**QUESTION BANK**

**SUBJECT : EE6701 HIGH VOLTAGE ENGINEERING**

## SEM / YEAR: VII/IV

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| **UNIT I - INTRODUCTION** |
| **SYLLABUS**Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Reflection and Refraction of Travelling waves- Protection against overvoltage. |
| **PART - A** |
| **Q.NO** | **Questions** | **BT Level** | **Competence** |
| 1. | Discuss different kinds of over voltages and its causes. | **1** | **Remember** |
| 2. | Define corona critical Disruptive voltage | **1** | **Remember** |
| 3. | Define lightning phenomenon | **1** | **Remember** |
| 4. | Define Isokeraunic level and back flash over | **2** | **Understand** |
| 5. | List out various schemes of protection against over voltages | **2** | **Apply** |
| 6. | Define Shielding angle. | **2** | **Understand** |
| 7. | List the techniques to be adopted for controlling switching | **2** | **Evaluate** |
| over voltages? |
| 8. | Infer the concept of switching surge? Mention its approximate | **1** | **Apply** |
| magnitude and frequency. |
| 9. | What are the methods employed for protection of over head | **1** | **Apply** |
| lines against lightning |
| 10. | Draw the mathematical model of lightning. | **1** | **Remember** |
| 11. | State the specifications of a travelling wave? | **3** | **Analyze** |
| 12. | Define surge impedance of a line? | **3** | **Remember** |
| 13. | Outline the concept you understand from the word “travelling | **3** | **Analyze** |
| waves? |
| 14. | Define attenuation? How they are caused | **4** | **Analyze** |
| 15. | List the origin of switching surges? | **4** | **Evaluate** |
| 16. | List the causes of power frequency over voltages in power | **4** | **Understand** |
| system? |
| 17. | Mention the specifications of the standard impulse voltage? | **6** | **Create** |
| 18. | Express the equations for reflection coefficient and refraction | **5** | **Understand** |
| co- efficient |

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| 19. | Draw the typical wave shape of switching surges. | **5** | **Create** |
| 20. | What is the use of protective devices? | **6** | **Remember** |
| **PART - B** |
| 1. | Explore the mechanism of lightning and mathematical model | **2** | **Evaluate** |
| of lightning. |
| 2. | Explain the different theories of charge formation in the | **3** | **Apply** |
| cloud. |
| 3. | Explain the various protection of transmission line against | **1** | **Evaluate** |
| different over voltages. |
| 4. | Explain various causes of power frequency over voltages in | **1** | **Remember** |
| power systems and its control techniques. |
| 5. | Derive the expression for velocity of travelling waves on | **3** | **Remember** |
| transmission line |
| 6. | Discuss elaborately on reflection and refraction of travelling | **2** | **Understand** |
| waves |
| 7. | Explain the control measures for over voltage due to | **2** | **Analyze** |
| Switching surge and lightning over voltages. |
| 8. | Give the origin and characteristics of switching surges and | **4** | **Understand** |
| explain the causes of over voltage due to switching surges in |
| EHV and UHV system |
| 9. | What are the causes for switching and power frequency over | **4** | **Apply** |
|  | voltages? How are they Controlled in power systems? |  |  |
| 10. | Write short notes on: (a) Rod gaps used as protective devices | **1** | **Create** |
|  | (b) Ground wires for protection of overhead lines |  |  |
| 11. | Discuss elaborately various sources of Temporary over | **1** | **Remember** |
| voltages. |
| 12. | Briefly explain about Corona loss and its effects related to | **6** | **Analyze** |
| Transmission system |
| 13. | Develop wave equation of travelling waves in transmission | **4** | **Analyze** |
| line and also discuss the behaviour of travelling waves in |
| open circuited transmission |
| 14. | i) Draw the cross sectional view of a valve type Lightning | **5** | **Analyze** |
| arrester and explain its Operation with V-I characteristics |
| ii) Give the requirements of ground wire for protecting power |
| conductors against Lightning stroke. Explain how they are |
| achieved in practice |

Part-C

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| 1. | An underground cable of inductance 0.150 mH/km and of capacitance 0.2µF/km is connected to an overhead line having an inductance of 1.2 mH/km and capacitance of 0.006µF/km. Calculate the transmitted and reflected voltage and current waves at the junction, if a surge of 200kv travels to the junction,(a) Along the cable (b) Along the overhead line. (15) | 5 | **Analyze** |
| 2. | 1. Cloud discharge 14 coulombs within 2ms on to a transmission line during lightening. Estimate the voltage produced at the point of stroke on the transmission line. Assume the surge impedance of the line is 350 ohm.(8)
2. An overhead line has inductance of 1.26 mH/km and capacitance of 0.009µF/km. Calculate the voltage developed when lightning strikes transmission line injecting a current of

15kA (7) | **4** | **Evaluate** |
| 3. | Show and explain the charge distribution patters in the cloudfollowing Wilson’s and Simpson’s theory. (15) | **5** | **Create** |
| 4. | 1. Cloud discharge 15 coulombs within 1.5ms on to a transmission line during lightening. Estimate the voltage produced at the point of stroke on the transmission line. Assume the surge impedance of the line is 350 ohm. (8)
2. How lightening is modelled mathematically. (7)
 | **4** | **Evaluate** |

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## SEM / YEAR: VII/IV

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| **UNIT II - II DIELECTRIC BREAKDOWN** |
| Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics. |
| **PART – A** |
| **Q.No** | **Questions** | **BT Level** | **Competence** |
| 1. | Outline the concept of electronegative gases? Give example | **2** | **Remember** |
| 2. | Discuss about ionization by collision | **2** | **Remember** |
| 3. | Define Paschen’s law | **2** | **Remember** |
| 4. | Define gas law | **1** | **Remember** |
| 5. | Outline the concept of corona discharge | **1** | **Remember** |
| 6. | Define intrinsic strength? | **1** | **Understand** |
| 7. | Give the criterion for breakdown in non-uniform fields? | **2** | **Apply** |
| 8. | Discuss about composite dielectric? List its properties? | **1** | **Analyze** |
| 9. | Define Townsends first ionization coefficient | **1** | **Understand** |
| 10. | What are pure liquid di-electrics? | **1** | **Understand** |
| 11. | Electron attaching gases useful for practical use as insulants whencompared to non-attaching gases-justify? | **3** | **Remember** |
| 12. | Define uniform and non-uniform fields. | **3** | **Understand** |
| 13. | Give the usual range of vacuum used in high voltage apparatus? | **3** | **Remember** |
| 14. | Commercial liquid dielectrics are different from pure liquid dielectrics? Justify | **4** | **Create** |
| 15. | List the factors that influence conduction in pure liquid dielectrics and in commercial liquid dielectrics? | **4** | **Evaluate** |
| 16. | Outline concept of “stressed oil volume theory"? | **4** | **Evaluate** |
| 17. | Give the Concept of time lag in breakdown of dielectrics? | **6** | **Analyze** |
| 18. | List out various quantities of transformer oil. | **5** | **Analyze** |

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| 19. | State the factors which affect breakdown of gaseous dielectrics | 5 | **Understand** |
| 20. | Explore the concept of penning effect | **6** | **Create** |
| **PART-B** |
| 1. | (i) Explain the Townsend’s first and second ionization processes. | **1** | **Remember** |
| (ii) Explain briefly various theories of breakdown in commercial |
| liquid dielectrics. |
| 2. | (i) Explain clearly various processes which explain electric | **3** | **Remember** |
| breakdown in vacuum.(8) |
| (ii) Discuss the properties of composite dielectrics.(8) |
| 3. | Explain the phenomenon of corona discharge and breakdown | 2 | **Remember** |
| Mechanism in non-uniform fields. |
| 4. | Explain the following | **1** | **Apply** |
| (i) Breakdown mechanism in solid dielectrics (8) |
| ii) Composite dielectrics and how the breakdown occurs in |
| it. (8) |
| 5. | Explain the various theories that explain breakdown in pure and | **3** | **Remember** |
| commercial liquid dielectrics. |
| 6. | Explain the phenomena of electrical conduction in liquids. | **2** | **Understand** |
| How does it differ from that in gases? |
| 7. | Explore "stressed oil volume theory", and how does it explain | **2** | **Understand** |
| breakdown in large volumes of commercial liquid dielectrics |
| 8. | Explain the difference between photo-ionization and photo- | **2** | **Analyze** |
| electric emission. |
| 9. | (i) Derive the criterion for breakdown in electronegative gases. | **4** | **Analyze** |
| (ii) Explain the Streamer theory of breakdown in air at |
| atmospheric pressure. |
| 10. | i) Outline concept of anode and the cathode streamers? Explain the | **4** | **Analyze** |
| mechanism of their formation and development leading to |
| breakdown(8) |
| ii) Describe the current growth phenomenon in a gas subjected to |
| uniform electric fields. (8) |
| 11. | (i) Discuss streamer theory of breakdown in gases (8) | **1** | **Analyze** |
| (ii) Explain various mechanisms of Vacuum breakdown (8) |
| 12. | Explain thermal breakdown mechanisms in solid dielectrics. | **1** | **Apply** |
| Derive an expression for critical thermal breakdown voltage (Vc) |
| and critical electric field (Ec) for the same. State clearly the |
| assumptions made |
| 13. | Briefly explain breakdown mechanisms in solid dielectrics and | **5** | **Create** |
| composite dielectrics |
| 14.. | Explain the dielectrics characteristics of liquid dielectrics and also | **4** | **Evaluate** |
| explain the liquid purification system |

Part-C

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| 1. | (i).List out the problems caused by corona discharge.(7) (ii)describe the mechanism of short term breakdown composite insulation.(8) | 5 | **Analyze** |
| 2 | 1. Name the primary ionization processes in gaseous dielectrics and explain in detail.(8)
2. how vacuum breakdown occurs according to particle

exchange mechanism.(7) | **4** | **Evaluate** |
| 3. | State why the very high intrinsic strength of solid dielectric isnot fully realized in practice. Explain in detail any one mechanism of breakdown in solid dielectrics.(15) | **5** | **Create** |
| 4. | (i).A steady state current of 5.5x10-8 A was noted duringexperiments in certain gas at 8Kv at a distance of 0.4cm between plane electrodes. Keeping the field constant and reducing the distance to 0.1cm resulted in a current of 5.5x10-9A. Calculate Townsend’s primary ionization coefficient alpha α.(8)(ii).Derive and expression for the growth of current due to Townsend’s primary ionization. Assume necessary data.(7) | **4** | **Evaluate** |

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| **UNIT III - GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS** |
| Generation of High DC, AC, impulse voltages and currents - Triggering and control of impulse generators. |
| **PART – A** |
| **Q.No** | **Questions** | **BT Level** | **Competence** |
| 1 | List the merits and demerits of Van de Graaff generator? | **1** | **Create** |
| 2 | Explain the superiority of cascaded transformer over two winding | **1** | **Arrange** |
| transformer used for generation of high ac voltages |
| 3 | Write the different forms of high voltages required for the testing of | **3** | **Analyze** |
| electrical apparatus |
| 4 | Comment- surge impedance of the transmission line is higher than | **3** | **Remember** |
| cable |
| 5 | Draw the voltage multiplier circuit. | **3** | **Apply** |
| 6 | What is the principle of operation of a resonant transformer and | **4** | **Remember** |
| deltatron circuit? |
| 7 | What is tesla coil? | **1** | **Remember** |
| 8 | Give the basic principle for electrostatic generator? | **1** | **Understand** |
| 9 | Draw the circuit for producing impulse voltage. | **4** | **Understand** |
| 10 | Draw Schematic diagram of Marx circuit arrangement for multistage | **4** | **Remember** |
| impulse generator |
| 11 | State the components of multistage impulse generator? | **5** | **Apply** |
| 12 | Draw a typical impulse current wave form | **2** | **Remember** |
| 13 | Define the front and tail times of an impulse wave. What are the | **5** | **Remember** |
| tolerances allowed as per the specifications |
| 14 | Differentiate between spark over, flash over and puncture? | **2** | **Analyze** |
| 15 | How is the wave front and wave tail times controlled in impulse | **6** | **Understand** |
| generator circuits? |
| 16 | Trigatron gap- Explain its functions and operation. | **6** | **Understand** |
| 17 | Mention the different methods of producing switching impulses in | **1** | **Evaluate** |
| test laboratories. |

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| 18 | How are rectangular current pulses generated for testing | **2** | **Evaluate** |
| purposes? How is their time duration controlled? |
| 19 | List the advantages of series resonant circuit | **2** | **Apply** |
| 20 | Mention the necessity of generating High DC voltage | **1** | **Create** |
| PART-B |
| 1 | Explain the resonant transformers used for generation of high ac | **1** | **Analyze** |
| voltages. What are its advantages? |
| 2 | Explain simple voltage doubler and cascaded voltage doubler | **2** | **Apply** |
| used for generation of high DC voltages. |
| 3 | Mention the necessity of generating High DC voltage and also | **1** | **Analyze** |
| with a neat sketch explain the working of a Van de Graaff |
| generator. |
| 4 | With a neat sketch explain the Cockcroft – Walton voltage | **1** | **Remember** |
| multiplier circuit for generation of high DC voltages. |
| 5 | Explain with diagrams, different types of rectifier circuits for | 1 | **Understand** |
| producing high D.C. voltages. |
| 6 | Discuss elaborately the principle and operation of Cascaded | **2** | **Understand** |
| transformers for generating high AC voltages. |
| 7 | Discuss elaborately the principle and operation of impulse current | **2** | **Understand** |
| generator |
| 8 | Give different circuits that produce impulse waves explaining clearly | **3** | **Analyze** |
| their relative merits and demerits. |
| 9 | Give the Marx circuit arrangement for multistage impulse | **3** | **Understand** |
| generators. How is the basic arrangement modified to |
| accommodate the wave time control resistances? |
| 10 | Explain the different methods of producing switching impulses in | **6** | **Evaluate** |
| test laboratories. |
| 11 | Trigatron gap-Explain its functions and operation. | **4** | **Remember** |
| 12 | Give the expression for ripple and regulation in voltage multiplier | **5** | **Remember** |
| circuits. How are the ripple and regulation minimized? |
| 13 | Explain the working of Cockroft-Walton voltage multiplier | **4** | **Analyze** |
| circuit under unloaded and Loaded conditions |
| 14 | A Cockroft Walton type voltage multiplier has eight stages with | **4** | **Remember** |
| capacitances ,all equal to 0.05µF.The supply transformer |
| secondary voltage is 125Kv at a frequency of 125Hz.If the load |
| current to be supplied is 4.5Ma.Find (1)the %ripple,(2)the |
| regulation |

Part-C

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| 1. | What is Tesla coil? How is damped high frequency oscillations obtained from a Tesla coil?(15) | 5 | **Analyze** |
| 2. | Calculate the peak current and wave shape of the output current of the following generator. Total capacitance of the generator is 53µF.the charging voltage is 240 Kv. the circuit inductance is1.54mH and the dynamic resistance of the test object is 0.05 ohms.(15) | **4** | **Evaluate** |
| 3 | An impulse generator has 10 stages with capacitor of 0.18µF rated at 150kV per stage. The load capacitor is 200PF. Estimate values of series and parallel resistance needed to produce animpulse of wave shape 1.2/50µs.(15) | **5** | **Create** |
| 4 | A ten stage Cockraft-Walton circuit has all capacitor of 0.04µF the secondary voltage of the supply transformer is 120Kv at a frequency of 150HZ.if the load current is 1.2 milliamps, determine (i)voltage regulation (ii) the ripple(iii)the optimum number of stages for maximum output voltage(iv) the maximumoutput voltage | **4** | **Evaluate** |

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| **UNIT IV - MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS** |
| **PART – A** |
| **Q.No** | **Questions** | **BT Level** | **Competence** |
| **1.** | Discuss the advantages and limitations of generating volt meters? | **2** | **Remember** |
| **2.** | Enumerate | the | reason | of | using | sphere type | electrodes | in | **2** | **Understand** |
| measurement of high voltage. |  |  |  |
| **3.** | Write the advantages and disadvantages of CVT. | **6** | **Evaluate** |
| **4.** | How the | stray | effect | is | reduced | in resistive | shunt type | of | **1** | **Apply** |
| measurements |  |  |  |  |  |  |
| **5.** | List the drawbacks of resistance potential divider? | **2** | **Remember** |
| **6.** | Give the basic principle of generating and electrostatic voltmeter? | **1** | **Evaluate** |
| **7.** | How stray effect is reduced in shunt type of measurement? | **3** | **Remember** |
| **8.** | List the effect of nearby earthed objects on the measurements |  | **1** | **Remember** |
| using sphere gaps? |  |  |  |  |  |
| **9** | List some | advantages of Faraday generator. |  |  | **5** | **Understand** |
| **10** | List the general methods used for measurement of high frequency | **1** | **Understand** |
| and impulse currents |  |  |  |  |  |
| **11** | List out various techniques for high voltage DC measurement | **1** | **Understand** |
| **12** | State the type of measuring devices preferred for measurement |  | **2** | **Remember** |
| of high frequency impulse current. |  |  |  |
| **13** | Explain the basic principle of hall generator. | **3** | **Apply** |
| **14** | List the factors that are influencing the peak voltage measurement | **2** | **Analyze** |
| using sphere gap. |  |  |  |  |  |  |
| **15** | Outline the limitations of generating voltmeter? | **6** | **Analyze** |
| **16** | State the demerits of CVT measurement of HVAC measurements? | **1** | **Analyze** |
| **17** | Give the principle of mixed potential divider? How is it used for |  | **3** | **Apply** |
| impulse voltage measurements? |  |  |  |
| **18** | Outline requirements of an oscillograph for impulse and high |  | **4** | **Understand** |
| frequency measurements in high voltage test circuits? |  |

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| **19** | What are the problems associated with measurement of very high | **4** | **Create** |
| impulse voltages |
| **20** | List out different types of resistive shunts used for impulse current | **5** | **Remember** |
| measurements |
| **PART-B** |
| **1.** | With a neat circuit and phasor diagram, explain the Capacitance | **2** | **Remember** |
| Voltage Transformer. |
| **2.** | List the various techniques used for measurement of Dc voltages? | **3** | **Remember** |
| Explain |
| (i) Generating Voltmeter. (ii) Resistance potential divider |
| (iii) Series resistance |
| **3.** | micrometer | **1** | **Remember** |
|  |
| Explain series impedance, series capacitance and capacitance |  |
| potential dividers used for measurement of high ac voltages. |  |
| **4.** | Explain briefly the Electrostatic Voltmeter. Also list the | **1** | **Remember** |
| advantages and disadvantages |
| **5.** | Explain the peak reading AC voltmeter? | **3** | **Understand** |
| **6.** | (i)Explain the Hall generator for measuring high dc current. | **2** | **Understand** |
| (ii)Explain the measurement of high power frequency alternating |
| current using CT with electro optical signal converter. |
| (iii)Enumerate digital peak voltmeter |
| **7.** | Explain Sphere gaps for measurement of high dc, ac and impulse | **2** | **Apply** |
| voltages & the factors affecting the measurement. |
| **8.** | (i) Explain hall generators for measurement of High currents.(8) | **4** | **Apply** |
| (ii) Explain high- power frequency ac current using current |
| transformer with electro optical signal converter.(8) |
| **9.** | Explain Electrostatic voltmeter used for measurement of high | **4** | **Understand** |
| voltage. |
| **10** | With neat circuit diagram explain the capacitance potential | **1** | **Evaluate** |
| transformer. Draw the necessary phasor diagram |
| **11** | Briefly explain arrangements of Rogowski coil and magneto optic | **1** | **Analyze** |
| methods for high current measurements |
| **12** | Discuss elaborately about various digital techniques in HV | **6** | **Analyze** |
| measurement |
| **13** | Describe the construction, principle of operation of a generating | **4** | **Analyze** |
| voltmeter and give its application and limitations |
| **14** | Discuss and compare the performance of resistance capacitance | **5** | **Create** |
| and mixed R-C potential dividers for measurement of impulse |
| voltages |

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| 1. | Explain any two methods to measure high impulse current(15) | 5 | **Analyze** |
| 2. | A Rogowski coil is required to measure impulse current of 8KA having rate of change of current of 1010 A/sec .The voltmeter is connected across the integrating circuit which reads 8KV for full scale deflection. The input to integrating circuit is from Rogowski coil. Determine the mutual inductance of coil, R andC for the integrating circuit. | **4** | **Evaluate** |
| 3 | 1. Explain the different methods of high current measurements with their relatives merits and demerits.
2. Explain with neat diagram how rod gaps can used for

measurement of high voltages compare its performance with sphere gap. | **5** | **Create** |
| 4 | A coaxial shunt is to designed to measure an impulse current of 50 KA. If the bandwidth of shunt is to be at least 10 MHZ and if the voltage drop across the shunt should not exceed 50V,Findthe ohmic value and its dimensions. | **4** | **Evaluate** |

Part-C

**QUESTION BANK SUBJECT : EE6701 HIGH VOLTAGE ENGINEERING**

## SEM / YEAR: VII/IV

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| **UNIT V - HIGH VOLTAGE TESTING & INSULATION COORDINATION** |
| High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination |
| **PART – A** |
| **Q.No** | **Questions** | **BT Level** | **Competence** |
| **1.** | Define disruptive discharge voltage? | **2** | **Remember** |
| **2.** | Define withstand and flashover voltage? | **1** | **Remember** |
| **3.** | Define 50% and 100% flashover voltage? | **1** | **Analyze** |
| **4.** | Define creepage distance? | **1** | **Remember** |
| **5.** | Enumerate the difference between type and routine tests? | **1** | **Understand** |
| **6.** | Define air density correction factor | **2** | **Apply** |
| **7.** | Discuss about BIL in power system insulation coordination? | **2** | **Remember** |
| **8.** | List the tests to be carried out on insulator and give a brief account | **2** | **Apply** |
| of each test? |
| **9.** | Infer the significance of power factor tests? | **3** | **Analyze** |
| **10** | List out the standards for testing bushing, CB, insulators and | **4** | **Understand** |
| transformer |
| **11** | List out tests conducted on power transformer as per standard | **4** | **Create** |
| **12** | State the various test conducted on bushing | **3** | **Understand** |
| **13** | Define impulse voltage and withstand voltage | **3** |  |
| **14** | List out various tests to be carried out on circuit breaker | **1** | **Understand** |
| **15** | Give the values of reference atmospheric condition as per I.S | **1** | **Apply** |
| specifications |
| **16** | Outline the demerits of synthetic testing of circuit breaker | **4** | **Evaluate** |
| **17** | Explore the concept of insulation coordination | **5** | **Remember** |
| **18** | Examine the concept of one minute dry/wet withstand test | **6** | **Analyze** |

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| **19** | How is impulse voltage withstand test conducted | **5** | **Understand** |
| **20** | Distinguish between flashover and puncture | **6** | **Analyze** |
| **PART – B** |
| **1.** | Explain the following: (i) Flashover voltage (ii) Withstand voltage | **1** | **Remember** |
| (iii) Impulse voltage (iv) Creepage distance. |
| **2.** | Discuss the different high voltage tests conducted on bushings. | **3** | **Remember** |
| **3.** | What are the tests conducted on isolators and circuit breakers? | **3** | **Understand** |
| Explain in detail. |
| **4.** | Explain the different aspects of insulation design and insulation | **4** | **Apply** |
| coordination adopted for EHV systems |
| **5.** | Explain the methods of impulse testing of high voltage | **4** | **Understand** |
| transformers. What is the procedure adopted for locating the |
| failure? |
| **6.** | What are the tests conducted on circuit breakers and isolators | **4** | **Remember** |
| switches |
| **7.** | Explain the following terms used in HV testing as per the | **2** | **Remember** |
| standards i) Disruptive discharge voltage |
| (ii)Creepage distance |
| (iii)Impulse voltage |
| (iv) 100% and 50 % flash over voltage |
| **8.** | Briefly discuss the various tests carried out the insulator | **2** | **Understand** |
| **9.** | List the different power frequency tests done on bushing? | **2** | **Apply** |
| **10** | Give the necessity of volt-time curves? Explain the procedure for | **1** | **Analyze** |
| constructing Volt-time curves with neat sketch. Give its |
| significance in power system studies |
| **11** | Discuss elaborately about Insulation coordination. | **1** | **Analyze** |
| **12** | Briefly explain short circuit plant pertaining to testing of CB | **1** | **Analyze** |
| **13** | i)Elaborately discuss about various types of standards for HV | **5** | **Create** |
| power apparatus testing of electrical power apparatus(8) |
| ii)write short notes on statistical methods for insulation |
| coordination(8) |
| **14** | i)Briefly explain about pollution testing of Insulators(8) | **6** | **Evaluate** |
| ii)Draw the layout for synthetic testing and explain the |
| procedure(8) |

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| 1. | Explain the different high voltage tests done on bushing? | 5 | **Analyze** |
| 2. | Explain the direct and synthetic testing of isolators and circuitbreakers in detail. | **4** | **Evaluate** |
| 3 | 1. How are the protective devices chosen for the optimal insulation level in a power system?
2. Explain the following (a)Withstand voltage (b)Flashover voltage

(c)50% of flashover voltage | **5** | **Create** |
| 4 | Explain the complete test procedure for conducting impulse voltagewithstand test on 33KV post insulator. | **4** | **Evaluate** |