Assistant Engineer (Electrical) — 2025 · Solved Past Paper

Body: Balochistan Public Service Commission (BPSC) · **Post:** Assistant Engineer (Electrical) · **Year:** 2025 · **Questions:** 70 in the original paper — **67 solved and verified**, 3 excluded as defective (Q8, Q24, Q25) · **Price:** Free

> **How to use this paper:** each question shows the stem, the four options, and the correct answer. Click “Why each option?” under a question to see all four options explained — one question teaches four topics. General Knowledge answers are as of the 2025 sitting.

Source note: testpointpk reproduction, 'BPSC Assistant Engineer Electrical Solved Past Paper 2025' (70 items, served order Q1–Q70) primary; the page states the year 2025 only, no day or month. No second source — every answer verified independently from domain knowledge. 1 printed-key correction (Q3: a capacitor's reactive power is Q < 0 under the standard load convention, not Q > 0). 4 PICK-ONE (Q18, Q36, Q42, Q52). 3 DEFECTIVE-excluded (Q8: the phasor value of 0.5 H needs an angular frequency that the stem never gives; Q24: data needed to answer is missing from the stem; Q25: the coal-consumption working gives no option). All decisions by the assistant under the owner's 8 Nov 2026 delegation.

Question 1 Electrical Engineering

A device that converts mechanical energy into electric energy is called _____?

- A. Motor
- B. Transformer
- C. Coil
- D. Generator ✓ **Correct answer**

motor does the opposite conversion, turning electrical energy into mechanical energy.

B. Wrong: a transformer transfers electrical energy between circuits at a different voltage; it converts no mechanical energy.

C. Wrong: a coil is just a winding of wire, a part of a machine, not a device that converts mechanical energy into electrical energy.

D. Correct: a generator converts mechanical energy (rotation of its shaft) into electrical energy by electromagnetic induction.

Question 2 Circuit Analysis

Determine the total charge entering a terminal between t = 1 s and t = 2 s if the current passing the terminal is $i = (3t^2 - t)$ A?

- A. 8.5 C
- B. 5.5 C ✓ **Correct answer**
- C. 6.5 C
- D. None of these

A. Wrong: integrating gives 5.5 C, not 8.5 C (8.5 comes from mishandling the limits).

B. Correct: charge is the integral of current, $q = \int_1^2 (3t^2 - t)\, dt = [t^3 - t^2/2]_1^2 = (8 - 2) - (1 - 0.5) = 6 - 0.5 = 5.5$ C.

C. Wrong: 6.5 C is the value of the upper-limit term alone ($8 - 2 = 6$, plus a slip); the lower limit must be subtracted.

D. Wrong: 5.5 C is among the options and is correct.

Question 3 Circuit Analysis

For capacitors, the reactive power Q must be _____?

0 ✓ Correct answer

- B. Q > 1
- C. Q > 0
- D. None of these

A. Correct: under the standard load convention an inductor absorbs positive reactive power (Q > 0) while a capacitor absorbs negative reactive power — it supplies vars to the system — so for a capacitor Q < 0.

B. Wrong: "greater than 1" is not a sign rule for reactive power, and a capacitor's Q is negative, not positive.

C. Wrong: Q > 0 is the inductor's sign; the printed key C is wrong (see verification summary).

D. Wrong: Q < 0 is among the options and is correct. Printed-key correction: testpointpk keys C 'Q > 0'; corrected to A 'Q < 0' (see verification summary).

Question 4 Electrical Engineering

The capacitance of a variable air capacitor is at maximum when _____?

- A. The movable plates half overlap the fixed plates
- B. The movable plates are most widely separated from the fixed plates
- C. Both sets of plates are exactly meshed ✓ **Correct answer**
- D. None of these

A. Wrong: half overlap gives about half the maximum overlapping area, hence about half the maximum capacitance.

B. Wrong: widest separation is the minimum-capacitance position (plates unmeshed), not the maximum.

C. Correct: capacitance is proportional to the overlapping plate area, which is largest when the movable plates are fully meshed with the fixed plates.

II meshing is among the options and is correct.

Question 5 Power Systems

Modern generators have the ability to generate approximately _____?

- A. 5kV - 10kV
- B. 13kV - 30kV ✓ **Correct answer**
- C. 13kV - 60kV
- D. None of these

A. Wrong: that band is below the terminal voltage of modern large generators (small older sets aside).

B. Correct: large modern turbo-generators generate at roughly 11–27 kV at their terminals (stepped up by the generator transformer for transmission), which sits inside the 13–30 kV band.

C. Wrong: no generator produces 60 kV at its terminals; 60 kV and above are transmission voltages reached only after step-up transformation.

D. Wrong: the 13–30 kV band is among the options and is correct.

Question 6 Circuit Analysis

The formula of Capacitance is _____ where A is the surface area of each plate, d is the distance between the plates, and ε is the permittivity of the dielectric material between the plates.

- A. $C = \varepsilon A^2/d$
- B. $C = \varepsilon A/d$ ✓ **Correct answer**
- C. $C = \varepsilon A/d^2$
- D. None of these

A. Wrong: the area appears once, not squared; capacitance grows linearly with plate area.

For a parallel-plate capacitor C = εA/d — capacitance rises with area and permittivity and falls as the plates move apart.

C. Wrong: the separation appears once in the denominator, not squared.

D. Wrong: C = εA/d is among the options and is correct.

Question 7 Electronics

An integrator is an op amp circuit whose output is proportional to the _____ of the input signal.

- A. Integral ✓ **Correct answer**
- B. Log
- C. Exponential
- D. None of these

A. Correct: an op-amp integrator (capacitor in the feedback path) gives an output proportional to the time integral of the input voltage.

B. Wrong: a logarithmic amplifier gives an output proportional to the log of the input, not an integrator.

C. Wrong: an exponential (antilog) amplifier gives an exponential output, not an integrator.

D. Wrong: "Integral" is among the options and is correct.

Question 8 Circuit Analysis

The phasor value of 0.5 H is _____?

- A. j6
- B. j4
- C. j2
- D. None of these

s given for this question, and none is taught. No correct option (DEFECTIVE-excluded)

A. Not derivable: it would be right only if ω = 12 rad/s, which the stem never states.

B. Not derivable: it would be right only if ω = 8 rad/s, which the stem never states.

C. Not derivable: it is the printed key, but it would be right only if ω = 4 rad/s, which the stem never states.

D. Not correct either as an answer to the question as set: "none of these" would be the refuge only if the question had a determinate answer outside the options, but here the question itself is under-specified, so the item is excluded rather than answered.

Question 9 Electrical Engineering

A fully charged 50 Ah battery rated for 10 h discharge can be discharged at a steady current of 5A for _____?

- A. 15 h
- B. 8 h
- C. 10 h ✓ **Correct answer**
- D. None of these

A. Wrong: 50 Ah at 5 A gives 50 ÷ 5 = 10 h, not 15 h.

B. Wrong: 8 h at 5 A would deliver only 40 Ah, less than the battery's 50 Ah.

C. Correct: time = capacity ÷ current = 50 Ah ÷ 5 A = 10 h, which is exactly the battery's 10-hour rating.

D. Wrong: 10 h is among the options and is correct.

Question 10 Circuit Analysis

An alternating current completes 100 cycles in 0.1 s. Its frequency is _____?

Hz ✓ **Correct answer**

- B. 20 Hz
- C. 100 Hz
- D. None of these

A. Correct: frequency = cycles ÷ time = 100 ÷ 0.1 s = 1,000 Hz = 1 kHz.

B. Wrong: 20 Hz would give only 2 cycles in 0.1 s.

C. Wrong: 100 Hz would give only 10 cycles in 0.1 s (100 Hz is the number of cycles, not the rate).

D. Wrong: 1 kHz is among the options and is correct.

Question 11 Power Systems

HVDC line of Pakistan has following power capacity?

- A. 8000 MW
- B. 800 MW
- C. 4000 MW ✓ **Correct answer**
- D. None of these

A. Wrong: Pakistan's HVDC line is rated at half of this, 4,000 MW.

B. Wrong: 800 MW is far below the line's rating.

C. Correct: Pakistan's only HVDC line, the ±660 kV Matiari–Lahore line (in commercial operation since 1 September 2021), is rated at 4,000 MW (4 GW).

D. Wrong: 4,000 MW is among the options and is correct.

Question 12 Circuit Analysis

In a Y-Y system, a line voltage of 220 V produces a phase voltage of _____?

- A. 127 V ✓ **Correct answer**

- C. 220 V
- D. None of these

A. Correct: in a star (Y) system line voltage = √3 × phase voltage, so phase voltage = 220 ÷ √3 = 127 V.

B. Wrong: 381 V is 220 × √3, the wrong way round — that would be the line voltage for a 220 V phase voltage.

C. Wrong: line and phase voltages are equal only in a delta system, not in a star system.

D. Wrong: 127 V is among the options and is correct.

Question 13 Circuit Analysis

The average power of AC network is calculated by _____?

- A. $P = 1/T \int_0^T p(t)\,dt$ ✓ **Correct answer**
- B. $P = N/T \int_0^T p(t)\,dt$
- C. $P = 2N/T \int_0^T p(t)\,dt$
- D. None of these

A. Correct: average power is the time average of the instantaneous power p(t) over one period T — the integral over the period divided by the period.

B. Wrong: there is no factor N (number of turns or anything else) in the definition of average power.

C. Wrong: the factor 2N has no place in the average-power definition.

D. Wrong: the correct formula is among the options.

Question 14 Circuit Analysis

The formula of equivalent conductance for N resistors in parallel will be _____?

= G1 + G2 + G3 +.....+GN ✓ **Correct answer**

- B. G^2eq = G1 + G2 + G3 +.....+GN
- C. G^3eq = G1 + G2 + G3 +.....+GN
- D. None of these

A. Correct: conductances in parallel add, just as resistances in series add (since G = 1/R, adding conductances is the reciprocal of the parallel-resistance formula).

B. Wrong: the equivalent conductance itself is the sum; it is not squared.

C. Wrong: the equivalent conductance is not cubed either.

D. Wrong: the plain sum is among the options and is correct.

Question 15 Electrical Engineering

How much energy does a 100-W electric bulb consume in four hours?

- A. 50 Wh
- B. 400 Wh ✓ **Correct answer**
- C. 200 Wh
- D. None of these

A. Wrong: 50 Wh would be a 100 W bulb running for half an hour, not four hours.

B. Correct: energy = power × time = 100 W × 4 h = 400 Wh.

C. Wrong: 200 Wh is a 100 W bulb running for two hours.

D. Wrong: 400 Wh is among the options and is correct.

Question 16 Electrical Engineering

An isolating transformer has _____ ratio.

- A. 2:2
- B. 1:2

- D. None of these

A. Wrong in form: 2:2 reduces to 1:1, but the standard statement of an isolation transformer's ratio is 1:1, and the option as written is not the textbook answer.

B. Wrong: 1:2 is a step-up ratio; an isolating transformer does not change the voltage.

C. Correct: an isolating (isolation) transformer has equal primary and secondary turns, so its voltage ratio is 1:1 — it isolates the circuits electrically without changing the voltage.

D. Wrong: 1:1 is among the options and is correct.

Question 17 Circuit Analysis

When a capacitor is connected to an a.c. supply the current?

- A. Lags the voltage by 90°
- B. Leads the voltage by 180°
- C. Leads the voltage by π/2 rad ✓ **Correct answer**
- D. None of these

A. Wrong: that is what happens in an inductor, not a capacitor; in a capacitor the current leads.

B. Wrong: the lead in a pure capacitor is a quarter-cycle, 90°, not a half-cycle, 180°.

C. Correct: in a pure capacitor the current leads the voltage by π/2 radians, i.e. 90°.

D. Wrong: the π/2 lead is among the options and is correct.

Question 18 Electrical Engineering

The _____ materials have a low reluctance and can be used as magnetic screens to prevent magnetic fields affecting materials within the screen.

- A. Copper

- ...omagnetic ✓ **Correct answer**
- C. Iron
- D. None of these

A. Wrong: copper is non-magnetic (diamagnetic) with permeability near that of free space, so it has high reluctance and is not a magnetic screen.

B. Picked: ferromagnetic materials (iron, nickel, cobalt and their alloys) have very high permeability and low reluctance, so magnetic flux prefers to pass through them, shielding what is inside.

C. Also defensible: iron is the classic ferromagnetic screening material, with low reluctance; it is not picked only because the stem asks for the material class rather than one example of it.

D. Wrong: ferromagnetic materials (and iron) are among the options and fit.

Question 19 Circuit Analysis

What is the voltage across a 3-μF capacitor if the charge on one plate is 0.12 mC?

- A. 140 V
- B. 40 V ✓ **Correct answer**
- C. 80 V
- D. None of these

A. Wrong: 140 V would need a charge of 0.42 mC on a 3 μF capacitor.

B. Correct: $V = Q/C = 0.12 \times 10^{-3}$ C ÷ 3×10^{-6} F = 40 V.

C. Wrong: 80 V would need twice the charge, 0.24 mC.

D. Wrong: 40 V is among the options and is correct.

20 Electronics

The relationship between Ic and IE for BJT is?

- A. Ic = -IE
- B. Ic > IE
- C. Ic < IE ✓ **Correct answer**
- D. Ic = Ie

A. Wrong: the emitter current is the sum of collector and base currents, not the negative of the collector current (the minus sign would apply only to a particular reference-direction convention, not to the magnitudes asked for).

B. Wrong: the collector current is only part of the emitter current, so it cannot exceed it.

C. Correct: IE = IC + IB, and since the base current IB is positive, the collector current is always slightly less than the emitter current.

D. Wrong: the two are equal only if the base current were zero, which it never is in an active BJT.

Question 21 Mathematics

The cos(wt - 90°) = _____?

- A. sin(2wt)
- B. sin wt ✓ **Correct answer**
- C. cos wt
- D. None of these

A. Wrong: cos(ωt − 90°) has the same frequency ω as the original, not double frequency.

B. Correct: by the identity cos(x − 90°) = sin x, so cos(ωt − 90°) = sin ωt.

C. Wrong: shifting a cosine by 90° turns it into a sine, not back into the same cosine.

D. Wrong: sin ωt is among the options and is correct.

22 Circuit Analysis

A 24 V DC source is connected to a series circuit with a 4 Ω and an 8 Ω resistor. What is the current flowing through the circuit?

- A. 3 A
- B. 4 A
- C. 2 A ✓ **Correct answer**
- D. None of these

A. Wrong: 3 A would need a total resistance of 8 Ω, but the series total is 12 Ω.

B. Wrong: 4 A would need a total resistance of 6 Ω.

C. Correct: total resistance = 4 + 8 = 12 Ω, so I = V/R = 24 ÷ 12 = 2 A.

D. Wrong: 2 A is among the options and is correct.

Question 23 Circuit Analysis

A series RLC circuit has a resistance of 10 Ω, an inductance of 0.1 H, and a capacitance of 100 µF. If the supply voltage is 100 V at 50 Hz, what is the impedance of the circuit?

- A. 10 Ω ✓ **Correct answer**
- B. 20 Ω
- C. 50 Ω
- D. None of these

A. Correct: XL = 2π × 50 × 0.1 = 31.4 Ω and XC = 1 ÷ (2π × 50 × 100 × 10^{-6}) = 31.8 Ω, so the net reactance is only about −0.4 Ω and Z = √(10^2 + 0.4^2) ≈ 10.0 Ω — the circuit is essentially at resonance.

B. Wrong: the impedance is near the resistance alone because the inductive and capacitive reactances almost cancel.

C. Wrong: 50 Ω is far above the near-resonant impedance of about 10 Ω.

) Ω (to the accuracy the options allow) is among the options and is correct.

Question 24 Electronics

A common-source MOSFET amplifier operates with a drain current of 5 mA and a drain resistor of 2 kΩ. If the MOSFET has an output resistance of 50 kΩ, what is the approximate voltage gain?

- A. 5
- B. 20
- C. 50
- D. None of these

No answer is given for this question, and none is taught. No correct option (DEFECTIVE-excluded)

A. Not derivable: no given data yields a gain of 5.

B. Not derivable: it is the printed key, and it would need an unstated gm of about 10 mS (10 mS × 1.92 kΩ ≈ 19); nothing in the stem gives gm.

C. Not derivable: no given data yields a gain of 50.

D. Not correct either as an answer to the question as set: the gain is not determinable from the data, so the item is excluded rather than answered.

Question 25 Power Systems

A 500 MW thermal power plant operates at an efficiency of 38%. If the calorific value of coal used is 25 MJ/kg, how much coal is consumed per hour?

- A. 32540 kg
- B. 18960 kg
- C. 52630 kg
- D. None of these

s given for this question, and none is taught. No correct option (DEFECTIVE-excluded)

A. Wrong: about one-sixth of the required 189,474 kg/h.

B. Wrong: it is the printed key, but it is almost exactly ten times too small — it is the answer obtained if the calorific value is mistakenly taken as 250 MJ/kg instead of 25 MJ/kg.

C. Wrong: about one-quarter of the required 189,474 kg/h.

D. Not correct either as an answer to the question as set: the correct value (about 189,474 kg/h) is outside the options, so the item is excluded rather than answered.

Question 26 Power Systems

A power transformer rated at 100 MVA, 220 kV/33 kV is protected by a differential relay. If the CT ratios are 1000:5 on the HV side and 5000:5 on the LV side, what is the purpose of the relay?

- A. To regulate the voltage during load variations
- B. To detect overcurrent in the transformer
- C. To detect internal faults within the transformer ✓ **Correct answer**
- D. None of these

A. Wrong: voltage regulation is done by tap changers, not by a differential relay.

B. Wrong: overcurrent is the job of overcurrent relays; the CT ratios here are given precisely so the differential relay can compare the two sides' currents.

C. Correct: a differential relay compares the current entering and leaving the transformer (the CT ratios match the two sides); any difference means current is leaking out through an internal fault, and the relay trips.

D. Wrong: internal-fault detection is among the options and is correct.

27 Power Systems

What is the primary purpose of an economizer in a thermal power plant?

- A. To preheat the feedwater using residual heat from the flue gases ✓ **Correct answer**
- B. To increase the pressure of steam
- C. To reduce the temperature of the flue gases
- D. None of these

A. Correct: the economizer sits in the flue-gas path and uses the waste heat of the outgoing gases to warm the boiler feedwater, raising plant efficiency.

B. Wrong: steam pressure is set by the boiler and turbine design, not by the economizer.

C. Wrong as the primary purpose: the gases do leave cooler, but that is a side effect of recovering their heat — the purpose is preheating the feedwater.

D. Wrong: feedwater preheating is among the options and is correct.

Question 28 Communication Systems

In an amplitude modulation (AM) system, what is the modulation index if the maximum and minimum envelope voltages are 10V and 2V, respectively?

- A. 1.2
- B. 0.4
- C. 0.67 ✓ **Correct answer**
- D. None of these

A. Wrong: a modulation index above 1 means over-modulation, and the figures here give a value below 1.

B. Wrong: 0.4 would need, for example, Vmax = 7 V and Vmin = 3 V.

C. Correct: $\mu = (V_{max} - V_{min}) \div (V_{max} + V_{min}) = (10 - 2) \div (10 + 2) = 8 \div 12 = 0.67$.

67 is among the options and is correct.

Question 29 Control Systems

In control systems, which method is most suitable for analyzing multiple-input multiple-output (MIMO) systems?

- A. Bode plot
- B. State-space representation ✓ **Correct answer**
- C. Root locus method
- D. None of these

A. Wrong: a Bode plot is a frequency-response tool for single-input single-output systems; it does not handle the interactions between several inputs and outputs.

B. Correct: state-space models describe a system by a set of first-order equations in matrix form, which handles many inputs and many outputs (and their cross-coupling) naturally.

C. Wrong: root locus is a single-loop, single-input single-output design tool; it is not the method for MIMO analysis.

D. Wrong: state-space representation is among the options and is correct.

Question 30 Control Systems

In a closed-loop control system, what is the primary advantage of using a PID controller?

- A. It provides proportional, integral, and derivative actions for better control. ✓ **Correct answer**
- B. It eliminates steady-state error
- C. It improves system stability
- D. None of these

A. Correct: the PID controller's advantage is that it combines all three actions — proportional for speed of response, integral to remove steady-state error, and derivative

rshoot — giving better overall control than any one action alone.

B. True but partial: removing steady-state error is the integral action's contribution alone, not the whole advantage of PID.

C. True but partial: improved stability and damping are mainly the derivative action's contribution, not the whole advantage of PID.

D. Wrong: the combined-actions answer is among the options and is correct.

Question 31 Power Systems

Which component of a smart grid is primarily responsible for real-time demand response and load balancing?

- A. Microgrid Controllers
- B. Demand Side Management (DSM) ✓ **Correct answer**
- C. Phasor Measurement Units (PMUs)
- D. None of these

A. Wrong: microgrid controllers manage a local microgrid's generation and loads, not grid-wide real-time demand response.

B. Correct: DSM is the smart-grid function that shifts or sheds consumer load in real time to balance demand against supply.

C. Wrong: PMUs measure voltage and current phasors for wide-area monitoring; they observe the grid, they do not manage demand.

D. Wrong: DSM is among the options and is correct.

Question 32 Power Electronics

Which power electronic converter is used to convert AC power to variable DC voltage?

- A. Controlled Rectifier ✓ **Correct answer**

- C. Cycloconverter
- D. None of these

A. Correct: a controlled rectifier (thyristor or SCR bridge) converts AC to DC, and varying the firing angle varies the DC output voltage.

B. Wrong: an inverter does the opposite conversion, DC to AC.

C. Wrong: a cycloconverter converts AC at one frequency directly to AC at another frequency, with no DC stage.

D. Wrong: the controlled rectifier is among the options and is correct.

Question 33 Power Electronics

Which control technique is commonly used in switch-mode power supplies to regulate output voltage efficiency?

- A. Pulse Width Modulation (PWM) ✓ **Correct answer**
- B. Phase-angle control
- C. Linear voltage regulation
- D. None of these

A. Correct: switch-mode supplies regulate their output by varying the duty cycle (the width of the switching pulses), which keeps efficiency high because the switch is either fully on or fully off.

B. Wrong: phase-angle control is used with AC thyristor circuits (such as dimmers), not to regulate a switch-mode DC supply.

C. Wrong: linear regulation drops the excess voltage as heat, which is inefficient — the opposite of what a switch-mode supply is for.

D. Wrong: PWM is among the options and is correct.

34 Digital Signal Processing

In digital signal processing, what is the main purpose of using the Z-transform?

- A. To eliminate the effects of aliasing in sampled signals
- B. To analyze and design linear time-invariant systems in the frequency domain ✓ **Correct answer**
- C. To convert continuous-time signals into discrete-time signals
- D. None of these

A. Wrong: aliasing is prevented by an anti-aliasing filter before sampling, not by the Z-transform.

B. Correct: the Z-transform is the discrete-time counterpart of the Laplace transform; it turns difference equations into algebra and lets LTI systems be analysed and designed in the frequency (z) domain.

C. Wrong: that conversion is sampling (analogue-to-digital conversion), not the Z-transform.

D. Wrong: the LTI analysis and design purpose is among the options and is correct.

Question 35 Power Systems

In power system analysis, which method is commonly used for solving large-scale load flow problems due to its fast convergence?

- A. Euler’s method
- B. Gauss-Seidel method
- C. Newton-Raphson method ✓ **Correct answer**
- D. None of these

A. Wrong: Euler's method solves ordinary differential equations numerically; it is not a load-flow method.

B. Wrong: Gauss-Seidel is a load-flow method, but it converges slowly (linearly) and is used

tems, not large ones.

C. Correct: Newton-Raphson converges quadratically, so it needs far fewer iterations and is the standard method for large-scale load-flow studies.

D. Wrong: Newton-Raphson is among the options and is correct.

Question 36 Power Systems

What is the main advantage of using high-impedance grounding in a power distribution system?

- A. It minimizes fault currents ✓ **Correct answer**
- B. It eliminates the need for protective relays
- C. It ensures continuous operation
- D. None of these

A. Picked: the high impedance in the neutral path limits a line-to-ground fault to a small current (typically a few amps), reducing damage and arc-flash hazard.

B. Wrong: relays are still needed to detect and locate the fault; grounding does not replace protection.

C. Also true: because the fault current is small, the system can keep running with a single ground fault present until it is located — it is not picked only because it is a consequence of the current limiting, not the primary advantage.

D. Wrong: fault-current limiting is among the options and is correct.

Question 37 Electrical Machines

Why is a series-wound DC motor unsuitable for applications requiring a constant speed under varying loads?

- A. It requires an external regulator to maintain field excitation
- B. Its torque decreases

- speed varies widely with changes in load ✓ **Correct answer**
- D. None of these

A. Wrong: a series motor's field is self-excited by its own armature current; no external regulator is the issue.

B. Wrong: a series motor's torque is very high at starting and falls as speed rises, but falling torque is not the reason it cannot hold constant speed.

C. Correct: in a series motor the flux depends on the load current, so a light load lets the speed rise dangerously high and a heavy load drags it down — the speed is strongly load-dependent, the opposite of constant.

D. Wrong: wide speed variation is among the options and is correct.

Question 38 Electrical Machines

In a DC shunt motor, what is the primary consequence of an open field winding during operation?

- A. The armature current will drop to zero.
- B. The motor will stop.
- C. The motor speed will increase uncontrollably. ✓ **Correct answer**
- D. None of these

A. Wrong: the armature current does not drop to zero — with the field gone the back EMF collapses and the armature draws a large current.

B. Wrong: the motor does not stop; it speeds up, which is the danger.

C. Correct: speed is roughly proportional to supply voltage divided by flux, so if the shunt field opens and the flux falls toward zero, the motor races to a destructively high speed (runaway).

D. Wrong: uncontrolled speed rise is among the options and is correct.

39 Communication Systems

In frequency modulation (FM), what is the primary factor that determines the bandwidth of the transmitted signal?

- A. Carrier frequency
- B. Amplitude of the modulating signal
- C. Frequency deviation and the highest frequency of the modulating signal ✓ **Correct answer**
- D. None of these

A. Wrong: the carrier frequency fixes where the signal sits in the spectrum, not how wide it is.

B. Wrong on its own: the modulating amplitude sets the frequency deviation, but the bandwidth also needs the highest modulating frequency (Carson's rule).

C. Correct: by Carson's rule the FM bandwidth is about 2(Δf + fm), i.e. it depends on the frequency deviation Δf and the highest modulating frequency fm.

D. Wrong: the Carson's-rule pair is among the options and is correct.

Question 40 Circuit Analysis

When analyzing a DC circuit using Thevenin’s theorem, what is the correct method to determine the Thevenin equivalent resistance?

- A. Short-circuit the output.
- B. Measure the total resistance of the circuit.
- C. Remove the load resistor and calculate the resistance seen from its terminals. ✓ **Correct answer**
- D. None of these

A. Wrong: short-circuiting the output terminals is how the Norton (short-circuit) current is found, not the Thevenin resistance.

e total resistance of the whole circuit is not the resistance seen from the load terminals (independent sources must first be turned off).

C. Correct: the Thevenin resistance is the equivalent resistance looking back into the network from the load terminals, with independent sources turned off (voltage sources shorted, current sources opened).

D. Wrong: the remove-the-load method is among the options and is correct.

Question 41 Power Systems

What is the primary reason for using flexible AC transmission systems (FACTS) in modern power grids?

- A. To eliminate the need for transmission line
- B. To replace traditional circuit breakers
- C. To enhance the controllability and stability ✓ **Correct answer**
- D. None of these

A. Wrong: FACTS devices work on transmission lines; they do not replace them.

B. Wrong: circuit breakers are still needed for fault interruption; FACTS controllers do not replace them.

C. Correct: FACTS devices (such as SVCs and STATCOMs) use power electronics to control power flow, voltage and damping, improving the controllability and stability of the grid.

D. Wrong: controllability and stability is among the options and is correct.

Question 42 Power Systems

Why are series capacitors used in long-distance AC transmission lines?

- A. Eliminate harmonics from the power system
- B. Improve power factor by compensating for inductive reactance ✓ **Correct answer**

- ease the voltage level at the receiving end
- D. None of these

A. Wrong: harmonics are dealt with by filters, not by series capacitors, which are not harmonic filters.

B. Picked: a series capacitor cancels part of the line's series inductive reactance, reducing the net reactance, improving power transfer and the power factor of the line.

C. Also true: with less net reactance the voltage drop along the line falls, so the receiving-end voltage rises — it is not picked only because it is an effect of the compensation rather than the compensation itself.

D. Wrong: reactance compensation is among the options and is correct.

Question 43 Power Systems

Why are high-voltage direct current (HVDC) transmission systems preferred for long-distance power transmission?

- A. They are less expensive to install than AC systems.
- B. They eliminate the need for transformers.
- C. They reduce transmission losses and improve efficiency. ✓ **Correct answer**
- D. None of these

A. Wrong: HVDC converter stations are expensive, so HVDC costs more to install than AC; it pays off over very long distances.

B. Wrong: HVDC still needs converter transformers at both ends.

C. Correct: over long distances DC has no reactive-power flow, no skin effect and no stability limit, so losses are lower and more power can be moved efficiently.

D. Wrong: lower losses and better efficiency is among the options and is correct.

44 Power Systems

Why is distance protection preferred for high-voltage transmission lines?

- A. It operates independently of the fault type.
- B. It responds only to overcurrent conditions.
- C. It determines fault location based on impedance measurement. ✓ **Correct answer**
- D. None of these

A. Wrong: distance protection does respond to different fault types (with different measuring elements); independence of fault type is not its distinguishing feature.

B. Wrong: that describes overcurrent protection, not distance protection.

C. Correct: a distance relay measures voltage divided by current — the impedance to the fault — and trips in a time graded by that distance, so it protects long high-voltage lines selectively.

D. Wrong: impedance-based fault location is among the options and is correct.

Question 45 Power Systems

In a nuclear power plant, what is the primary function of a moderator?

- A. To act as a coolant and transfer heat to the turbine
- B. To absorb excess neutrons and prevent overheating
- C. To slow down fast neutrons and sustain the chain reaction ✓ **Correct answer**
- D. None of these

A. Wrong: that is the coolant's job (water, gas or liquid metal); the moderator is a different component, though in light-water reactors the water does both.

B. Wrong: absorbing neutrons is the control rods' job (boron or cadmium); the moderator does the opposite — it keeps neutrons in play.

ssion releases fast neutrons, which are unlikely to cause further fission; the moderator (water, graphite or heavy water) slows them to thermal speeds where they readily fission U-235 and sustain the chain reaction.

D. Wrong: slowing neutrons is among the options and is correct.

Question 46 Control Systems

In a linear time-invariant (LTI) system, what does the observability condition ensure?

- A. The system can be controlled using a single input.
- B. All state variables can be reconstructed from output measurements. ✓ **Correct answer**
- C. The system remains stable for all input conditions.
- D. None of these

A. Wrong: being controllable from an input is controllability, not observability.

B. Correct: a system is observable when its internal states can be inferred from the measured outputs over time (the observability matrix has full rank).

C. Wrong: stability is a separate property (pole locations), not what observability ensures.

D. Wrong: state reconstruction from outputs is among the options and is correct.

Question 47 Power Systems

Which key feature allows a smart grid to integrate renewable energy sources efficiently?

- A. Manual control of power distribution
- B. Centralized power generation
- C. Advanced energy storage and real-time demand response ✓ **Correct answer**
- D. None of these

A. Wrong: manual control is too slow for variable renewables; the smart grid's point is automation.

renewables are distributed and variable, the opposite of centralised generation.

C. Correct: storage absorbs surplus renewable output and releases it when needed, while real-time demand response shifts load to match variable generation — together they let the grid absorb renewables efficiently.

D. Wrong: storage plus demand response is among the options and is correct.

Question 48 Electrical Machines

Why does a single-phase induction motor require an auxiliary starting mechanism?

- A. It does not require external power.
- B. It lacks a rotating magnetic field. ✓ **Correct answer**
- C. It cannot operate at high speeds.
- D. None of these

A. Wrong: a single-phase motor certainly needs external power; that is not a reason for a starter.

B. Correct: a single-phase winding produces only a pulsating (alternating) field, which has no starting torque — at standstill the torques in the two directions cancel — so an auxiliary winding or capacitor is needed to create a rotating field to start it.

C. Wrong: single-phase motors run at normal induction-motor speeds once started; speed is not the problem.

D. Wrong: the missing rotating field is among the options and is correct.

Question 49 Electrical Machines

In a three-phase induction motor, what causes the rotor to rotate?

- A. The applied DC voltage
- B. The presence of permanent magnets in the rotor
- C. The interaction between the motor's rotating magnetic field and rotor currents ✓

- D. None of these

A. Wrong: an induction motor is fed with AC, not DC.

B. Wrong: an ordinary induction motor's rotor has no permanent magnets (that would be a permanent-magnet synchronous motor).

C. Correct: the stator's rotating field induces currents in the rotor, and the interaction of that field with the rotor currents produces the torque that turns the rotor.

D. Wrong: the field–rotor-current interaction is among the options and is correct.

Question 50 Power Systems

What is the main advantage of using a ring main distribution system over a radial system?

- A. Lower installation cost
- B. Higher voltage drop
- C. Improved reliability and continuity of supply ✓ **Correct answer**
- D. None of these

A. Wrong: a ring main costs more to install (more cable and switchgear) than a radial system.

B. Wrong: a ring main gives a lower voltage drop, because each load can be fed from two directions.

C. Correct: in a ring main each consumer can be supplied from either side of the ring, so a fault on one section can be isolated without cutting off supply.

D. Wrong: reliability and continuity is among the options and is correct.

51 Control Systems

Which characteristic equation property ensures a control system is stable?

- A. All poles have positive real parts
- B. All poles lie in the right half of the s-plane
- C. All poles have negative real parts ✓ **Correct answer**
- D. None of these

A. Wrong: poles with positive real parts grow without bound — that is instability.

B. Wrong: the right half-plane is the unstable region; this is the same error as A in geometric form.

C. Correct: a system is stable when every pole of its characteristic equation lies in the left half of the s-plane, i.e. has a negative real part, so every transient decays.

D. Wrong: negative real parts is among the options and is correct.

Question 52 Control Systems

Which control system stability criterion is based on the location of poles in the s-plane?

- A. Root locus ✓ **Correct answer**
- B. Routh-Hurwitz criterion
- C. Bode plot
- D. None of these

A. Picked: root locus is the graphical method that shows where the poles sit in the s-plane and how they move, which is exactly "based on the location of poles in the s-plane".

B. Tempting but not picked: Routh-Hurwitz does determine stability from the poles' half-plane, but it does so from the characteristic equation's coefficients via the Routh array — it deliberately avoids finding or plotting the pole locations.

C. Wrong: a Bode plot is a frequency-response plot of gain and phase, not a pole-location

D. Wrong: root locus is among the options and is the method based on pole locations.

Question 53 Electrical Engineering

Which law states that the line integral of the magnetic field around a closed path is equal to the total current enclosed?

- A. Lenz's law
- B. Faraday's law
- C. Ampere's circuital law ✓ **Correct answer**
- D. None of these

A. Wrong: Lenz's law says the induced current opposes the change that produced it; it says nothing about a line integral round a closed path.

B. Wrong: Faraday's law relates the induced EMF round a loop to the rate of change of magnetic flux through it, not to the enclosed current.

C. Correct: Ampère's circuital law states $\oint B \cdot dl = \mu_0 I_enclosed$ — the line integral of the magnetic field round a closed path equals μ_0 times the current enclosed by the path.

D. Wrong: Ampère's circuital law is among the options and is correct.

Question 54 Power Electronics

Which semiconductor device is commonly used in high-power rectifier applications?

- A. BJT
- B. MOSFET
- C. SCR ✓ **Correct answer**
- D. None of these

A. Wrong: bipolar transistors are used for amplification and switching at modest power, not as the standard high-power rectifier device.

MOSFETs are fast switches for lower-voltage, high-frequency work; they are not the classic high-power rectifier device.

C. Correct: the silicon-controlled rectifier (thyristor) handles very high voltages and currents and is the standard device in high-power controlled rectifiers.

D. Wrong: the SCR is among the options and is correct.

Question 55 Power Systems

Which protection scheme is commonly used for detecting faults in a transformer?

- A. Directional protection
- B. Overvoltage protection
- C. Differential protection ✓ **Correct answer**
- D. None of these

A. Wrong: directional protection senses the direction of power flow (used on feeders), not transformer internal faults.

B. Wrong: overvoltage protection guards against voltage surges, not internal transformer faults.

C. Correct: differential protection compares the currents entering and leaving the transformer and trips on any difference, which is the standard scheme for detecting internal faults (winding faults, earth faults inside the tank).

D. Wrong: differential protection is among the options and is correct.

Question 56 Power Systems

Which type of relay operates when the impedance in a power system falls below a predetermined value?

- A. Thermal relay
- B. Distance relay ✓ **Correct answer**

- D. None of these

A. Wrong: a thermal relay operates on heating (overload), not on impedance.

B. Correct: a distance (impedance) relay measures V/I, and when a fault brings the measured impedance below its set reach it operates.

C. Wrong: a differential relay operates on a difference between two currents, not on impedance falling below a value.

D. Wrong: the distance relay is among the options and is correct.

Question 57 Power Systems

What is the primary function of a protective relay in a power system?

- A. Store electrical energy
- B. Generate electricity
- C. Detect faults ✓ **Correct answer**
- D. None of these

A. Wrong: storing energy is the job of batteries and capacitors, not of a relay.

B. Wrong: a relay generates nothing; generators generate electricity.

C. Correct: a protective relay's primary function is to detect abnormal conditions (faults) and then command the circuit breaker to isolate the faulty section.

D. Wrong: fault detection is among the options and is correct.

Question 58 Electrical Machines

Which part of a DC machine is responsible for converting electrical energy into mechanical energy?

- A. Field winding

- C. Armature ✓ **Correct answer**
- D. None of these

A. Wrong: the field winding produces the magnetic flux; it does not itself convert energy.

B. Wrong: the commutator is a mechanical rectifier that keeps the armature current in the right direction; it converts AC to DC (or vice versa), it is not where the energy conversion happens.

C. Correct: the armature conductors carry current in the magnetic field, so the electromagnetic force on them produces the torque — the armature is where electrical energy becomes mechanical energy in a DC motor.

D. Wrong: the armature is among the options and is correct.

Question 59 Communication Systems

What is the main purpose of a modulator in communication systems?

- A. To amplify the signal
- B. To convert digital to analog
- C. To impress information ✓ **Correct answer**
- D. None of these

A. Wrong: amplification is the amplifier's job; a modulator does not primarily amplify.

B. Wrong: digital-to-analogue conversion is a DAC's job; modulation is a different process (though digital modulation does map bits onto a carrier).

C. Correct: a modulator impresses the information (message) signal onto a carrier — varying the carrier's amplitude, frequency or phase in step with the message — so it can be transmitted.

D. Wrong: impressing information is among the options and is correct.

60 Power Systems

Which component is used to protect power distribution systems from overcurrent?

- A. Inductor
- B. Transformer
- C. Circuit breaker ✓ **Correct answer**
- D. None of these

A. Wrong: an inductor stores energy in a magnetic field and limits the rate of change of current; it does not interrupt an overcurrent.

B. Wrong: a transformer changes voltage levels; it does not protect against overcurrent.

C. Correct: a circuit breaker detects an overcurrent and opens its contacts to interrupt the faulty circuit, protecting the distribution system.

D. Wrong: the circuit breaker is among the options and is correct.

Question 61 Electrical Engineering

What is the primary purpose of a step-down transformer in distribution systems?

- A. Generate electrical power
- B. Increase voltage
- C. Convert AC to DC
- D. Reduce voltage ✓ **Correct answer**

A. Wrong: a transformer generates no power; it only transfers it.

B. Wrong: increasing voltage is a step-up transformer's job, the opposite of step-down.

C. Wrong: converting AC to DC is a rectifier's job, not a transformer's.

D. Correct: a step-down transformer (fewer secondary turns than primary) reduces the high distribution voltage to the lower voltage consumers use.

62 Digital Signal Processing

What is the main advantage of digital signal processing over analog signal processing?

- A. Continuous signal consumption
- B. Lower power
- C. Higher noise immunity ✓ **Correct answer**
- D. None of these

A. Wrong: "continuous signal consumption" is not a property of digital processing, and digital signals are discrete, not continuous.

B. Wrong: digital processing is not generally lower-power than analogue (analogue circuits can be very low power); power is not its main advantage.

C. Correct: digital signals are numbers, so they can be stored, copied and processed without the degradation noise causes in analogue signals — digital processing is far more immune to noise.

D. Wrong: higher noise immunity is among the options and is correct.

Question 63 Control Systems

Which component in a control system is responsible for processing the error signal and generating the control action?

- A. Plant
- B. Sensor
- C. Controller ✓ **Correct answer**
- D. None of these

A. Wrong: the plant is the system being controlled; it receives the control action, it does not generate it.

B. Wrong: the sensor measures the output and feeds it back; it does not process the error or decide the control action.

The controller takes the error signal (reference minus feedback) and computes the control action that drives the plant toward the desired output.

D. Wrong: the controller is among the options and is correct.

Question 64 Power Electronics

Which power electronic device is commonly used as a switch in dc circuits?

- A. Capacitor
- B. Diode
- C. MOSFET ✓ **Correct answer**
- D. None of these

A. Wrong: a capacitor stores charge; it is not a switch.

B. Wrong: a diode is an uncontrolled one-way valve — it conducts when forward-biased and cannot be turned off by a control signal, so it is not used as a controlled DC switch.

C. Correct: the MOSFET is a voltage-controlled switch that turns on and off quickly with a gate signal, and it is the standard controlled switch in DC circuits (DC choppers, switch-mode supplies, motor drives).

D. Wrong: the MOSFET is among the options and is correct.

Question 65 Power Systems

In a thermal power plant, what is the primary energy conversion that takes place?

- A. Chemical → Electrical
- B. Mechanical → Electrical
- C. Heat → Mechanical → Electrical ✓ **Correct answer**
- D. None of these

A. Wrong: that skips the intermediate steps — chemical energy is not converted directly to electricity in a thermal plant (that would be a fuel cell or battery).

at is only the last step (turbine to generator); it leaves out the heat stage.

C. Correct: fuel is burned to make heat, heat makes steam that drives the turbine (mechanical energy), and the turbine drives the generator (electrical energy).

D. Wrong: the heat-to-mechanical-to-electrical chain is among the options and is correct.

Question 66 Electrical Engineering

Which type of power is measured in volt-amperes (VA)?

- A. Active power
- B. Reactive power
- C. Apparent power ✓ **Correct answer**
- D. None of these

A. Wrong: active (real) power is measured in watts (W).

B. Wrong: reactive power is measured in volt-amperes reactive (VAR).

C. Correct: apparent power S = VI is measured in volt-amperes (VA).

D. Wrong: apparent power is among the options and is correct.

Question 67 Electrical Engineering

What is the formula for electrical power in a DC circuit?

- A. $P = V \times I$ ✓ **Correct answer**
- B. $P = V \times I^2$
- C. $P = V^2 \times I$
- D. None of these

A. Correct: in a DC circuit power is voltage times current.

B. Wrong: that mixes the two forms (VI and I^2R) into a meaningless product.

at mixes V²/R with VI into a meaningless product.

D. Wrong: P = VI is among the options and is correct.

Question 68 Circuit Analysis

Instantaneous power in inductor is proportional to the _____?

- A. Temperature of the inductor
- B. Product of the instantaneous current and rate of charge of current ✓ **Correct answer**
- C. Square of the rate of charge of current
- D. None of these

A. Wrong: an ideal inductor stores energy in its magnetic field; its instantaneous power has nothing to do with its temperature.

B. Correct: instantaneous power p = v·i, and for an inductor v = L(di/dt), so p = L·i·(di/dt) — proportional to the product of the instantaneous current and the rate of change of current ("rate of charge" in the reproduction is evidently "rate of change").

C. Wrong: the power is proportional to i × (di/dt), not to $(di/dt)^2$.

D. Wrong: the current-times-rate-of-change product is among the options and is correct.

Question 69 Circuit Analysis

A network with b branches, n nodes, and l independent loops will satisfy the fundamental theorem of network topology?

- A. b = l + n - 4
- B. b = l + n - 2
- C. b = l + n - 1 ✓ **Correct answer**
- D. None of these

A. Wrong: the constant in the fundamental relation is 1, not 4.

e constant is 1, not 2.

C. Correct: the fundamental theorem of network topology states b = l + n − 1, i.e. the number of independent loops is l = b − n + 1.

D. Wrong: b = l + n − 1 is among the options and is correct.

Question 70 Electrical Machines

Typical values of slip between no load and full load are about _____ per cent for large motors.

- A. 3.5 to 5
- B. 1.5 to 2 ✓ **Correct answer**
- C. 2.5 to 3
- D. None of above

A. Wrong: 3.5–5% slip is typical of small motors, not large ones.

B. Correct: large induction motors are designed with low rotor resistance and high efficiency, so their slip rises only slightly from no load to full load, typically about 1.5–2% (full-load slip is about 2% for large motors against about 6% for small ones).

C. Wrong: 2.5–3% is above the typical no-load-to-full-load change for a large motor.

D. Wrong: 1.5 to 2 is among the options and is correct.

This paper remains the paper of the Balochistan Public Service Commission. Ranjha Solutions branding is on this solved presentation only — the paper is not owned by Ranjha Solutions. BPSC publishes no past papers officially.

Past papers are **free** — no charge is taken from any student for papers. General Knowledge answers are as of the 2025 sitting.

Source: https://testpointpk.com/paper-mcqs/6458/bpsc-assistant-engineer-electrical-past-paper-2025 (accessed 8 Nov 2026). See the source note on this page about the fold-in