B.E.(Electrical Engineering (Electronics & Power)) Semester Seventh (C.B.S.)
# High Voltage Engineering

P. Pages : 3

Time : Three Hours

|||*0826*|||

Max. Marks : 80

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Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data wherever necessary.
10. Use of non programmable calculator is permitted.

1. a) What is meant by "thermal breakdown" in solid dielectrics & how is it practically more significant than other mechanism ? **6**

   b) In an experiment for determining the breakdown strength of transformer oil, the following observations were made. Determine the power law dependence between the gap spacing and the applied voltage of the oil. Also graph for breakdown voltage as a function of Gap spacing. **7**

Distance in cm	0.4	0.6	0.10	1.2
Breakdown voltage in kv	90	140	210	255

OR

2. a) How does the internal discharge phenomena leads to breakdown in solid dielectrics. **5**

   b) What are the desirable properties of liquid dielectrics. **4**

   c) Explain the mechanism for vacuum breakdown. **4**

3. a) Explain the classification of lightning stroke to their effect on power system. **6**

   b) A lightning arrestor is required to protect a 5000 kVA, 66 kv/11 kv transformer. The transformer is connected to a 66 kv system and the voltage fluctuation are of the order of 10%. The neutral of the transformer and that of the network are directly & solidly grounded. Choose a suitable arrestor rating in kv (rms) from the given table. **7**

Arrestor rating kv (rms)	50	60	73
Crest kv impulse sparkover (1/50 μsec) wave	172	215	258
Crest kv impulse voltage drop across arrestor for (10 x 20 μsec) current wave at 10 kA	176	220	264

Assume suitable data and write the assumptions.

OR

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4.	a)	Explain the purpose of grounding wires, counter poise and ground rods in respect of lightning.	**6**
	b)	What is the difference between surge absorber and surge diverter. Explain in brief the Ferranti surge absorber and metal oxide surge diverter.	**8**
5.	a)	Explain in short, the volt-time characteristics and its importance with respect to insulation co-ordination.	**6**

5. b) Define the following terms : **7**

i)	Transient	ii)	Travelling wave
iii)	Characteristic impedance	iv)	Attenuation constant
v)	propagation constant	vi)	BIL
vii)	SIL		

<div align="center">OR</div>

6.	a)	What is travelling waves. Explain the development of such wave on the overhead transmission line.	**6**

6. b) An overhead transmission line has a surge impedance of 400Ω and a surge voltage $v(t)=250\left(e^{-0.05t}-e^{-t}\right)$ kv where t in µsec. travels along the line of transformer feeder. The surge impedance of each feeder is 300Ω. The transformer are protected by surge diverter each having a surge impedance of 15Ω. Determine the maximum voltage which will appear across the transformer. Assume transformer to have infinite surge impedance. **7**

7. a) Give the marx circuit arrangement for 3 stage impulse generation. How is the basic arrangement & components used to modify to accommodate the wave time control resistances. **7**

7. b) A cock-croft Walton type voltage multiplier has ten stages with capacitances all equal to 0.06 µf the supply transformer secondary voltage is 100 kv at a frequency of 140 Hz. If the load current supplied is 1 mA. Find. **6**

i) % ripple
ii) % regulation
iii) maximum output voltage
iv) optimum no. of stages for minimum regulation.

<div align="center">OR</div>

8. a) Explain different methods of producing switching impulses in test laboratories analyse any one of the method in detail. **6**

8. b) An impulse generator has eight stages with each condenser rated for 0.16 µf and 125 kv. The load capacitor available is 1000 pf. Find the series resistance and the damping resistance needed to produce 1.2/50 µsec impulse wave. What is the maximum output voltage of the generator if the charging voltage is 120 kv. **7**

9. a) What is CVT ? Explain with suitable diagram how it can be used for voltage measurement in power system. Draw its phasor diagram also. **6**

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b) Explain how a sphere gap can be used to measure the peak values of voltages what are the parameters and factors that influence such voltage measurements. **7**

OR

10. a) Explain the principle, construction and working of generating voltmeter enumerate its advantages and limitations. **7**

b) An electrostatic voltmeter has two circular plates the movable plate is 10 cm in diameter when 10 kv is applied between the plates the force is 5×10^{-3} N. Determine the change in capacitance of the meter for the movement of 1 mm of movable plate. **6**

11. a) Explain how the measurement of dielectric constant and loss factor is done by transformer voltage ratio bridge. **7**

b) The volume resistivity of a bakelite piece was determined using standard circular electrodes, a sensitive galvanometer & a stabilized power supply. When the applied voltage is 1000V. The galvanometer deflection with the specimen was 3.2 m when a standard resistance of R_S = 10 MΩ is used for calibration the deflection was 33.30 cm with a universal shunt ratio of 3000. The diameter of the electrodes is 10 cm & the thickness of the specimen is 2 mm. Find the volume resistivity. **7**

OR

12. a) What are different high voltage test performed on insulator. Explain in detail. **7**

b) Explain how partial discharges in an insulation system or equipment can be detected and displayed using straight detector. **7**

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