
Conceptual understanding	2
Presentation	1
Total Marks	10 marks