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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION - JULY 2024

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| **Semester : VII** | **Date :01-JULY-2024** |
| **Course Code :EEE3006** | **Time :1:30PM-4:30PM** |
| **Course Name :** **High Voltage Engineering** | **Max Marks :100** |
| **Program :B.Tech** | **Weightage :50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 4 QUESTIONS 4Q X 5M=20M** | | | |
| 1 | The effective transmission of power in extensive systems relies on elevated system voltages. Mention the primary factors leading to over voltages in electric power systems? | (CO 1) | [Knowledge] |
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| 2 | State Panchen’s Law and its significance in the context of gas discharge. How does Paschen's Law relate to the breakdown voltage in gases and what factors influence its applicability? | (CO 1) | [Knowledge] |
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| 3 | Overvoltage’s refer to the occurrence of voltages in an electrical system that exceed the specified or designed levels. Define the following terminologies associated with over voltages.  a. Disruptive discharge voltage b. Fifty percent flashover voltage | (CO 4) | [Knowledge] |
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| 4 | An impulse voltage is normally a unidirectional voltage. Define wave front time and wave tail time of an impulse voltage waveform. | CO 2) | [Knowledge] |
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| 5 | What is insulation coordination in electrical systems, and state why is it essential for power systems? | (CO 4) | [Knowledge] |
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| 6 | Accurate measurements of high voltages are paramount for the safe and reliable operation of electrical systems. Describe the key considerations, techniques, and instruments involved in accurately measuring and monitoring high voltages. | (CO 3) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 7 | Describe the significance and methodology of partial discharge measurements in the context of electrical systems. Also explain the types of equipment and techniques commonly employed for partial discharge measurements. | (CO 3) | [Comprehension] |
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| 8 | Explain briefly different tests that are carried out on bushings and cables with respect to several terminologies that are used to test them. | (CO 4) | [Comprehension] |
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| 9 | Discuss the various aspects of lightning phenomena, including the formation, types, and characteristics of lightning. Explain the key factors that contribute to the occurrence of lightning. | (CO 4) | [Comprehension] |
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| 10 | Which is the most accurate method of the measurement applicable to both ac power frequency and impulse voltage? Describe the principle and operation of that method in detail. | (CO 3) | [Comprehension] |
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| 11 | What considerations or challenges are associated with the design and utilization of multistage impulse voltage generators in various testing or experimental setups? Explain it with necessary diagrams. | (CO 2) | [Comprehension] |
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| 12 | What is the purpose of performing Electrical Tests on electrical equipment produced in a factory and used at generation transmission and distribution? Which such tests are known to you? Describe the importance of those tests related to HV equipment. | (CO 4) | [Comprehension] |
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| 13 | What fundamental breakdown mechanism governs the initiation and propagation of electrical discharges in uniform fields and non-uniform fields, influencing the design of insulation systems and impacting safety and efficiency in high voltage engineering? | (CO 1) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 15M=30M** | | | |
| 14 | a. For producing high power frequency test voltages of the order of >= 350kV, which type of test sets are produced? Explain those tests with necessary reasons for developing such tests.  b. A high voltage testing laboratory is required to test an apparatus with a capacitance of the order of 1000 pF used in a 440 kV system. If the test voltage requirement is three times the system rated voltage, estimate the kVA rating of the test transformer at 50 Hz operation. | (CO 2) | [Application] |
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| 15 | a. Explain Townsend's Theory of breakdown in gases. Derive the expression for self-sustained discharge when the gases follow the Townsend's mechanism of breakdown. Elaborate the conditions under which the theory is valid.  b. Three measurements of the current between two parallel plates were 1.22, 1.82 and 2.22 of the initiating photo current Io at distances 0.5, 1.50 and 1.9 cm respectively. E/p and p were maintained constant during the measurements. (i).List the parameters that can be computed with the given data. (ii). Compute the listed parameters. (Note: If required assume the necessary data) | (CO 1) | [Application] |
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| 16 | a. An electrostatic voltmeter consists of parallel plates, one movable and one fixed. With applied between the plates, it is found that the pull is 10 milli Newton’s on the movable plate. Determine the change in capacitance produced for a movement of movable plate by 1 mm. Diameter of movable plate is 150 mm.  b. A peak reading voltmeter is required to measure voltage up to 220 kV. The peak voltmeter uses an RC circuit micro ammeter, and a capacitive potential divider. The potential divider has a ratio of 1500:1 and the micro ammeter can read up to 20 micro A. Determine C and R if the time constant of RC circuit is 5 s. | (CO 3) | [Application] |
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