Name:

Enrolment No:

UPES

End Semester Examination, May 2024

Course: Switchgear & protection **Semester: VI**

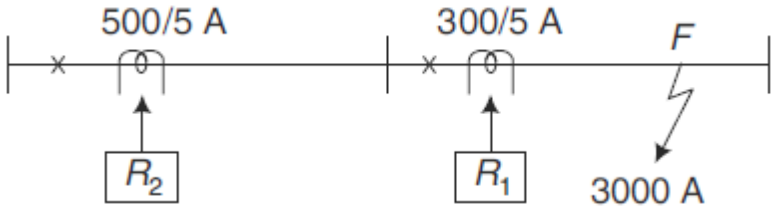
Program: B.Tech. Electrical Engg. **Time : 03 hrs.**

Course Code: EPEG 3022 **Max. Marks: 100**

No. of pages (2)

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Elucidate why the ratio of reset to pick up should be high.	**4**	**CO1**
Q 2	List the advantages of static relays over electromechanical relays.	**4**	**CO1**
Q 3	State the limitations of the simple differential protection scheme.	**4**	**CO2**
Q 4	Brief the various classifications of electrical faults, including their characteristics and implications within power systems.	**4**	**CO1**
Q 5	An overcurrent relay of current rating 5 A and setting 150% is connected to the secondary of CT of ratio 400/5. Calculate the current in lines for which the relay picks up.	**4**	**CO2**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Investigate and formulate a comprehensive mathematical model describing the torque generation mechanism in an induction relay.	**10**	**CO2**
Q 7	Substantiates an advanced protective scheme be designed to ensure the reliability and safety of parallel feeders in an electrical distribution system.	**10**	**CO3**
Q 8	Compare the time-current characteristics of inverse, very inverse and extremely inverse overcurrent relays. Discuss their area of applications.	**10**	**CO2**
Q 9	Explain impedance relay characteristic on the R-X diagram. Discuss the range setting of three impedance relays placed at a particular location. Discuss why the I zone unit is not set for the protection of 100% of the line. **OR** Derive an expression for Restriking voltage and Rate of Rise of Restriking voltage for a circuit breaker along with its waveform schematic and equivalent circuit diagram.	**10**	**CO3**
SECTION-C **(2Qx20M=40 Marks)**			

<table>
<tr>
<td>Q 10</td>
<td>Two relays R1 and R2 are connected in two sections for a feeder as shown in figure.
Relay R1 : CT ratio = 300/5, plug setting = 50%, TMS = 0.3
Relay R2 : CT ratio = 500/5, plug setting = 75%.
A fault at F results in a fault current of 3000 A. Find TMS of R2 to give time-grading margin of 0.5 sec between the relays.
 

The operating time characteristic of relays is given in the table below.
<table>
<tr><td>PSM</td><td>2</td><td>4</td><td>5</td><td>8</td><td>10</td><td>20</td></tr>
<tr><td>Operating time in second</td><td>10</td><td>5</td><td>4</td><td>3</td><td>2.8</td><td>2.4</td></tr>
</table>
</td>
<td>20</td>
<td>CO3</td>
</tr>
<tr>
<td>Q 11</td>
<td>In a 220 kV system, the reactance and capacitance up to the location of circuit breaker is 8 ohm and 0.025 microF, respectively. A resistance of 600 ohms is connected across the contacts of the circuit breaker. Determine the following:
(a) Natural frequency of oscillation
(b) Damped frequency of oscillation
(c) Critical value of resistance which will give no transient oscillation
(d) The value of resistance which will give damped frequency of oscillation, one-fourth of the natural frequency of oscillation

OR

In a 132 kV system, the inductance and capacitance per phase up to the location of the circuit breaker is 10 H and 0.02 microF, respectively. If the circuit breaker interrupts a magnetising current of 20 A (instantaneous), current chopping occurs. Determine the voltage which will appear across the contacts of the circuit breaker. Also calculate the value of the resistance which should be connected across the contacts to eliminate the transient restriking voltage.</td>
<td>20</td>
<td>CO4</td>
</tr>
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