

**POWER SYSTEM PROTECTION & SWITCHGEAR
EEC601**

MCQ

1.	Isolators are used to disconnect a circuit when
Option A:	Line is on full load
Option B:	Line is energized
Option C:	Circuit breaker is not open
Option D:	There is no current in the line.
2.	When the 3-phase system is grounded and if single line to ground fault occurs, the voltage of the other two healthy phases will be
Option A:	Increases
Option B:	Decreases
Option C:	Remains Unaffected
Option D:	Medium affected
3.	Which of following is correct property of SF ₆ gas
Option A:	It is chemically stable at atmospheric pressure and at up to 500 degree Celsius temperature
Option B:	It is toxic at normal room temperature and pressure
Option C:	It is a corrosive gas at ambient temperatures
Option D:	Dielectric strength is almost same as that of air at atmospheric pressure
4.	Keeping in view the cost and the overall effectiveness, which of the following circuit breaker is best
Option A:	SF ₆ circuit breaker
Option B:	Vacuum circuit breaker
Option C:	Minimum oil circuit breaker
Option D:	Air blast circuit breaker
5.	The Fuse is mainly used for
Option A:	to prevent electrical circuit from very high current
Option B:	to open and close electric circuit
Option C:	protection of overhead line
Option D:	to prevent under current levels
6.	In carrier current protection, wave trap is used is for trapping
Option A:	Over voltages
Option B:	High frequency waves entering in generating units
Option C:	Over currents

Option D:	Power frequency waves
7.	HRC fuse provides the best protection against
Option A:	Open circuit
Option B:	Overload
Option C:	Reverse current
Option D:	Short circuit
8.	Which of following is not actuating quantity of relay
Option A:	Phase angle of voltage
Option B:	Frequency
Option C:	Current magnitude
Option D:	Resistance of relay contacts
9.	IDMT relays have full form
Option A:	Inverse definite minimum time
Option B:	Inverse differential minimum time
Option C:	Inverse distance minimum time
Option D:	Inverse double minimum time
10.	In order to change plug setting of relay one have to change
Option A:	Medium of conduction
Option B:	Air gap between contacts
Option C:	Number of ampere turns
Option D:	Circuit breaker
11.	Primary use of Buchholz relay is to protect against
Option A:	External faults
Option B:	Internal faults
Option C:	Theft of instruments
Option D:	Rotor winding faults
12.	A relay is used to
Option A:	Break the fault current
Option B:	Sense the fault
Option C:	Sense the fault and direct to trip the circuit breaker
Option D:	Direct trips the circuit breaker
13.	In an alternator the voltage of field system is usually
Option A:	More than 1000 V
Option B:	Between 400 V and 600 V
Option C:	Less than 200 V
Option D:	More than 200 V
14.	When an induction motor runs at rated load and speed, the iron losses are

Option A:	Negligible
Option B:	Very heavy
Option C:	Independent of supply frequency
Option D:	Independent of supply voltage
15.	Generator internal fault protection is usually based on the principle of
Option A:	Differential protection
Option B:	Cross-differential protection
Option C:	Negative sequence protection
Option D:	Positive sequence protection
16.	Pilot wire protection is used for the protection of
Option A:	Transmission lines
Option B:	Alternators
Option C:	Switchgears
Option D:	Transformers
17.	Relays for transmission line protection are
Option A:	In three zones
Option B:	In two zones
Option C:	Independent of zone
Option D:	No Zones
18.	Overhead ground wires are used to protect a transmission line against.
Option A:	Line to ground faults
Option B:	Arcing earths
Option C:	Voltage surges due to direct lightning
Option D:	High-voltage oscillations due to switching
19.	A bimetal strip, in a thermal relay, consists of two metal strips of different
Option A:	Specific heat
Option B:	Thermal conductivity
Option C:	Coefficients of expansion
Option D:	Load Expansion
20.	The universal gate in a static Relay is
Option A:	NAND gate
Option B:	OR gate
Option C:	AND gate
Option D:	NOR gate
21.	The isolators used in the transmission lines are capable of breaking
Option A:	Fault current
Option B:	No current
Option C:	Charging current
Option D:	Load current

22.	Which of the following correctly represents the sequence of operations of isolator, circuit breaker and earthing switch while opening a circuit
Option A:	Close earthing switch - open circuit breaker open isolator
Option B:	Open isolator - close circuit breaker - open earthing switch
Option C:	Open circuit breaker - open isolator - close earthing switch
Option D:	Close circuit breaker - close isolator - open earthing switch
23.	Which of the following equipment is not installed in a substation?
Option A:	Shunt reactors
Option B:	Exciters
Option C:	Voltage transformers
Option D:	Series capacitors.
24.	The resistance of an electric arc can be increased by
Option A:	Increasing the concentration of ionized particles.
Option B:	Reducing the arc length.
Option C:	Splitting the arc.
Option D:	Increasing the arc cross section.
25.	A circuit breaker is
Option A:	power factor correcting device
Option B:	a device to neutralize the effect of transients
Option C:	a waveform correcting device
Option D:	a current interrupting device
26.	Which of the following circuit breakers is preferred for EHT application
Option A:	SF ₆ oil circuit breakers
Option B:	Air blast circuit breakers
Option C:	Bulk oil circuit breakers
Option D:	Minimum oil circuit breakers
27.	Fusing factor for a HRC fuse is
Option A:	Minimum fusing current / Prospective current of circuit.
Option B:	Minimum fusing current / Current rating
Option C:	Maximum fusing current / Minimum fusing current
Option D:	Minimum fusing current / Minimum rupturing time
28.	The transient voltage that appears across the contacts at the instant of arc extinction is called

Option A:	supply voltage
Option B:	recovery voltage
Option C:	re striking voltage
Option D:	Peak voltage.
29.	Air used in air blast circuit breaker
Option A:	must have least carbon dioxide
Option B:	must be ionized
Option C:	must have oil mist
Option D:	must be free from moisture
30.	The most efficient torque producing actuating structure for the induction type relays is
Option A:	Watt hour meter structure
Option B:	Shaded pole structure
Option C:	Induction cup structure
Option D:	Single induction loop structure
31.	Which is not related with method of backup protection
Option A:	Relay Backup
Option B:	Breaker back up
Option C:	Remote backup
Option D:	CT back up
32.	From the Following which is not related with desirable qualities of protective relaying
Option A:	Adequateness
Option B:	Fault clearing time
Option C:	Selectivity
Option D:	Reliability
33.	MHO relay is inherently a
Option A:	Directional type
Option B:	Non-directional type
Option C:	Unidirectional type
Option D:	Bi-directional
34.	In Merz-Price differential protection of a delta star transformer, the CT secondaries connection in the primary and secondary winding of the transformer would be in the form of
Option A:	Delta star
Option B:	Star delta
Option C:	Delta delta
Option D:	Star star

35.	The single phasing relays are used for the protection of
Option A:	Single phase motors only
Option B:	Two phase motors only
Option C:	Two single phase motor running in parallel
Option D:	Three phase motors
36.	A differential relay responds to
Option A:	Algebraic difference of two or more similar electrical quantities
Option B:	Phasor difference of two or more similar electrical quantities
Option C:	Algebraic difference between two currents
Option D:	Algebraic difference between two voltages
37.	In a three-step distance protection the reach of the three zones of the relay at the beginning of the first line typically extends into
Option A:	100% of the first line, 50% of the second line and 20% of the third line
Option B:	50% of the first line, 50% of the second line and 20% of the third line
Option C:	80% of the first line, of 50% of the second line and 20% of the third line
Option D:	80% of the first line, 50% of the second line and 10% of the third line
38.	Phase comparators in case of static relays and electro-mechanical relays normally are
Option A:	Sine and cosine comparators respectively
Option B:	Cosine and sine comparators respectively
Option C:	Both are cosine comparators
Option D:	Both are sine comparators
39.	Two-input phase comparator in a static relay is made up of a
Option A:	Transformer Amplifier
Option B:	Transistor logic circuit
Option C:	Rectifier bridge
Option D:	Thyristor bridge
40.	For which of the following protection from negative sequence current is provided?
Option A:	Generators
Option B:	Motors
Option C:	Transmission line
Option D:	Transformers
41.	MHO relay is inherently type
Option A:	Unidirectional
Option B:	non directional
Option C:	Directional
Option D:	Overcurrent

42.	The burden of a protective relay is the power
Option A:	Required to operate the circuit breaker
Option B:	Absorbed by the relay trip circuit
Option C:	Developed by the relay circuit
Option D:	Absorbed by the transmission line
43.	Directional Restraint Over current relay is employed to measure
Option A:	Reactance
Option B:	Impedance
Option C:	Admittance
Option D:	Overcurrent
44.	Current Setting of relay 1 is 100% and relay 2 is 125%. For both the relays, given CT ratio = 400/5. Fault current = 2000 A. Determine the PSM of both the relays.
Option A:	5.8, 4.5
Option B:	10, 8
Option C:	6, 8
Option D:	5, 4
45.	At ZPF lag, this Directional relay connection is not preferred
Option A:	Relay Angle = 90 degrees with maximum torque angle = 45 degrees
Option B:	Relay Angle = 30 degrees with maximum torque angle = 0 degrees
Option C:	Relay Angle = 30 degrees with maximum torque angle = 45 degrees
Option D:	Relay Angle = 90 degrees with maximum torque angle = 0 degrees
46.	% bias in the Differential Relay is
Option A:	Bias Current
Option B:	Differential Current
Option C:	Current due to spring constant
Option D:	ratio of number of turns of bias coil to the number of turns of operating coil
47.	The economical protection preferred for the Magnetic Inrush Currents in inexpensive Transformers is
Option A:	Mho Relay
Option B:	IDMT relay with delay of 5 to 6 cycles
Option C:	Reactance Relay
Option D:	2nd Harmonic Restraint Relay
48.	Speed of Response of this relay is the fastest
Option A:	Thermal Relay
Option B:	Static Relay
Option C:	Electromagnetic Relay
Option D:	Numerical Relay

49.	R, L, C, transistors, analog ICs comparators are used in
Option A:	Thermal Relay
Option B:	Static Relay
Option C:	Electromagnetic Relay
Option D:	Numerical Relay
50.	Compute the average Rate of Rise of Restriking Voltage, where source, $v(t) = 10000 \cos 314t$ volts, $L = 1\text{mH}$, $C = 500\text{pF}$
Option A:	6 kV/microseconds
Option B:	9 kV/microseconds
Option C:	11 kV/microseconds
Option D:	15 kV/microseconds
51.	If the restriking voltage rises more rapidly than the dielectric strength, gap space breaks down and arc strikes again and persist. This is
Option A:	Slepian's Theory
Option B:	Energy Balance Theory
Option C:	Cassie's Theory
Option D:	Cascade Theory
52.	High Resistance Interruption method is not suitable for
Option A:	Miniature AC Breaker
Option B:	HV AC and DC Breakers
Option C:	Low voltage AC Breakers
Option D:	Medium Voltage AC breakers
53.	Merz-price circulating-current system does not protect the Alternator, against
Option A:	L-G fault
Option B:	phase-to – phase
Option C:	turn-to-turn fault on the same phase winding of the stator
Option D:	L-L-G fault
54.	The most commonly used scheme for busbar protection is
Option A:	Differential protection
Option B:	Distance Protection
Option C:	Time-graded overcurrent protection
Option D:	Translay Scheme
55.	If the Relay Torque is given by , $T = k_1 I^2 - k_2 V^2 - k_4$, where k_4 is the spring constant, the Relay is called as
Option A:	Directional Restrained Overcurrent Relay
Option B:	Voltage Restrained Directional Relay
Option C:	Voltage Restrained Overcurrent Relay
Option D:	Directional Restrained Overvoltage Relay

56.	If excitation fails, synchronous generator runs at a super-synchronous Speed and
Option A:	Supplies reactive power to the power system
Option B:	Reactive Power has no role to play
Option C:	Reactive Power is zero
Option D:	draws reactive power from the power system
57.	The following statement is associated with the Buchholz relay is not true
Option A:	It is a gas actuated device
Option B:	It is a current operative device
Option C:	It is placed between the transformer tank and the conservator
Option D:	It causes alarm for minor fault and tripping for major fault
58.	Admittance relay is _____ a relay.
Option A:	Over Current Directional Relay
Option B:	Directional Distance Relay
Option C:	Non-directional Distance Relay
Option D:	Differential Relay
59.	Which of the following parameters can be neglected for a short line?
Option A:	Capacitance
Option B:	Reactance
Option C:	Resistance
Option D:	Inductance
60.	A Buchholz relay is used for
Option A:	Protection of a transformer against external faults.
Option B:	Protection of induction motors.
Option C:	Protection of a transformer against both internal and external faults
Option D:	Protection of a transformer against internal faults.
61	In numerical relays, the output of the CTs and PTs are fed to the
Option A:	Sample and Hold Circuit
Option B:	Anti aliasing filter
Option C:	Multiplexer
Option D:	Analog to Digital Converter
62	Aliasing is a phenomenon where
Option A:	The given signal is lost
Option B:	The given signal is sampled
Option C:	The given signal is in hold
Option D:	The given signal is modulated
63	The Nyquist limit is the point where
Option A:	the signal frequency is greater than sampling frequency
Option B:	the sampling frequency is greater than signal frequency

Option C:	the sampling frequency and signal frequency are unequal
Option D:	the sampling frequency and signal frequency are equal
64	The travel of a relay moving elements after the removal of the actuating force is known as _____.
Option A:	Overtravel
Option B:	Overreach
Option C:	Underreach
Option D:	Undertravel
65	In a circuit breaker the arcing contacts are made of which material:
Option A:	Porcelain
Option B:	Tungsten
Option C:	Electrolytic Copper
Option D:	All of these
66	The time from the closure of trip circuit to final arc extinction is called as _____.
Option A:	Trip circuit closing time
Option B:	Total break time
Option C:	Circuit breaker time
Option D:	Fault clearing time
67	Out of the following, which of the circuit breakers is preferred for indoor switchgear rated upto 12 to 36 kV, 750 MVA ?
Option A:	Minimum oil CB
Option B:	SF6 CB
Option C:	Air Blast CB
Option D:	Vacuum CB
68	A 3 phase, 10 MVA, 11 kV alternator is provided with restricted earth fault protection. The percentage of winding protected against phase to earth fault is 80 %. The relay trips for 20 % out of balance current. Calculate the resistance to be added in neutral to ground connection.
Option A:	12.11 ohms
Option B:	12.10 ohms
Option C:	12.09 ohms
Option D:	12.08 ohms
69	A 3 phase 66/11 kV star delta transformer is operated by Merz – Price system. The CTs on LT side have ratio 420/5. Find the ratio of CTs on HT side.
Option A:	70 : 5.33
Option B:	70 : 8.66
Option C:	70 : 2.88
Option D:	70 : 5.99
70	An over current relay has pick up current of 6.25 ampere and it is connected to CT with ratio 400/5 Amp. Find the current setting on the plug bridge.
Option A:	1.25

Option B:	1.50
Option C:	6.25
Option D:	6.50
71	The neutral point of a 10 kV alternator is earthed through a resistance of 10 ohms. The relay is set to operate when there is an out of balance current of 1 A. The CTs have a ratio of 1000:5. What percentage of the winding is unprotected against fault to earth ?
a)	34.8
b)	34.6
c)	65.2
d)	65.3
72	A 3 phase , 132 kV/11kV power transformer is delta star connected. It is to be protected by differential protection. If CT on HT side has a ratio of 50:5. Find the CT ratio on LT side.
a)	$600/\sqrt{3} : 5$
b)	$600 : 5\sqrt{3}$
c)	$600 : 5/\sqrt{3}$
d)	6005
73	What is the type of protection scheme used for long transmission lines where simultaneous opening of circuit breakers at both ends is necessary ?
a)	Pilot wire differential protection
b)	Carrier current protection
c)	Time graded overcurrent protection
d)	Current graded overcurrent protection
74	In which of the following faults, the negative sequence component is not present ?
a)	Line to line fault
b)	Line to ground fault
c)	Double line to ground fault
d)	Three phase short circuit fault
75	What must be the minimum value of earthing resistance required to give 90% protection to each phase winding of a 10 kV alternator which is earthed through a resistance of 10 ohms? The relay operates at a current of 1 A. The CTs have a ratio of 1000 : 5.
a)	2.86 ohms
b)	2.87 ohms
c)	2.88 ohms
d)	3.88hms
76	For distribution systems of 6 – 33 kV with transformers feeder supply, select the type of bus zone protection required.
a)	Instantaneous overcurrent relays
b)	Biased Differential protection
c)	Overvoltage protection
d)	Circulating current Differential protection
77	Of the given below protection schemes, which one is best suitable for single radial feeders ?
a)	Pilot wire differential protection
b)	Carrier current protection
c)	Graded Time Lag Overcurrent protection

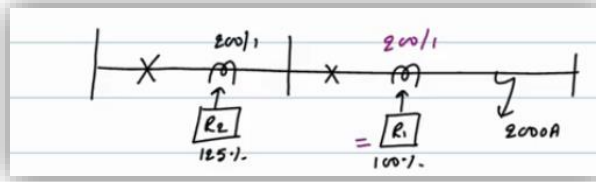
d)	Distance protection
78	For a 45 MVA, 11 kV/66 kV , star delta transformer, the CT secondary currents are 3.938 A and 3.936 A respectively. Calculate the circulating current of the differential bias protection scheme.
a)	0.002
b)	0.02
c)	3.937
d)	3.973
79	Which type of relays are most affected by the over reach characteristics of the instantaneous over current relay ?
a)	Differential relays
b)	Distance relays
c)	Induction relays
d)	Magnetic relays
80	Select the type of protection scheme widely used in motors (below 1 MW) against phase and earth faults.
a)	HRC fuses
b)	Negative sequence
c)	Zero sequence CT
d)	Single phase preventers
81	For which of the following transformer, the core does not saturate
a)	Metering CT
b)	Metering PT
c)	Protection CT
d)	Protection PT
82	Which type of relays are used for chemical processes, metallurgical processes and motor controls ?
a)	Thermal Relays
b)	Bimetal Relays
c)	DC Relays
d)	Frequency Relays
83	For which type of fault, the voltage at the fault location drops to zero ?
a)	Through faults
b)	Metallic faults
c)	Series faults
d)	External faults
84	Which of the following relay trips during normal load conditions?
a)	Overcurrent Relay
b)	Impedance Relay
c)	Reactance Relay
d)	MHO Relay
85	An overcurrent relay is used for protection with current of 175%. The CT ratio is 100/1 A. Find the pick up current.
a)	1.75
b)	3.50
c)	5.25

d)	7.00
86	The shape of the disc in an induction disc-type overcurrent relay is
a)	Circular
b)	Spiral
c)	Elliptical
d)	Rectangle
87	The time from occurrence of fault till the final arc extinction in circuit breaker is called
a)	Relay time
b)	Circuit Breaker Time
c)	Fault Clearing Time
d)	Pick up time
88	If relay RA is for primary protection and relay RB is for secondary protection, then which of the following is true during fault occurrence?
a)	Relay RA must operate first
b)	Relay RB must operate first
c)	RB must operate in sync with RA
d)	RA and RB should operate together
89	A 400:5 CT is connected to an overcurrent relay having a setting of 125%. The circuit carries a fault current of 4000A. Find the PSM (Plug setting multiplier).
a)	2
b)	4
c)	8
d)	10

DESCRIPTIVE QUESTIONS

	Explain:- i) Pantograph isolator ii) Contactors as starters for motors
	Explain in detail, ELCB?
	Explain Primary & back-up protection?
	What is Restricted earth fault protection in generator?
1.	Explain time graded over current protection provided to any one of these feeders:- i) Radial feeder ii) Parallel feeder
2.	Draw the block diagram of Numerical Relay and purpose of each block.
3.	Give the working principle of HRC fuse.
4.	Why is Harmonic Restraint Relay applied in the protection of transformers?

5.	Compare Electromagnetic, Static and Numerical Relays
6.	Explain the working of Buchholz Relay
7.	Derive the Restriking voltage and RRRV
8.	Where and why isolators, contactors and circuit breaker are used in power system
9.	List the desirable qualities of protection scheme & explain any two qualities in details.
10.	Explain different methods of arc interruption
11.	Explain percentage differential protection scheme for star-delta connected transformer
12.	Explain construction & working principle of Minimum oil circuit breaker.
13.	Explain the properties of SF 6 gas
14.	Explain the advantages & disadvantages of static relays
15.	Explain the time grading protection for radial feeder
16.	Explain construction & working principle of HRC fuse. Draw cutoff characteristics of fuse
17.	List the different types of fault that occurs in Induction motor? Also draw and explain a scheme for motor against single phasing.
18.	Elaborate the desirable qualities of protective relaying
19.	Classify various protection schemes provided for Generators, Transformers and Induction Motors
20.	Why only 95% of the stator winding is protected upon a Phase to earth fault?
21.	Explain the working principle of VCB.
22.	Why is Carrier Current Protection provided? Elaborate.
23.	Explain the basic block diagram of Numerical Relay.
24.	Explain the working of a Reactance Relay. Comment about the effect of Power Swings and Arc Resistance on it
25.	How is thermal overload protection done in Motors, using Contactors?
26.	For a given power system, relay 1 is set at 100% and relay 2 is set at 125%. CT ratio of 200/1 for both the relays is given. Fault occurs near relay 1, with a magnitude of 2000 A. The time margin between both the relays is 0.5 seconds. Determine the actual operating time of the relay1 and relay 2. Relay 1 has a TMS= 0.2.



The operating time for various PSM is given below at TMS=1.

PSM	2	3.6	5	8	10	15	20
Operating time in seconds	10	6	3.9	3.15	2.8	2.2	2.1

27.	Illustrate the protection scheme for the motor against single phasing/phase failure using a neat labelled diagram.
28.	Illustrate using a neat labelled diagram the importance of biased differential protection for the delta star transformer.
29.	Discuss the time graded protection for a ring feeder using a neat labelled diagram.
30.	Illustrate using a single line diagram the significance of phase comparison carrier current protection.
31.	Illustrate using a neat labelled diagram, explain pantograph type of isolator.
32.	Discuss a short note on substation layout.
33.	Explain the protection provided for different types of bus zone.
34.	Using a neat labelled diagram, explain carrier aided distance scheme.
35.	Explain the advantages and disadvantages of static relays.
36.	Illustrate the importance of Phase Measurement Unit (PMU) using a neat block diagram.
37.	Illustrate restricted earth fault protection (REF) of the alternator with a neat labelled diagram. How 100% winding is protected ?
38.	Illustrate construction and operation of Buchholz relay with a neat labelled diagram, and explain its importance in transformer protection.
39.	Illustrate the importance of inrush current protection for transformer using a neat labelled diagram.
40.	Illustrate the construction and working principle of electromagnetic induction disc relay and derive the torque equations.
41.	Illustrate the working principle and applications of Impedance relay, Reactance relay and Mho relay using their characteristics.
42.	Illustrate the construction and working principle of SF6 circuit breaker.
43.	Illustrate the construction and working principles of HRC fuse with its advantages over other types.
44.	Illustrate arc quenching methods for circuit breakers.
45.	Discuss about MCB and MCCB
46.	Discuss about air blast circuit breaker.
47.	Discuss about oil circuit breaker.

48.	Discuss islanding and the various methods to achieve islanding.
49.	State the difference between a switch, a fuse, a circuit breaker. (Mention two points). State the difference between a measuring and a protective CT with the help of its characteristics curve.
50.	Explain the working principle of a contactor with the help of a neat and labelled diagram. State two applications of contactors.
51.	Explain the working mechanism of Impedance relay, Reactance relay and Mho relay with the help of their characteristics. Discuss/Compare these relays on the basis of directional property, performance during normal load and performance during power swing.
52.	Mention six desirable qualities of protective relaying. Explain any two qualities in detail.
53.	Define isolator and earthing switch. Name the three types of isolators based on the type of construction/operation. With the help of a neat and a labelled diagram, explain one type of isolator in detail.
54.	Draw a labelled one line diagram of a substation showing the isolator, CB, CT, PT, earthing switch and lightning arrester. Write a short note on substation equipments.
55.	Explain the construction and working principle of an induction disc relay. Derive the torque equation and mention two important conclusions.
56.	Explain the working of a thermal and bimetal relay with the help of a neat and a labelled diagram. Define shunt fault. What are the causes and effects of shunt faults ?