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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## February / March 2023 Semester End Main Examinations

**Programme: B.E.** **Semester: VII**
**Branch: Electrical & Electronics Engineering** **Duration: 3 hrs.**
**Course Code: 19EE7PCSPE** **Max Marks: 100**
**Course: Sustainable Practices in Power Engineering** **Date: 05.03.2023**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.



### UNIT - I

| | | | |
|---|---|---|---|
| 1 | a) | Name top **three** requirements to sustain in the supply of electrical power.<br>List **two** adverse situations that can result due to loss of electrical power. | **03**<br>**01** |
| | b) | List **four** reasons for **Technical** T&D Losses in India.<br>What are the ongoing / available solutions to reduce them? | **02**<br>**04** |
| | c) | List **four** reasons for **Commercial** T&D Losses in India.<br>What are the possible solutions to mitigate them? | **02**<br>**04** |
| | d) | Name **four** alternate sources of energy to generate electrical power, and **their pros and cons.** | **04** |

### UNIT - II

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| 2 | a) | List any **four** LV Switchgear Devices used for protection or control of electrical power.<br>Mention their **operational life** at rated current.<br>Mention their capability to Make, Break, and Withstand **Overload current**.<br>Mention their capability to Make, Break, and withstand **Short-Circuit current**. | **02**<br>**02**<br>**02**<br>**02** |
| | b) | In what duration (mill-seconds) should a short-circuit current be **terminated**?<br>What can happen if switchgear **fails to terminate** it within specified duration? | **02** |
| | c) | Draw a **sketch** showing construction of an HRC/HBC Fuse-link.<br>**Label** each component, describe its **function**, and state its **material**.<br>Describe **how** an HRC/HBC fuse **terminates** a short-circuit current. | **02**<br>**04**<br>**02** |

**OR**

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|---|---|---|---|
| 3 | a) | For which application do we use a **contactor?**<br>**How** is high operational life in millions of operations **achieved** in contactors?<br>**Why** is contactor **not** capable of breaking high short-circuit current? | **01**<br>**02**<br>**02** |
| | b) | Describe normal operation (AC-3 duty) of a **contactor** during starting a motor.<br>Describe its operation (AC-4) in locked-rotor situation.<br>Why is the AC-4 duty life of a contactor much lower, than its life for AC-3 duty? | **02**<br>**02**<br>**02** |
| | c) | Describe **contact-bounce** in a contactor.<br>Why is it detrimental? How can it be minimized? | **02**<br>**02** |

| | | | |
|---|---|---|---|
| | d) | Describe **contact pop-up** in a contactor. Is it related to value of current?<br>What are its adverse effects? How can we reduce pop-up? | **03**<br>**02** |

**UNIT - III**

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|---|---|---|---|
| 4 | a) | Describe the effect of 5mA, 30mA, 100mA current through human body.<br>Within what time should such 30mA **current** needs to be terminated?<br>How do we ensure quick termination of leakage currents? | **03**<br>**01**<br>**02** |
| | b) | With a schematic diagram explain the working of an **ELCB,** and the function of **CBCT** (Core Balance Current Transformer) and **(PMR)** Relay in it.<br>Describe the Design Parameters associated with (CBCT).<br>How to ensure properties of CBCT are **retained** through the life of an ELCB? | **04**<br>**02**<br>**02** |
| | c) | Describe Design Parameters associated components of **(PMR)** Relay in ELCB?<br>How is flatness, polish and cleanliness of relay's mating surfaces achieved? | **03**<br>**03** |

**OR**

| | | | |
|---|---|---|---|
| 5 | a) | Can electrical fires be initiated even at rated current? How?<br>Why do devices like Breakers / Fuses not prevent such fires?<br>How do AFCI / AFDD sense and offer protection against small arcing currents? Within what time should undesired arcing current be sensed and interrupted to avoid electrical fire? | **02**<br>**02**<br>**02**<br>**01** |
| | b) | Differentiate between Parallel-Arc and Series-Arc.<br>What are potential sources of arcing in a circuit that can give a **pseudo signal** to cause **unwarranted** tripping of AFCI / AFDD?<br>In which type of installations would you recommend **not** to use devices like AFCI / AFDD? | **02**<br>**02**<br>**01** |
| | c) | Describe **Arc-Flash** in a Power Panel?<br>Describe the damage that it can cause if it is not controlled?<br>How can the damage due to Arc-Flash be minimised?<br>What parameter decides the type of **PPE** to be used? | **01**<br>**03**<br>**03**<br>**01** |

**UNIT - IV**

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|---|---|---|---|
| 6 | a) | Describe **Selectivity** with a sketch diagram between upstream & downstream switchgear and its **importance**.<br>Explain how selectivity is achieved using Time-Current Characteristics, $I^2t$ Characteristics, Time-Delay, and ZSI (Zone Selective Interlocking) | **04**<br>**04** |
| | b) | Describe in brief the role of following sub-systems in a switchgear:<br>(i) Current Path ; (ii) Arc-extinction System ; (iii) Auxiliary Signal system?<br>How can each of these sub-systems fail? | **03**<br>**03** |
| | c) | What is **Clearance and Creepage** associated with electrical switchgear?<br>Explain the difference between them using a sketch.<br>What are the **Parameters** used to specify minimum values for Clearance and Creepage? | **03**<br>**03** |

**UNIT - V**

| | | | |
|---|---|---|---|
| 7 | a) | How would you define a **robust** design?<br>Describe **four** processes that can help to design robust products.<br>What is a '**Fail-Safe**" design?<br>How '**Six Sigma**' approach helps to assure performance of safety products? | **01**<br>**04**<br>**01**<br>**02** |
| | b) | How would you define **Reliability** of switchgear products?<br>How does testing a product 'to death' help, as against testing it only for | **02** |

relevant specifications? **02**

Give an example of **(ALT)** Accelerated Life Testing and its benefits. **02**

c) Describe **classification** for 'Ingress Protection' for enclosures, used to house electrical switchgear and its **related parameters**. **04**

Explain failure modes if the enclosure fails to meet ingress of solids and liquids. **02**

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