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Hirasugar Institute of Technology, Nidasoshi.

Inculcating Values, Promoting Prosperity

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EEE Dept.
Exam.
Internal Assessment
Odd sem(2018-19)

FIRST INTERNAL ASSESSMENT

Sem :VII **Sub: High Voltage Engineering** **Sub. Code: 15EE73**

Date:11/09/2018 **Time:11:00AM-12.00 Noon** **Max. Marks: 25**

Note: Answer two full questions, draw sketches wherever necessary.

Q.N		Discription of Question	M	CO	RBT L
1	a	Explain with circuit diagram, the working of simple voltage doubler circuit for generation of D.C high voltage.	7	CO403.3	L2
	b	A Cock Croft-Walton type voltage multiplier has 8 Stages with capacitances, all equal to 0.05 μF. The supply transformer secondary voltage is 125KV at a frequency of 150Hz. If the load current to be supplied is 5mA, find i) The percentage ripple ii) The regulation iii) The Optimum number of stages for minimum regulation	6	CO403.3	L3
		OR			
2	a	Describe with the help of neat diagram, the cascade connection of transformer units for the generation of power frequency high voltages.	7	CO403.3	L2
	b	Describe the working of a multi stage Marx impulse generator with a neat sketch.	6	CO403.3	L2
3	a	Explain the principle of measurement of high AC voltage using sphere gap & discuss the effect of atmosphere condition for its calibration.	6	CO403.4	L2
	b	A generating voltmeter is required to measure voltage 15 to 250 KV D.C. If the indicating meter reads a minimum current of 2μA and maximum current of 35 μA, determine the capacitance of the generating voltmeter. Assume that, the speed of driving synchronous motor is 1500 rpm.	6	CO403.4	L3
		OR			
4	a	Describe the construction & working of Electrostatic Voltmeter.	6	CO403.4	L2
	b	An electrostatic voltmeter has movable circular plate 8 cms in diameter. If the distance between the plates during a measurement is 4mm, determine the potential difference when the force of attraction is 0.2 gm.wt.	6	CO403.4	L3

8.9.18

Course Coordinator **Module Coordinator** **HOD**

Prof. S.D.Hirekodi **Prof. H.R.Zinage** **Dr. Basavraj Madiggond**

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E & E Dept | Exam | IA Scheme | 2018-19 (Odd)

SCHEME OF EVALUATION IA - I

SEM: VII | SUBJECT: High Voltage Engg | SUBJECT CODE: 15EE73 | DATE: 11/9/2018

Q.No.	Bits	DESCRIPTION	Marks	CO's
		Scheme of Evaluation		
1	a.	To draw Circuit dgm. of Voltage doubler — 4m For Explanation with waveforms — 3m	7m	403.3
	b.	To calculate i) Percentage ripple — 2m ii) Regulation — 2m iii) Optimum no. of Stages — 2m	6m	403.3
2	a.	To draw circuit dgm of Cascade Connection of Transformer units. — 4m For Explanation — 3m	7m	403.3
	b.	To draw Circuit dgm of Marx Multistage I.N — 3m For Explanation — 3m	6m	403.3
3	a	To draw Schematic dgm of Sphere gap arrangement - 1 Explain Principle of Measurement — 4 Discuss effects of atmosphere condition - 1	6m	403.4
	b	For calculation of I_{rms} — 2m Capacitance of Meter — 4m	6m	403.4
4	a.	To draw Schematic dgm. of Electrostatic Voltmeter - 3m To explain Construction & working — 3m	6m	403.4
	b.	For Calculation of Potential difference b/w plates — 6m	6m	403.4

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Solution Scheme

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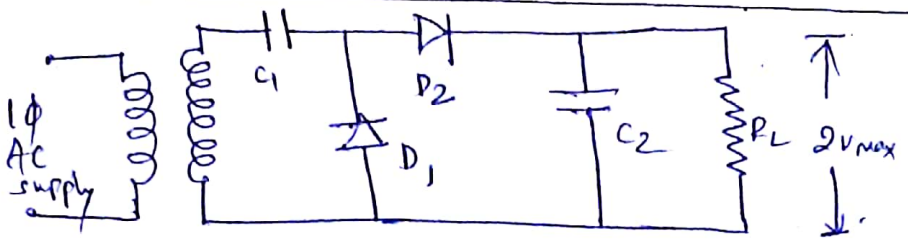
SCHEME OF EVALUATION IA - I

SEM: VII | SUBJECT: High Voltage Engineering | SUBJECT CODE: 15EE73 | DATE: 11/9/18

Q.No.	Bits	DESCRIPTION	Marks	CO's
1	a	 Voltage double Circuit		
	b.	i) Calculation of percentage ripple $\delta V = \frac{I}{fc}\frac{n(n+1)}{2}$ Here n = 16 (No. of Capacitors) $\delta v = \frac{5\times10^{-3}}{150\times1.05\times10^{-6}} \times \frac{16\times17}{2}$ $= 90.7$ kV		
		% ripple $= \frac{\delta V}{2nV_{max}} \times 100$ $= \frac{90.7\times100}{2\times125\times8} = 4.53\%$		
		ii) Calculation of Regulation Voltage drop $\Delta V = \frac{I}{fc}\left[\frac{2}{3}n^3 + \frac{n^2}{2} - \frac{n}{6}\right]$ $= \frac{5\times10^{-3}}{150\times0.05\times10^{-6}}\left[\frac{2}{3}8^3 + \frac{8^2}{2} - \frac{8}{6}\right]$ $\Delta V = 248$ kV		
		% regn $= \frac{\Delta V}{2nV_{max}} \times 100 = \frac{248}{2\times8\times125} \times 100 = 12.4\%$		
		iii) Calculation of Optimum No. of Stages $N_{optimum} = \sqrt{\frac{V_{max}\,fc}{I}} = \sqrt{\frac{125\times150\times1.05\times10^{-6}\times10^{?}}{5\times10^{-3}}}$ $= 13.69 \simeq 14$ stages.		

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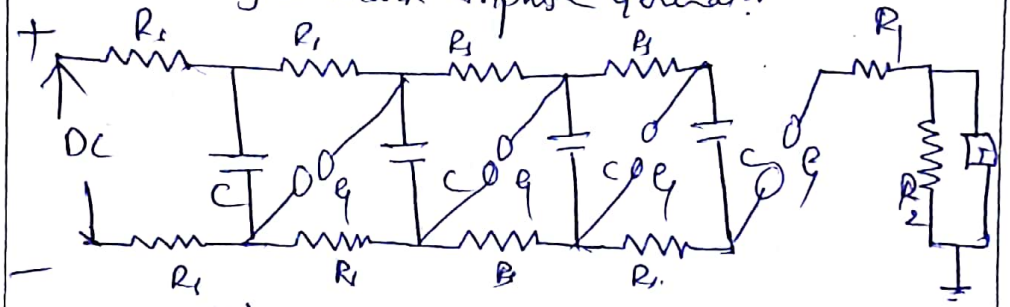
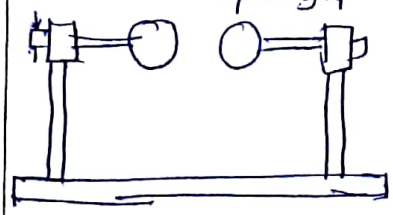
SCHEME OF EVALUATION IA - I

SEM: VII | SUBJECT: High Voltage Engg | SUBJECT CODE: 15EE74 | DATE: 11/9/18

Q.No.	Bits	DESCRIPTION	Marks	CO's
2	a	 3-stage Cascaded transformer		
	b.	Multistage Marx Impulse Generator 		
3	a	Sphere gap  Horizontal arrangement In case of AC peak value measurement the applied voltage is uniformly increased until sparkover occurs in the gap. Generally mean of about five breakdown values is taken when they agree to within ±3%. The sparkover voltage of a sphere gap depends upon the air density which varies with the change in both temperature and pressure $d = P/760 \left[\frac{293}{273+T}\right]$		

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SCHEME OF EVALUATION IA - I

SEM: VII | SUBJECT: High Voltage Engg | SUBJECT CODE: 15EE73 | Page No : 4/4 | DATE: 11/9/18

Q.No.	Bits	DESCRIPTION	Marks	CO's

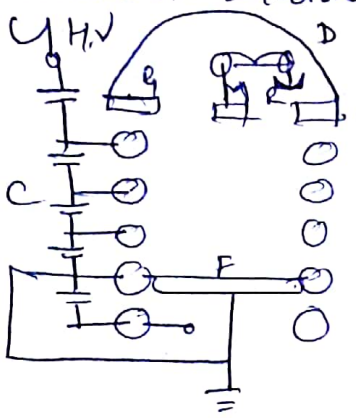
b. $I_{rms} = \frac{V C_m W}{\sqrt{2}}$ $\quad 2\times10^{-6} = \frac{15\times10^{3}}{\sqrt{2}} C_m \times \frac{2\pi\times150}{60}$

$C_m = 1.2pF$

At 250 kV, the $I_{rms} = \frac{250\times10^{3}\times1.2\times10^{-12}}{\sqrt{2}} \times \frac{2\pi\times150}{60}$

$I_{rms} = 33.3 mA$

4 a. Construction of Electrostatic voltmeter



M – Moving plate
F → Fixed plate
C – Capacitance divider
R – Balancing weight
m – mirror
D – Dome

b. Force of Attraction $F = \frac{1}{2} \in \frac{V^2}{d^2} A$ Newton

Area of Plates $A = \frac{\pi D^2}{4} = \frac{\pi 8^2}{4} = 16\pi cm^2$ or

$A = 16\pi \times 10^{-4} m^2$

Spacing b/w the Plates $d = 4mm$ or $4\times10^{-3} m$

∴ Force of Attraction

$0.2\times10^{-3}\times 9.8 = \frac{1}{2}\times 8.84\times10^{-12}\times\frac{V^2}{16\times10^{-6}}\times16\times10^{-4}$

∴ $V = 1188$ Volts.

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