BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER: VII**
BRANCH: EEE **SESSION: MO/2022**

SUBJECT: EE401 SWITCHGEAR AND PROTECTION

TIME: 2 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

				CO	BL
Q1	(a)	Interpret the need and significance of power system protection, supported with the zones of protection.	[2]	CO1 & CO3	**BL3**
Q1	(b)	Discuss the arcing phenomenon of circuit breaker and suggest in details the method of arc extinction by low resistance interruption methods.	[3]	CO1	**BL2**
Q2	(a)	A single phase equivalent circuit for studying the recovery voltage when a CB clears a fault is given as in Fig. 1. Evaluate average value of RRRV, when $v(t) = 11{,}000\cos 314t$ volts, L=1mH, C= 400 pF.	[2]	CO1 & CO5	**BL5**
Q2	(b)	Discuss the phenomenon of current chopping. During which condition the chopping phenomenon is observed.	[3]	CO1	**BL2**
Q3	(a)	Analyze the significance of resistance switching phenomenon while interruption of fault current.	[2]	CO1	**BL4**
Q3	(b)	A circuit breaker interrupts the magnetizing current of 100 MVA transformer at 220 kV. The magnetizing current of the transformer is 5% of the full load current. Examine the maximum voltage which may appear across the gap of the breaker when the magnetizing current is interrupted at 53% of its peak value. The stray capacitance is 2500 micro farad. The inductance is 30 H.	[3]	CO1 & CO5	**BL5**
Q4	(a)	Explain the typical working principle of relays, in co-ordination with instrument transformers and CBs, using proper block diagram.	[2]	CO2	**BL2**
Q4	(b)	An earth fault develops at point F on the feeder as shown in Fig. 2, and the fault current is 16000 A. The IDMT relay at point A and B are fed via 800/5 A CTs. The relay at B has a plug setting of 125% and time multiplier setting of 0.2. The circuit breaker takes 0.20 s to clear the fault, and the relay error in each case is 0.15 s. For plug setting of 200% on the relay A, appraise the minimum TMS on that relay for it not to operate before the circuit breaker at B has cleared the fault.	[3]	CO2 & CO5	**BL5**

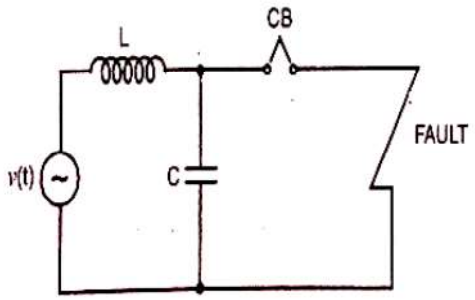

Fig. 1

PTO

At TMS = 1, operating time at various PSM are:

PSM	-	2	4	5	8	10	16	20
Operating time in (sec)	-	10	6	4.8	4.5	3	2.5	2.4

Fig. 2

Q5 (a) Investigate the application significance of directional relay with respect to over-current relays for power system protection planning. The analysis may be detailed with proper example. [2] CO2 **BL6**

Q5 (b) report the operation of induction type relays supported with proper mathematical basis. [3] CO2 **BL2**

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