Ref No:

# Ex/EE/5/T/422/2017 (Old) B.E.ELECTRICAL ENGG. (PART TIME) EXAMINATION 4<sup>TH</sup> YEAR, 2<sup>ND</sup> SEMESTER 2017 (Old)

# SUBJECT: - POWER SYSTEM PROTECTION & SWITCHGEAR

Time: Three hours

Full Marks: 100 (50 marks for this part)

No. of	PART -I	Marks
Questions	Answer any Three	
	(Two marks reserved for well organized answers)	(10)
1) a)	Draw a typical sketch for trip coil current, lauli current, voltage	(10)
}	between fixed contact and moving contact, and travel records of a	
	circuit breaker while closing. Also define making time.	
		$\langle \zeta \rangle$
( 6)	with respect to the operation of a circuit breaker, briefly discuss	(6)
{	(1) contact erosion,(11) opening speed, and (111) closing speed.	
	In record to an electric are explain thermionic emission and field	$(A \pm A)$
[2) a)	m regard to an electric arc explain merimonic emission and neid	(4,4)
]	collisions help to maintain the electric arc	
	consions help to maintain the electric are.	
b)	Briefly explain the different types of operating mechanism for	(8)
	circuit breakers.	(-)
3) a)	From the following data of a 50Hz generator, find	(8)
	a) the maximum voltage across the contacts of a circuit breaker	. ,
	when it breaks a short circuit current at current zero,	
	b) the frequency of the transient oscillation, and	
	c) the average rate of rise of re-striking voltage up to the first peak	
	of oscillation.	
	Given :	
	Per phase r.m.s voltage = $7.5$ KV	
[	reactance of generator and connected system = $4$ W.	
ļ	Distributed capacitance to neutral = $0.01 \mu F$	
	Resistance – negligible.	
		(0)
6)	Discuss about low resistance arc interruption theories. Why is it	(8)
}	preferred over high resistance arc interruption theory for high power	
	a. Concurt oreaking:	
(4) a)	Explain resistance switching in circuit breakers	(8)
., .,		(9)
b)	With the help of relevant diagrams explain current chopping	(8)
	phenomenon in circuit breakers.	
(	(please turn over)	

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5) a)	What are the advantages of using $SF_6$ gas as an arc interrupting medium in circuit breakers?	(8)
b)	What are the advantages and disadvantages of oil circuit breakers?	(8)

#### Ex/EE/5/T/422/2017(Old)

#### BACHELOR OF ELECTRICAL ENGINEERING (EVENING)EXAMINATION, 2017

### (4<sup>TH</sup> Year, 2<sup>nd</sup> Semester)

#### POWER SYSTEM PROTECTION & SWITCHGEAR

Time: 90mins

Full Marks: 50

8marks

#### PART-II

Answer any 3 questions

#### ( 2 marks reserved for neatness)

Q1.(a)Draw a single phasing preventer circuit for 3 phase induction motors using negative sequence filter and explain its working. 6 marks (b)Explain the carrier current phase comparison for the protection of transmission lines. 10 marks Q2.(a)Draw the Inverse, More Inverse, Extremely Inverse, Definite relay characteristics and explain PSM 8 marks and TSM (b)Determine the time of operation of a 5A, 3sec overcurrent relay having a current setting of 125% and a time setting multiplier of 0.6 connected to a supply circuit through a 400/5 CT when the circuit carries a fault current of 4000A.(Characteristic gives operating time of 3.5 sec for PSM of 8 and TSM 0.6) 8 marks Q3. (a)Draw a simple diagram to realize any solid state distance relay. 6 marks 10 marks (b)Derive the Universal Relay torque equation. Q4. (a)Explain how arc resistance affects a plain impedance distance relay. 6 marks (b)Explain in details how the relay may be modified to overcome the above problem. 10 marks Q5. (a)Draw the functional block diagram of a digital relay. 8 marks (b) A 3 phase 220/11000V star delta transformer is protected by the Merz Price system. The CT's

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on the lv side have a ratio of 500/5. Find the ratio of the CT's on the hv side.