Power System

1) On which one of the following cycles does a modern steam plant work ?
a) Carnot cycle b) Rankine cycle c) Otto cycle d) Bell-Coleman cycle
= Answer (b) Rankine cycle

2) A power station,s plant load factor is defined as the rate of
a) the energy generated to that of maximum maximum energy that could have been generated
b) average load to peak load
c) maximum load to peak load
d) minimum load to average load
= Answer (b) average load to peak load
Load factor = $\frac{Average\ load}{Peak\ load}$

3) In hydro power stations,what is an enlarged body of water just above the intake and used as a regulating reservoir ?
a) Spill Ways b) Forebay c) Reservoir d) Penstock
= Answer (b) Forebay

4) In a nulear reactor,chain reaction is controlled by introducing
a) iron rods b) cadmium rods c) graphite rods d) brass rods
= Answer (b) cadmium rods

5) For variable heads of near about but less than 30 m.Which type of turbines is used in hydro power stations ?
a) Pelton b) Kaplan c) Francis d) None of these
= Answer (b) Kaplan

6) Match List I (Power plant) with List II (Materials) and select the correct answer using the codes given below the lists.

List I	**List II**
P. Moderator	1. Boron
Q. Control rod	2.Concrete
R. Coolant	3.Graphite
S. Shield	4. Sodium

Codes

	P	Q	R	S
a)	3	1	4	2
b)	1	3	2	4
c)	3	1	2	4
d)	1	3	4	2

P Q R S
= Answer (a) 3 1 4 2
Moderator → Graphite
Control rod → Boron
Coolant → Sodium
Shield → Concrete

7) Match List I (Classification of head) with List II (Types of turbine) and select the correct answer using the codes given below the lists.

List I	List II
P. Low head,2-15 m	1. Propeller or Kaplan
Q. Medium head,15-70 m	2. Kaplan or Francis
R. High head,70-500 m	3. Pelton
S. Very high head,>500 m	4. Francis or Kaplan

Codes

	P	Q	R	S
a)	1	3	4	2
b)	4	2	1	3
c)	1	2	4	3
d)	4	3	1	2

	P	Q	R	S
= Answer (c)	1	2	4	3

8) Control rods used in nuclear reactors are made of
a) zirconium b) boron c) berillium d) lead
= Answer (b) boron

9) Load factor of a power station is generally
a) equal to unity b) less than unity
c) more than unity d) more than 10
= Answer (b) less than unity

10) In a thermal nuclear rector,
a) the purpose of moderator is to slow down fast neutrons produced due to fission.
b) the moderator material must have low molecular weight.
c) ordinary water can be used as moderator with natural uranium as fuel.
d) the multiplication factor is kept slightly greaterthan unity during its normal functioning.
Of these statements,which are correct ?
a) 1 and 3 b) 3 and 4 c) 1,2 and 3 d) 1,2 and 4
= Answer (d) 1,2 and 4

11) The formula for specific speed N_s of turbine is
a) $N_s = \frac{N(P)^2}{H^{3/2}}$ b) $N_s = \frac{N(P)^{1/2}}{H^{3/4}}$ c) $N_s = \frac{N(P)^{1/2}}{H^{5/4}}$ d) $N_s = \frac{N\sqrt{P}}{H}$
= Answer (c) $N_s = \frac{N(P)^{1/2}}{H^{5/4}}$

$N_s = \frac{N\sqrt{P}}{H^{1.25}}$

$= \frac{N(P)^{1/2}}{H^{5/4}}$

12) In a nuclear power station using boiling water reactor,water is used as
a) a moderator but not as a coolant
b) a coolant but not as a moderator
c) both moderator and coolant

d) Neither moderator nor coolant
= Answer (c) both moderator and coolant

13) The most appropriate operating speeds in rpm of generator used in thermal,nuclear and hydro power plants would be
a) 3000,300 and 1500 b) 3000,3000 and 300
c) 1500,1500 and 3000 d) 1000,900 and 750
= Answer (b) 3000,3000 and 300

14) The specific speed of turbine for a speed of 100 rpm,power of 2800 HP and head of 12.5 m will be
a) 275 rpm b) 250 rpm c) 225 rpm d) None of these
= Answer (c) 225

$N_s = \frac{N\sqrt{P}}{H^{1.25}}$

$= \frac{100\sqrt{2800}}{(12.5)^{1.25}}$

= 225 rpm

15) A river has discharge of 6000 m^2/s with a head of 25 m.The overall efficiency η being 75%,the power generated is
a) 10 MW b) 1103625 kW c) 10625 kW d) Data is insufficient
= Answer (b) 1103625 kW
P = 0.981QH η
= 9.81×600×25×0.75
= 1103625 kW

16) An industrial consumer has a daily load pattern of 2000 kW,0.8 lag for 12 h and 1000 kW at UPF for 12 h.The load factor is
a) 0.65 b) 0.5 c) 0.6 d) 2.0
= Answer (a) 0.65

∵Load factor = $\frac{Average\ load}{Maximum\ load}$

But average load = $\frac{Unit\ generated\ per\ day}{24\ h}$

$= \frac{2000\times0.8\times12+1000\times1\times12}{24}$

$= \frac{31.2\times10^3}{24}$

$= 1.3\times10^3$ kW

∴ Load factor = $\frac{1.3\times10^3}{2000}$

= 0.65

17) A 100km long transmission line is loaded at 110 kV.If the loss of line is 50 MW and the load is 150 MVA,the resistance of the line is
(a) 0.806 Ω/phase (b) 8.06 Ω/phase (c) 0.0806 Ω/phase (d) 80.6 Ω/phase
= Answer (d) 80.6 Ω/phase
∵ P = VI
=>I = $\frac{P}{V}$
=>I = $\frac{150\times10^6}{110\times10^3}$

∴ I = 1.363×10^3

Again,

∵ P = I^2R

=>$150\times10^6 = (1.363 \times 10^3)^2\times$R

∴ R = 80.6 Ω/Phase

18) In a DC transmission line

a) it is necessary for the for the sending end and receiving end to be operated in synchronism

b) there are no effects due to inductive and capacitive reactances

c) the effects of inductive and capacitive reactances are greater than in an AC transmission line of the same rating

d) power transfer capability is limited by stability consideration

= Answer (b) there are no effects due to inductive and capacitive reactances

19) A single phase transmission line of impedance J 0.8Ω supplies a resistive load of 500 A at 300 V.The sending end power factor

a) unity b) 0.8 lag c) 0.6 lag d) 0.8 leading

= Answer (b) 0.8 lag

∵ $V_S = V_R$ + IZ_S

= 300 + j0.8(500×0.8 − J500×0.6)

= 300 + j0.8(400 − j300)

= 300 + j320 + 240

= 540 + j320

tanθ = $\frac{320}{540}$

=>θ = $tan^{-1}(\frac{320}{540})$

∴ θ = $tan^{-1}(\frac{320}{540})$

∴ Power factor = cosθ

= 0.86 lag

20) A medium line with parameters A,B,C and D is extended by connecting a shprt line of impedance Z in series.The overall ABCD parameters of the series combination will be

a) A,AZ : C + DZ,D b) A + BZ,B : C + DZ,D

c) A,AZ + B : C,CZ + D d) AZ,B:C/Z,D

= Answer (c) A,AZ + B : C,CZ + D

21) If in a short transmission line,resistance and inductance are found to be equal and regulation appears to be zero,then the load will

a) have unity power factor b) have zero power factor

c) be 0.707 lag d) be 0.707 leading

= Answer (d) be 0.707 leading

22) Series capacitive compensation on EHV transmission line is used to

a) reduce the line loading b) improve the protection of the line

c) reduce the voltage profile d) improve the stability of the system

= Answer (b) improve the protection of the line

23) The advantage of neutral earthing is

a) over voltage due to lighting can be discharged to earth
b) simplified design of earth fault protection scheme
c) freedom from persistant arcing ground
d) All of the above
= Answer (d) All of the above

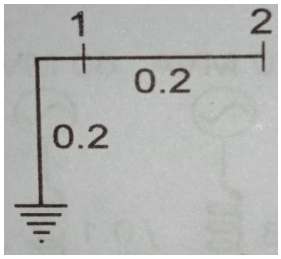
24) In load flow analysis,the load at a bus is represented as
a) a constant current drawn from the bus
b) a constant impedance connected at the bus
c) constant real and reactive power drawn from the bus
d) a voltage dependent impedance at the bus
= Answer (c) constant real and reactive power drawn from the bus

25) Buses for load flow studies are classified as (I) the load bus,(II) the generator bus and the (III) slack bus the correct combination of the pair quantities specified having their usual meaning for different buses

	Load bus	Generator bus	Slack bus
a)	P,$\|V\|$	P,Q	P,δ
b)	P,Q	P, $\|V\|$	$\|V\|$,δ
c)	$\|V\|$,Q	P,δ	P,Q
d)	P,δ	Q, $\|V\|$	Q,δ

Load bus	Generator bus	Slack bus
= Answer (b)) P,Q	P, $\|V\|$	$\|V\|$,δ

26) In the network as shown in figure the marked parameter are per unit impedances.The bus admittance matrix of the network is



a) $\begin{bmatrix} 10 & -5 \\ -5 & 5 \end{bmatrix}$ b) $\begin{bmatrix} 5 & -5 \\ -5 & 10 \end{bmatrix}$ c) $\begin{bmatrix} -10 & 5 \\ 5 & -5 \end{bmatrix}$ d) $\begin{bmatrix} -5 & 5 \\ 5 & -10 \end{bmatrix}$
= Answer (a) $\begin{bmatrix} 10 & -5 \\ -5 & 5 \end{bmatrix}$
$Y_{11} = \frac{1}{0.2} + \frac{1}{0.2}$
$=10$
$Y_{22} = \frac{1}{0.2}$
$= 5$

27) The bus admittance matrix of a power system is given as

$$\begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array}\begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} -j50 & +j10 & +j5 \\ +j10 & -j30 & +j10 \\ +j5 & +j10 & -j25 \end{bmatrix} \end{array}$$

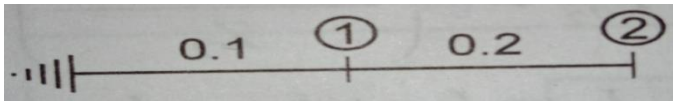
The impedance of line between bus 2 and 3 will be equal to
a) + j0.1 b) − j0.1 c) + j0.2 d) − j0.2
= Answer (a) + j0.1

$Z_{23} = -\frac{1}{Y_{23}}$

$= -\frac{1}{J10}$

= + j0.1

28) The bus admittance matrix of the network shown in the given figure,for which the marked parameters are per unit impedance,is



a) $\begin{bmatrix} 0.3 & -0.2 \\ -0.2 & 0.2 \end{bmatrix}^{-1}$ b) $\begin{bmatrix} 0.3 & 0.2 \\ 0.2 & 0.2 \end{bmatrix}$ c) $\begin{bmatrix} 0.3 & -0.2 \\ -0.2 & 0.2 \end{bmatrix}$ d) $\begin{bmatrix} 15 & -5 \\ -5 & 5 \end{bmatrix}$
=Answer (d) $\begin{bmatrix} 15 & -5 \\ -5 & 5 \end{bmatrix}$

$Y_{11} = \frac{1}{0.1} + \frac{1}{0.2}$

= 10 + 5

= 15

$Y_{22} = \frac{1}{0.2}$

= 5

29) The positive,negative and zero sequence impedances of a solidly grounded system under steady state condition always follow the relation
a) $Z_1 > Z_2 > Z_0$ b) $Z_1 < Z_2 < Z_0$ c) $Z_0 < Z_1 < Z_2$ d) None of these
= Answer (a) $Z_1 > Z_2 > Z_0$

30) The diagonal elements of a nodal admittance matrix are strengthened by adding

a) shunt inductances b) shunt capacitors c) loads d) generators
= Answer (a) shunt inductances

31) In the solution of load flow equation,Newton-Raphson (NR) method is superior than the Gauss-Seidal (GS) method,because the
a) time taken to perform one iteration in the NR method is less when compared to the time taken in the GS method
b) number of iteration required in the NR method is more when compared to that in the GS method
c) number of iteration required is not independent of the size of the system in the NR method
d) convergence characteristics of the NR method are not affected by the selection of slack bus
= Answer (d) convergence characteristics of the NR method are not affected by the selection of slack bus

32) If $\alpha = e^{j\frac{2\pi}{3}}$ and I = AI_s,Where I is equal to phase current vector and I_s is equal to symmetrical current vector,then which one of the following matrices is the symmetrical components transformation matrix A ?

a) $\begin{bmatrix}1 & 1 & 1\\ 1 & \alpha & \alpha^2\\ 1 & \alpha^2 & \alpha\end{bmatrix}$ b) $\begin{bmatrix}1 & \alpha & \alpha^2\\ 1 & 1 & 1\\ 1 & \alpha^2 & \alpha\end{bmatrix}$ c) $\begin{bmatrix}1 & 1 & 1\\ 1 & \alpha^2 & \alpha\\ 1 & \alpha & \alpha^2\end{bmatrix}$ d) $\begin{bmatrix}1 & \alpha^2 & \alpha\\ 1 & \alpha & \alpha^2\\ 1 & 1 & \alpha\end{bmatrix}$

= Answer (c) $\begin{bmatrix}1 & 1 & 1\\ 1 & \alpha^2 & \alpha\\ 1 & \alpha & \alpha^2\end{bmatrix}$

Type equation here.

33) Zero sequence currents can flow from a line into a transformer bank,if the windings are in
a) grounded star/delta b) delta/star c) star/grounded star d) delta/delta
= Answer (a) grounded star/delta

34) For stability and economic reasons,we operate the transmission line with power angle in the range
a) 10^0 to 25^0 b) 30^0 to 45^0 c) 60^0 to 75^0 d) 65^0 to 85^0
= Answer (b) 30^0 to 45^0

35) Shunt compensation in an EHV is restored to
a) improve the stability b) reduce the fault level
c) improve the voltage profile d) as a substitute for synchronous phase modifier
= Answer (c) improve the voltage profile

36) Series compensation in an EHV lines is restored to
a) improve the stability b) reduce the fault level
c) improve the voltage profile d) as a substitute for synchronous phase modifier
= Answer (a) improve the stability

37) The inertia constants of two groups of machines which do not swing together are M_1 and M_2.The equivalent inertia constant of the system is
a) M_1+M_2 b) M_1-M_2 c) $\frac{M_1M_2}{M_1+M_2}$ d) $\sqrt{M_1M_2}$
= Answer (c) $\frac{M_1M_2}{M_1+M_2}$

38) The inertia constants of two groups of machines which swing together are M_1 and M_2. The inertia constant of the system is
a) $\frac{M_1M_2}{M_1+M_2}$ b) M_1-M_2,if M_1>M_2
c) M_1+M_2 d) $\frac{M_1+M_2}{M_1M_2}$
= Answer (c) M_1+M_2

39) If a generator of 250 MVA rating has an inertia constant of 6 MJ/MVA,its inertia constant on 100 MVA base is
a) 15 MJ/MVA b) 10.5 MJ/MVA c) 6 MJ/MVA d) 2.4 MJ/MVA
= Answer (a) 15 MJ/MVA
$H_1S_1 = H_2S_2$
=>$H_1 \times 100 = 6 \times 250$
=>$H_1 = \frac{6 \times 250}{100}$
$\therefore H_1 = 15$

40) For a synchronous phase modifier the load angle is
a) 0^0 b) 25^0 c) 30^0 d) None of these
= Answer (a) 0^0

41) The critical clearing time of a fault in power system is related to
a) reactive power limit b) short circuit limit
c) steady state stability limit d) transient stability limit
= Answer (d) transient stability limit

42) If X is the system reactance and R is the resistance,the power transferred is maximum when
a) X = R b) X = $\sqrt{2R}$ c) X = $\sqrt{3R}$ d) X = 2R
= Answer (c) X = $\sqrt{3R}$

43) Which of the following statements is true ?
a) Steady state stability limit is greater than transient stability limit
b) Steady state stability limit is equal to transient stability limit
c) Steady state stability limit is less than the transient stability limit
d) None of the above
= Answer (a) Steady state stability limit is greater than transient stability limit

44) If a synchronous machine is under excited,it takes lagging VARs from the system when it is operated as
a) synchronous motor b) synchronous generator
c) synchronous motor as well as generator d) None of the above
= Answer (c) synchronous motor as well as generator

45) The Buchholz relay protect a transformer from
a) all types of internal fault b) a turn to turn fault
c) winding to winding fault d) None of the above
= Answer (a) all types of internal fault

46) If the fault current is 2000 A,the relay setting 50% and the CT ratio is 400 : 5,then the plug setting multiplier will be

a) 25 A b) 15 A c) 50 A d) None of these

= Answer (c) 50 A

$$\text{PSM} = \frac{Primary\ current}{Relay\ current\ setting \times CT\ ratio}$$

$$= \frac{2000}{0.5 \times \frac{400}{5}}$$

$$= \frac{2000}{0.5 \times 80}$$

= 50

47) A three-phase breaker is rated as 2000 MVA,33 kV,its making current will be

a) 35 KA b) 49 KA c) 70 KA d) 89 KA

= Answer (d) 89 KA

$$\text{Symmetrical braking current} = \frac{2000}{\sqrt{3} \times 33}$$

= 34.99 A

Making current = 2.55 × Braking current

= 2.55 × 34.99

= 89.22 KA

≈ 89 KA

48) If the fault current is 3000 A for a relay with a plug setting of 50% and CT ratio of 1000 : 1,the plug setting multiplier would be

a) 1.5 b) 3 c) 4.5 d) 6

= Answer (d) 6

$$\text{PSM} = \frac{3000}{0.5 \times \frac{1000}{1}}$$

= 6

49) Match List I (Protective scheme) with List II (Equipment) and select the correct answer using the codes given the lists.

List I	List II
P. Mho relay	1. Generators
Q. Inverse time over current relay	2. Transmission lines
R. Differential relay	3. Motors

Codes

	P	Q	R
a)	2	1	3
b)	2	3	1
c)	3	2	1
d)	1	3	2

	P	Q	R
= Answer (b)	2	3	1

50) Resistance switching is normally resorted in case of

a) bulk oil circuit breakers b) minimum oil circuit breakers

c) air blast circuit breakers d) all types of breakers

= Answer (c) air blast circuit breakers

51) The rate of rise of restriking voltage depends upon
a) the type of circuit breaker
b) the inductance of the system only
c) the capacitance of the system only
d) the inductance and capacitance of the system
= Answer (d) the inductance and capacitance of the system

52) A Mho relay is a
a) voltage restrained directional relay
b) voltage controlled over current relay
c) directional restrained over current relay
d) directional restrained over voltage relay
= Answer (a) voltage restrained directional relay

53) Match List I (Types of relays) with List II (Types of protection) and select the correct answer using the codes given below the lists.

List I	**List II**
P. Directional relay	1. Relay operates for fault within certain distance of its Location.
Q. Impedance relay	2. Relay will trip for fault in one location and block for all other locations.
R. Differential relay	3. High speed protection for entire transmission line.
S. Pilot relay	4. The principle of current continuity is used to devise a simple and effective relaying system over a small physical space.

Codes

	P	Q	R	S
a)	1	2	4	3
b)	2	1	3	4
c)	2	1	4	3
d)	1	2	3	4

	P	Q	R	S
= Answer (c)	2	1	3	4

54) Match List I (Relays) with List II (Protection) and select the correct answer using the codes given below the lists.

List I	**List II**
P. Buchholz relay	1. Feeder
Q. Translay relay	2. Transformer
R. Carrier current phase comparison relay	3. Ring main distributor
S. Differential over current relay	4. Long overhead transmission line

Codes

	P	Q	R	S
a)	2	3	4	1
b)	4	1	2	3
c)	2	1	4	3
d)	4	3	2	1

	P	Q	R	S
= Answer (c)	2	1	4	3

55) Consider the following statements with reference to protective relays :
1. The minimum relay coil current at which the relay operates is called pick-up value.
2. The pick-up value of a relay is 7.5 A and fault current is 30 A.Therefore,its plug setting multiplier is 5.
3. An earth fault current is generally lesser than the short circuit current.
4. Induction relays are used with both AC and DC quantities.
Which of these statements are correct ?
a) 1 and 2 b) 2 and 3 c) 1 and 3 d) 1,2 and 4
= Answer (c) 1 and 3

56) Main operation of differential protection of transformers due to magnetizing inrush current is prevented by
a) setting the current of the relay higher than the maximum value of inrush current
b) keeping the time setting long enough for the inrush current to all to a value below the primary operating current of the relay
c) bypassing the inrush current from the operating coil of the relay
d) filtering the second harmonic content of the inrush current flowing through the operating coil and passing through the restraining coil
=Answer (d) filtering the second harmonic content of the inrush current flowing through the operating coil and passing through the restraining coil

57) In order to have a lower cost of electrical energy generation,
a) the load factor and diversity factor should be low
b) the load factor should be low but diversity factor should be high
c) the load factor should be high but diversity factor should be low
d) the load factor and diversity factor should be high
=Answer (d) the load factor and diversity factor should be high

58) Which material is used in controlling chain reaction in a nuclear reactor ?
a) Thorium b) Heavy water c) Boron d) Beryllium
= Answer (b) Heavy water

59) A water boiler at home is switched-on to the AC mains supplying power at 230 V,50 Hz.The frequency of instaneous power consumed by the boiler is
a) zero b) 50 Hz c) 100 Hz d) 150 Hz
= Answer (c) 100 Hz
Frequency at the time of switching = 2×50
= 100 Hz

60) In a thermal power plant,the feed water coming to the economizer is heated using

a) high pressure steam b) low pressure steam
c) direct heat in the furnace d) flue gases
= Answer (b) low pressure steam

61) Consider a power system with three identical generators.The transmission losses are negligible.One generator (G_1) has a speed governor which maintains its speed constant at the rated value,while the generators (G_2 and G_3) have governors with a drop of 5%.If the load of the system is increased,then in steady stateis
a) generation of G_2 and G_3 is increased equally while generation of G_1 is unchanged
b) generation of G_1 alone is increased while generation of G_2 and G_3 is unchanged
c) generation of G_1, G_2 and G_3 is increased equally
d) generation of G_1, G_2 and G_3 is increased in the ratio 0.5 : 0.25 : 0.25
= Answer (a) generation of G_2 and G_3 is increased equally while generation of G_1 is unchanged

62) Incremental fuel costs (in some appropriate unit) for a power plant consisting of three generating units are

$IC_1 = 20 + 0.3P_1$
$IC_2 = 30 + 0.4P_2$
$IC_3 = 30$

Where, P_i is the power in MW by unit i,for i = 1,2 and 3.Assume that all the three units are operating all the time.Minimum and maximum loads on each unit are 50 MW and 300 MW respectively.If the plant is operating on economic load dispatch to supply the total power demand of 700 MW,the power generated by each unit is
a) P_1 = 242.86 MW, P_2 = 157.14 MW and P_3 = 300 MW
b) P_1 = 157.14 MW, P_2 = 242.86 MW and P_3 = 300 MW
c) P_1 = 300 MW, P_2 = 300 MW and P_3 = 100 MW
d) P_1 = 233.3 MW, P_2 = 233.3 MW and P_3 = 233.4 MW
= Answer (a) P_1 = 242.86 MW, P_2 = 157.14 MW and P_3 = 300 MW
For optimal generation, P_3 = 300 MW (maximum load)
Also, $IC_1 = IC_2$
$\therefore 20 + 0.3P_1 = 30 + 0.4P_2$ ----------(i)
Again, $P_1 + P_2 + P_3 = 700$
$\Rightarrow P_1 + P_2 = 400$
$\therefore P_2 = 400 - P_1$
From (i), $20 + 0.3P_1 = 30 + 0.4(400 - P_1)$
$\Rightarrow 0.7P_1 = 170$
$\therefore P_1 = 242.8$
$P_2 = 400 - 242.8$
$= 157.14$
$P_3 = 300$

63) A hydraulic turbine having rated speed of 250 rpm is connected to a synchronous generator.In order to produce power at 50 Hz,the number of poles required in the generator are
a) 6 b) 12 c) 16 d) 24
= Answer (d) 24
$\because N_s = \frac{120f}{P}$
$\Rightarrow P = \frac{120f}{N_s}$

$\Rightarrow P = \frac{120 \times 50}{250}$

$\therefore P = 24$

64) Out of the following plant categories :
(I) Nuclear
(II) Run of river
(III) Pump storage
(IV) Diesel
The base load power plants are
a) (I) and (II) b) (II) and (III)
c) (I),(II) and (IV) d) (I),(III) and (IV)
= Answer (a) (I) and (II)

65) Match the List I with List II and find the correct answer using the codes given below the lists.

List I	**List II**
P. A	1. $1 + \frac{ZY}{2}$
Q. B	2. Z
R. C	3. $Y(1 + \frac{ZY}{4})$

Codes

	P	Q	R
a)	1	2	3
b)	2	3	1
c)	1	3	2
d)	3	2	1

	P	Q	R
= Answer (a)	1	2	3

66) The per unit impedance of a circuit element is 0.15.If the base kV and base MVA are halved,then the new value of the per unit impedance of the circuit element will be
a) 0.075 b) 0.30 c) 0.15 d) 0.600
= Answer (b) 0.30

$\because X_{pu(new)} = X_{pu(old)} \cdot \frac{MVA_{(new)}}{MVA_{(old)}} \cdot (\frac{kV_{old}}{kV_{new}})^2$

$= 0.15 \times \frac{\frac{1}{2}}{1} \times (\frac{1}{\frac{1}{2}})^2$

$= 0.15 \times \frac{1}{2} \times 4$

$= 2 \times 0.15$

$= 0.30$

67) The inductance of line is minimum when
a) GMD is low but GMR is high
b) GMR is low
c) GMD is high
d) Both GMD and GMR are high
= Answer (a) GMD is low but GMR is high

68) When bundle conductors are used in place of single conductors,the effective inductance and capacitance will respectively
a) decrease and increase b) increase and decrease
c) decrease and remaining unaffected d) remain unaffected and increase
= Answer (a) decrease and increase

69) Ring main distribution system is preferred to a radial system,because
a) it is less expensive b) voltage drop in the feeder is less
c) power factor is higher d) supply is more reliable
= Answer (d) supply is more reliable

70) When a fixed amount of power is to be transmitted,the efficiency of transmission increases when
a) voltage decreases,power factor remains constant
b) voltage increases,power factor increases
c) voltage decreases,power factor decreases
d) voltage constant,power factor decreases
= Answer (b) voltage increases,power factor increases

71) The selection of size of conductors for a distributor in a distribution system is goverened by
a) corona loss b) temperature rise c) radio interference d) voltage drop
= Answer (d) voltage drop

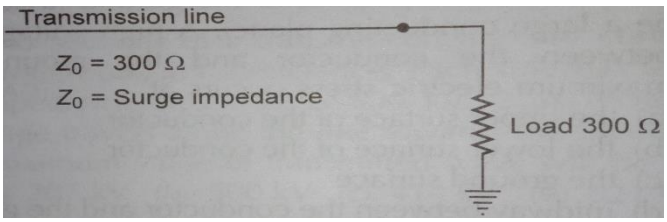
72) The inductance of a power transmission line increases with
a) decrease in line length
b) increase in diameter of conductor
c) increase in spacing between the phase conductors
d) increase in load current carried by the conductors
= Answer (c) increase in spacing between the phase conductors

72) A hollow conductor Is at a potential V. The potential at) any point inside the hollow is
a) zero b) V/2 c) 2V d) None of these
= Answer (a) zero

73) The main criterion for selection of the size of distributors for a radial distribution system is
a) voltage drop b) corona loss c) temperature rise d) capital cost
= Answer (a) voltage drop

74) The surge impedance of a 400 km long overhead transmission line is 400 Ω.For a 200 km length of the same line,the surge impedance will be
a) 200 Ω b) 800 Ω c) 400 Ω d) 100 Ω

75) The reflection coefficient for the transmission line ahown in figure at P is



a) + 1 b) – 1 c) zero d) 0.5
= Answer (c) zero
Reflection coefficient = $\frac{Z_L - Z_0}{Z_L + Z_0}$
= $\frac{300-300}{300+300}$
= 0

76) Series capacitive compensation in EHV transmission lines is used to
a) reduce the line loading
b) improve the stability of the system
c) reduce the voltage profile
d) improve the protection of the line
= Answer (b) improve the stability of the system

77) The load carrying capability of a long AC transmission line is
a) always limited by the conductor size
b) limited by stability considerations
c) reduced at a low ambient temperatures
d) decreased by the use of bundled conductors of single conductors
= Answer (b) limited by stability considerations

78) For a given base voltage and base volt-amperes,the per unit impedance value of an element is x.What will be the per unit impedance value of this element when the voltage and volt-ampere bases are both doubled ?
a) 0.5 x b) 2x c) 4x d) x
= Answer (a) 0.5 x

$x_{pu(new)} = x_{pu(old)} \times \frac{(kVA)_{new}}{(kVA)_{old}} \times \frac{(kV)_{old}{}^2}{(kV)^2{}_{new}}$
= x $\times \frac{2}{1} \times (\frac{1}{2})^2$
= x $\times \frac{2}{4}$
= 0.5 x

79) A 50 Hz balanced three-phase,Y-connected supply is connected to a balanced three-phase Y-connected load.If the instantaneous phase-α of the supply voltage is Vcos(ωt) and the phase-α of the load current is Icos($\omega t - \varphi$),the instantaneous three-phase power is
a) a constant with a magnitude of VI cosφ
b) a constant with a magnitude of (3/2) VI cosφ
c) time varying with an average value of (3/2) VI cosφ and a frequency of 100 Hz
d) time varying with an average value of VI cosφ and a frequency of 50 Hz
= Answer (b) a constant with a magnitude of (3/2) VI cosφ

80) Consider a long,two wire line composed of solid round conductors.The ratio of both conductors is 0.25 cm and the distance between their centres is 1 m.If this distance is doubled,then the inductance per unit length
a) doubles b) half
c) increases but does not double d) decreases but does not half
= Answer (c) increases but does not double

81) A long wire composed of a round conductors runs above and parallel to the ground (assumed to be a large conducting plate).A high voltage exists between the conductors and the ground.The maximum electric stress occurs at
a) the upper surface of the conductor
b) the lower surface of the conductor
c) the ground surface
d) midway between the conductor and the ground
= Answer (b) the lower surface of the conductor

82) Bundled conductors are mainly used in high voltage overhead transmission line to
a) reduce transmission line losses
b) increase mechanical strength of the line
c) reduce corona
d) reduce sag
= Answer (c) reduce corona

83) The insulation strength of an EHV transmission line is mainly governed by
a) load power factor b) switching over voltage
c) harmonics d) corona
= Answer (b) switching over voltage

84) An 800 kV transmission line has a maximum power transfer capacity of P.If it is operated at 400 kV with the series reactance unchanged,the new maximum power transfer capacity is approximately
a) P b) 2P c) $\frac{P}{2}$ d) $\frac{P}{4}$
= Answer (d) $\frac{P}{4}$

85) High voltage DC (HVDC) transmission is mainly used for
a) buck power transmission over very long distances
b) inter-connecting two systems with the same nominal frequency
c) eliminating reactance power requirement in the operation
d) minimizing harmonics at the converter station
= Answer (a) buck power transmission over very long distances

86) For a fixed value of complex power flow in a transmission line having a sending end voltage V,the real power loss will be proportional to
a) V b) V^2 c) $1/V^2$ d) 1/V
= Answer (b) V^2

87) The insulation resistance of cable of length 10 km in 1 MΩ.For a length of 100 km of the same cable,the insulation resistance will be
a) 1 MΩ b) 10 MΩ c) 0.1 MΩ d) 0.01 MΩ
= Answer (c) 0.1 MΩ
Insulation resistance of a cable is,

$$R = \frac{\rho}{2\pi l} \log\frac{r_2}{r_1} \text{ ----------(i)}$$

Where,
l = Length of the cable
ρ = Specific resistance of the material

r_2 = Radious of the conductor

r_1 = inner radious of the sheath

For a length of 10 km,

From (i),

$$R = \frac{1}{l} \text{ ----------(ii)}$$

Similarly,

$$R^{/} = \frac{\rho}{2\pi l^{/}} \log \frac{r_2^{/}}{r_1^{/}} \text{ ----------(iii)}$$

Where,

$R^{/}$ = Insulation resistance

$l^{/}$ = length of the conductor

$r_2{}^{/}$= Radious of the conductor

$r^{/}{}_1$ = Inner radious of the sheath

For a length of 100 km,

From (iii),

$$R^{/} = \frac{1}{l^{/}} \text{ ----------(iv)}$$

Divide (ii) by (iv),

$$\frac{R}{R^{/}} = \frac{1/l}{1/l^{/}}$$

$$\Rightarrow \frac{R}{R^{/}} = \frac{l^{/}}{l}$$

$$\Rightarrow \frac{1}{R^{/}} = \frac{100}{10}$$

$$\Rightarrow R^{/} = \frac{1}{10}$$

$$\therefore R^{/} = 0.1$$

88) A lossless radial transmission line with surge impedance loading

a) takes negative VAR at sending end and zero VAR at receiving end

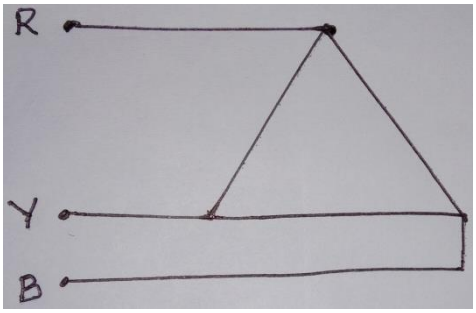
b) takes positive VAR at sending end and zero VAR at receiving end

c) has flat voltage profile and unity power factor at all points along it

d) has sending end voltage higher than receiving end voltage and unity power factor at sending end

= Answer (c) has flat voltage profile and unity power factor at all points along it

89) The phase sequence of the 3-phase system shown in figure is



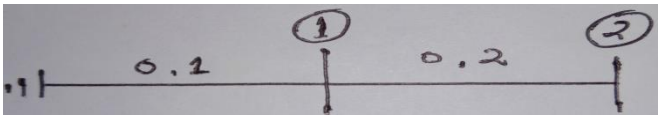
A) RYB b) RBY c) BRY d) YBR

= Answer (b) RBY

90) Corona losses are minimized when

a) conductor size is reduced
b) smooth conductor is reduced
c) sharp points are provided in the line hardware
d) current density in conductor is reduced
= Answer (b) smooth conductor is reduced

91) The bus admittance matrix of the network shown in the given figure,for which the marked parameters are per unit impedance is



a) $\begin{bmatrix} 15 & -5 \\ -5 & 5 \end{bmatrix}$ b) $\begin{bmatrix} 0.3 & 0.2 \\ 0.2 & 0.2 \end{bmatrix}$ c) $\begin{bmatrix} 0.3 & -0.2 \\ -0.2 & 0.2 \end{bmatrix}$ d) $\begin{bmatrix} 0.3 & -0.2 \\ -0.2 & 0.2 \end{bmatrix}^{-1}$
= Answer (a) $\begin{bmatrix} 15 & -5 \\ -5 & 5 \end{bmatrix}$

$Y_{11} = \frac{1}{0.1} + \frac{1}{0.2}$
$= 10 + 5$
$= 15$
$Y_{22} = \frac{1}{0.2}$
$= 5$

92) Buses for load flow studies are classified as
1. The load bus
2. The generator bus
3. The slack bus
The correct combination of the pair of quantities specified having their usual meaning for different buses is

	Load bus	Generator bus	Slack bus
a)	P,$\|V\|$	P,Q	P,δ
b)	P,δ	Q,$\|V\|$	Q,δ
c)	$\|V\|$,Q	P,δ	P,Q
d)	P,Q	P,$\|V\|$	$\|V\|$,δ

	Load bus	Generator bus	Slack bus
= Answer (d)	P,Q	P,$\|V\|$	$\|V\|$,δ

93) For an unbalanced fault,with paths for zero sequence currents,at the points of fault
a) the negative and zero sequence voltages are minimum
b) the negative and zero sequence voltages are maximum
c) the negative sequence voltage is minimum and zero sequence voltage is maximum
d) the negative sequence voltage is maximum and zero sequence voltage is minimum
= Answer (b) the negative and zero sequence voltages are maximum

94) If the reference bus is changed in two load flow studies runs with same system data and power obtained for reference bus taken as specified P and Q in the letter run
a) the system losses will be unchanged but complex bus voltage will change
b) the system losses will changed but complex bus voltages remain unchanged

c) the system losses as well as complex bus voltage will change
d) the system losses as well as complex bus voltage will be unchanged
= Answer (a) the system losses will be unchanged but complex bus voltage will change

95) For a fault at the terminal of a synchronous generator the fault current is maximum for a
a) 3-phase fault b) 3-phase to ground fault
c) line to ground fault d) line to line fault
= Answer (b) 3-phase to ground fault

96) Higher synchronous reactance is preffered in the present day alternators because one can have
a) reduced sub-transient current b) reduce harmonic current
c) reduce transient current d) higher voltage regulation with load
= Answer (c) reduce transient current

97) The concept of an electricity short,medium and long be is primarily based on the
a) nominal voltage of the line b) physical length of the line
c) wavelength of the line d) power transmitted over the line
= Answer (b) physical length of the line

98) The inertia constant of a group of machine which do not swing together M_1 and M_2.The equivalent inertia constant of the system is
a) $M_1 + M_2$ b) $M_1 - M_2, if\ M_1 > M_2$ c)$\sqrt{M_1 M_2}$ d) $\frac{M_1 M_2}{M_1 + M_2}$
= Answer (d) $\frac{M_1 M_2}{M_1 + M_2}$

99) The voltage of generator and an infinite bus are given as $0.92<10^0$ and $1.10<0^0$ respectively.The generator act as a
a) Shunt capacitor b) Shunt coil
c) Data is insufficient d) None of these
= Answer (b) Shunt coil

100) An alternator having an induced emf of 2.4 Pu is connected to an infinite bus of 1 Pu.if the bus-bar has reactance of 0.3 Pu and alternator has reactance of 0.3 Pu,the maximum power that can be transferred is given by,
a) 6 Pu b) 4.67 Pu c) 2 Pu d) 4 Pu
= Answer (d) 4 Pu
Power transferred,

$$P = \frac{EV}{X} \sin\delta$$

Maximum power transferred at $\delta = \frac{\pi}{2}$

$$\therefore\ P_{max} = \frac{EV}{X}$$
$$= \frac{2.4 \times 1}{0.3+0.3}$$
$$= \frac{2.4}{0.6}$$
$$= 4$$

101) A synchronous generator connected to infinite bus delivers power at a lagging power factor.If its excitation is increase

a) the terminal voltage increases b) voltage angle δ increases
c) current delivered increased d) Both (b) and (c)
= Answer (d) Both (b) and (c)

102) If X is the system reactance and R is the resistance the power transferred is maximum when
a) X = $\sqrt{3}$R b) X = $\sqrt{2}$R c) X = R d) X = 2R
= Answer (a) X = $\sqrt{3}$R

103) The transient stability of the power system can be effectively improved by
a) excitation control b) phase shifting transformer
c) single pole switching of circuit breaker d) increasing the turbine valve opening
= Answer (c) single pole switching of circuit breaker

104) The rated voltage of a three phase power system is given as
a) rms phase voltage b) peak phase voltage
c) rms line to line voltage d) peak line to line voltage
= Answer (c) rms line to line voltage

105) Total instantaneous power supplied by a 3-phase AC supply to a balanced RL load is
a) zero
b) constant
c) pulsating with zero voltage
d) pulsating with non-zero voltage
= Answer (b) constant

106) Rate of Rise of Restriking Voltage (RRRV) depends upon
a) capacitance of the system only
b) inductance of the system only
c) type of circuit breaker
d) inductance and capacitance of the system
= Answer (d) inductance and capacitance of the system

107) An over current relay of current rating 5 A and setting 150% is connected to the secondary of CT of ratio 300/5.Then,the current in the line for which the relay pick up is
a) 450 A b) 150 A c) 300 A d) 200 A
= Answer (a) 450 A
Current rating of relay = 5 A
For 150% plug setting current = $5 \times 150\%$

$$= 5 \times \frac{150}{100}$$
$$= 5 \times 1.5$$
$$= 7.5 \text{ A}$$

Line current for secondary current = Ratio of CT $\times$ Plug setting current

$$= \frac{300}{5} \times 7.5$$
$$= 450 \text{ A}$$

108) A Buchholz is used
a) Protection of a transformer against all internal faults.

b) Protection of a transformer against external faults.
c) Protection of a transformer against both internal and external faults.
d) Protection of induction motors.
= Answer (a) Protection of a transformer against all internal faults.

109) HVDC transmission is preferred to EHV-AC because
a) HVDC transmission equipment are in expensive
b) VAR compensation is not required in HVDC system.
c) System stability can be improved.
d) Harmonic problem is avoided.
= Answer (c) System stability can be improved.

110) Resistance switching is normally employed in
a) all breakers b) buck oil breakers
c) minimum oil breakers d) air blast circuit breakers
= Answer (d) air blast circuit breakers

111) The use of high speed circuit breakers
a) reduce the short circuit current
b) improve system stability
c) decrease system stability
d) increase the short circuit current
= Answer (b) improve system stability

112) Reactance relay is normally preferred for protection against
a) earth faults b) phase faults
c) open circuit faults d) None of the above
= Answer (c) open circuit faults

113) Buck power transmission over long HVDC lines are preferred,on account of
a) low cost of HVDC terminals b) no harmonic problems
c) minimum line power losses d) simple protection
= Answer (c) minimum line power losses

114) If the length of a wire of resistance R is uniformly stretched to n times its original value,its new resistance is
a) nR b) $\frac{R}{n}$ c) n^2R d) $\frac{R}{n^2}$
= Answer (c) n^2R
Length of wire is stretched to n times its original value.

$R = \rho \frac{l}{A}$ ----------(i)

$l^{/} = nl$

$A^{/} = \frac{A}{n}$

$R^{/} = \rho \frac{l^{/}}{A^{/}}$

$\Rightarrow R^{/} = \rho \frac{nl}{\frac{A}{n}}$

$\Rightarrow R^{/} = \rho \frac{l}{A} n^2$

=>$R^{/}$ = R n^2 [From (i)]
$\therefore R^{/} = n^2$R

115) In an inverse definite minimum time,electromagnetic type over current relay,the minimum time feature is achieved because of
a) saturation of the magnetic circuit b) proper mechanical design
c) appropriate time delay element d) electromagnetic damping
= Answer (a) saturation of the magnetic circuit

116) In the protection of transformers,harmonic restraint is used to guard against
a) magnetising inrush current b) unbalanced operation
c) lighting d) switching over voltages
= Answer (a) magnetising inrush current

117) The interrupting time of a circuit breaker is the period between the instant of
a) initiation of short circuit and the arc extinction on an opening operation
b) energizing of the trip circuit and the arc extinction of an opening operation
c) initiation of short circuit and the parting of primary arc contacts
d) energizing of the trip circuit and the parting of primary arc contacts
= Answer (b) energizing of the trip circuit and the arc extinction of an opening operation

118) Choose two appropriate auxiliary components of a HVDC transmission system from the following
P) DC line inductor
Q) AC line inductor
R) Reactive power sources
S) Distance relays on DC line
T) Series capacitance of AC line
a) P and Q b) P and R c) Q and S d) S and T
= Answer (b) P and R

119) The transmission line distance protection relay having the property of being inherently directional is
a) impedance relay b) Mho relay c) Ohm relay d) reactance relay
= Answer (b) Mho relay

120) In a biased directional relay,the bias is defined as a ratio of
a) number of turns of restraining and operating coil
b) operating coil current and restraining coil current
c) fault current and operating coil current
d) fault current and restraining coil current
= Answer (b) operating coil current and restraining coil current

121) Keeping in view,the cost and overall effectiveness,the following circuit breaker is best suited for capacitor bank switching
a) vacuum b) air blast c) SF_6 d) oil
= Answer (a) vacuum

122) A HVDC link consists of rectifier,inverter transmission line and other equipments.Which one of the following is true for this link ?
a) The transmission line produces/supplies reactive power.
b) The rectifier consume reactive power and the inverter supplies reactive power from/to the respective connected AC system.
c) Rectifier supplies reactive power and the inverter consumes reactive power to/from the respective connected AC system.
d) Both the converters (rectifier and inverter) consume reactive power from the respective connected AC system.
= Answer (b) The rectifier consume reactive power and the inverter supplies reactive power from/to the respective connected AC system.

123) For equilateral spacing of conductors of an untransposed 3-phase line,we have
a) balanced receiving end voltage and no communication interference
b) unbalanced receiving end voltage and no communication interference
c) balanced receiving end voltage and communication interference
d) unbalanced receiving end voltage communication interference
= Answer (c) balanced receiving end voltage and communication interference

124) The incremental cost characteristics of two generators delivering 200 MW are as follows

$\frac{dF_1}{dP_1}$ = 2.0 + 0.01P_1

$\frac{dF_2}{dP_2}$ = 1.6 + 0.02P_2

For economic operation,the generators P_1 and P_2 should be
a) P_1 = P_2 = 100 MW
b) P_1 = 80 MW, P_2 = 120 MW
c) P_1 = 200 MW, P_2 = 0
d) P_1 = 120 MW, P_2 = 80 MW
= Answer (d) P_1 = 120 MW, P_2 = 80 MW

P_1 + P_2 = 200 ----------(i)

$\frac{dF_1}{dP_1} = \frac{dF_2}{dP_2}$

=>2.0 + 0.01P_1 = 1.6 + 0.02P_2

=>0.01P_1 - 0.02P_2 = 1.6 – 2

=>0.01P_1 - 0.02P_2 = - 0.4

=>P_1 - 2P_2 = - 40

∴ P_1 = 2P_2 – 40

Putting P_1 = 2P_2 – 40 in (i),

2P_2 – 40 + P_2 = 200

=>3P_2 = 240

∴ P_2 = 80

From (i),

P_1 + 80 = 200

=>P_1 = 200 – 80

∴ P_1 = 120

125) Match the items in List I with the items in List II and select the correct answer using the codes given below the lists

List I	List II
P. Improve power factor	1.Shunt reactor
Q. Reduce the current ripples	2. Shunt capacitor
R. Increases the power flow in line	3. Series capacitor
S. Reduce the Ferranti effect	4. Series reactor

Codes

	P	Q	R	S
a)	2	3	4	1
b)	2	4	3	1
c)	4	3	1	2
d)	4	1	3	2

	P	Q	R	S
= Answer (b)	2	4	3	1

126) A list of relays and the power system components protected by the relays are given in List I and List II and find the correct answer using the codes given below

List I	List II
P. Distance relay	1.Transformers
Q. Under frequency relay	2. Turbines
R. Differential relay	3. Busbars
S. Buchholz relay	4. Shunt capacitors
	5. Alternators
	6. Transmission line

Codes

	P	Q	R	S
a)	6	5	3	1
b)	4	3	2	1
c)	5	2	1	6
d)	6	4	5	3

	P	Q	R	S
= Answer (a)	6	5	3	1

127) Match List I (type of transmission line) with List II (type of distance relay preferred) and select the correct answer using the codes given below the lists

List I	List II
P. Short line	1. Ohm relay
Q. Medium line	2. Reactance relay
R. Long line	3. Mho relay

Codes

	P	Q	R
a)	2	1	3
b)	3	2	1
c)	1	2	3
d)	1	3	2

	P	Q	R
= Answer (c)	1	2	3

128) A 500 MW,21 kV,50 Hz,two pole synchronous generator having a rated 0.9 p.f. has a moment of inertia of 27.5×10^3 Kg-m^2.The inertia constant (H) will be

a) 2.44 S b) 2.71 S c) 4.88 S d) 5.42 S

= Answer (a) 2.44 S

G = $\frac{P}{cos\varphi}$

= $\frac{500}{0.9}$ MW

= 555.56 MVA

N_s = $\frac{120 \times f}{2}$

= $\frac{120 \times 50}{2}$

= 3000 rpm

KE stored = $\frac{1}{2} \times$ M $\times (\frac{2\pi N}{60})^2$

= $\frac{1}{2} \times 27.5 \times 10^3 \times (\frac{2\pi \times 3000}{60})^2$

= 1357.07 MJ

H = $\frac{KE}{MVA}$

= $\frac{1357.07}{555.56}$

= 2.44 Mj/MVA

= 2.44 S

129) Unit of inertia constant

= Mj/MVA

= S

130) In order to keep the magnetization current at the same level as that for normal 50 Hz supply,at 25 Hz supply voltage should be

a) 230 V b) 460 V c) 115 V d) 65 V

= Answer (c) 115 V