Code No: **R204102G** **R20** **Set No. 1**

IV B.Tech I Semester Regular Examinations, January – 2024

HIGH VOLTAGE ENGINEERING

(Electrical & Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 a) Explain the mobility of ions and electrons in the process of collision? [7]

b) Calculate the break down strength of air for small gap of 1.3mm and for large gaps of 22.6mm under uniform field conditions and standard atmospheric conditions? [7]

(OR)

2 a) List out and explain properties of different types of gaseous insulating materials? [7]

b) Discuss in detail about the Townsend's criterion for break down process with relevant equations? [7]

UNIT - II

3 a) Elaborate the characteristic features of liquids that are used as insulating materials? [7]

b) Derive the expression for highest apparent electric stress in the electro mechanical break down? [7]

(OR)

4 a) Draw and explain the conduction current –electric field characteristics in hydro carbon liquid? [7]

b) Describe the mechanism of short-term breakdown of composite insulation. [7]

UNIT - III

5 a) Derive the current waveform of first and last capacitors of the voltage multiplier circuit used in high voltage DC voltage generation? [7]

b) Describe the principle of operation of charge spaying generator with neat diagram? [7]

(OR)

6 a) Explain the principle of operation of a resonant transformer? [7]

b) Explain the process of excitation with cascaded and isolating transformer with circuit diagram? [7]

Code No: **R204102G** **R20** **Set No. 1**

UNIT – IV

7 a) List out and explain in detail about the specifications of standard impulse wave? [7]

b) Draw the basic impulse generator circuit and explain the process of generation? [7]

(OR)

8 a) What is a trigatron gap? Explain its functions and operation. [7]

b) An impulse current generator has a total capacitance of 8.7 micro farads. The charging voltage is 22kV. If the generator has to given an output current of 11kA with 8/20 micro second waveform (root α equal to 0.0535×10^6 and LC=65). Find the circuit inductance and dynamic resistance of the circuit? [7]

UNIT - V

9 a) Describe the role of resistance potential divider in the voltage measurement with diagram? [7]

b) A Rogowski coil is designed to measure impulse currents of 9kA having a rate of change of current 10^{10}A/S. The current is ready by a TVM as a potential drop across the integrations circuit connected to the secondary. Estimate the values of mutual inductance, resistance and capacitance to be connected, if the meter reading is to be 10V for full-scale deflection. [7]

(OR)

10 a) Draw the diagram and explain the operating principle of capacitor voltage transformer? [7]

b) Describe the role of hall generator in the measurement of impulse quantities? [7]

Code No: **R204102G** **R20** **Set No. 2**

IV B.Tech I Semester Regular Examinations, January – 2024

HIGH VOLTAGE ENGINEERING

(Electrical & Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks
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UNIT - I

1 a) Describe and compare the process and outcomes of elastic and inelastic collisions? [7]

b) Explain the field distortion in a gap due to space charge in streamer theory with diagram? [7]

(OR)

2 a) Define Townsend's first and second ionization coefficients and derive the condition for breakdown obtained in a Townsend discharge. [7]

b) Find the value of γ at break down for a parallel plate electrode configuration under uniform electric field by using Paschen's law if the gap distance is 1.4cm, pressure is 740 torr, temperature is 34^0C when break down voltage is 32,540V? Assume A= 14/cm and B=335/cm? [7]

UNIT – II

3 a) Explain in detail about the objectives and outcomes of break down tests in the liquids? [7]

b) Draw and analyze the thermal instability characteristics of solid dielectrics? [7]

(OR)

4 a) Discuss in detail suspended particle theory with necessary expressions? [7]

b) A solid specimen of dielectric has a dielectric constant of 4.7, and tanδ is 0.001 at 50Hz frequency. If it is subjected to an alternating field of 44kV/cm, find the heat generated in the specimen due to dielectric loss? [7]

UNIT – III

5 a) Draw the circuit and explain cascaded rectifier unit in voltage multiplier circuit? [7]

b) Justify why vande graaff generators are used for very high voltage and low current applications? Draw its diagram also. [7]

(OR)

Code No: **R204102G** **R20** **Set No. 2**

6 a) Explain different schemes for cascade connection of transformers for producing very high ac voltages. [7]

b) Derive and analyze the equivalent circuit of resonant transformer along with advantages? [7]

UNIT - IV

7 a) Write about and analyze the double exponential waves of standard impulse wave shapes? [7]

b) Elaborate the arrangement of capacitors for high impulse current generation? [7]

(OR)

8 a) Explain Marx circuit for multistage impulse generator. [7]

b) Elaborate the process of tripping and control of impulse generator? [7]

UNIT – V

9 a) A generating voltmeter has to be designed so that it can have a range from 20 to 200kV dc if the indicating meter reads to minimum current of 3μA and maximum current of 30μA, what should the capacitance of the generating voltmeter? [7]

b) Derive and analyze the equivalent circuit of capacitive voltage transformer? [7]

(OR)

10 a) Obtain and analyze the kV-micro amperes characteristics of rotating cylinder type generating type voltmeter? [7]

b) Discuss in detail about the construction of light beam electrostatic voltmeter with diagram? [7]

Code No: **R204102G** **R20** **Set No. 3**

IV B.Tech I Semester Regular Examinations, January – 2024

HIGH VOLTAGE ENGINEERING

(Electrical & Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks
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UNIT - I

1 a) Describe the electron energy distributions and collision cross section with relevant to collision process? [7]

b) State streamer theory and explain the formation of avalanches due to photo ionization? [7]

(OR)

2 a) Explain in detail and summarize the applications of various gaseous insulating materials? [7]

b) For a certain gap with uniform field electrodes, α was 7.9/cm with a gap distance of 7.3mm before break down. Calculate the secondary ionization coefficient γ? [7]

UNIT - II

3 a) By drawing the current-electric field characteristics explain the conduction and break down in pure liquids? [7]

b) Compare the electronic break down of solids with streamer break down with an example? [7]

(OR)

4 a) Study and explain the effect of moisture on the break down strength of liquid dielectrics? [7]

b) Describe in detail about the required conditions for the electromechanical breakdown of solids? [7]

UNIT – III

5 a) Analyze the role of voltage doubler circuit in high DC voltage generation with waveforms? [7]

b) Draw the construction diagram and explain the operation of vande graaff generator? [7]

(OR)

Code No: **R204102G** **R20** **Set No. 3**

6	a)	Draw the circuit and explain cock craft-walton voltage multiplier circuit?	[7]
	b)	Obtain the output waveform of tesla coil from its equivalent circuit diagram?	[7]

UNIT – IV

7	a)	Draw and discuss voltage verses time characteristics of impulse wave.	[7]
	b)	An impulse current generator is rated for 66kW second. The parameters of the circuit are C=54micro farads, L=1.44 micro Henry and the dynamic resistance is 0.0256 ohms. Find the peak value of the current and the time to front and the time to tail of the current waveform?	[7]

(OR)

8	a)	Prove that the product of roots of equation of RLC impulse generator circuit is 1/LC?	[7]
	b)	Draw and explain different types of impulse current waveforms?	[7]

UNIT – V

9	a)	Discuss the principle of operation of generating voltmeter with relevant equations?	[7]
	b)	Derive the voltage ratio and explain the capacitive voltage transformer with circuit diagram?	[7]

(OR)

10	a)	Obtain and analyze the kV-micro amperes characteristics of rotating vane type generating type voltmeter?	[7]
	b)	Explain the combined operation of potential dividers with CRO for impulse measurements?	[7]

Code No: **R204102G** **R20** **Set No. 4**

IV B.Tech I Semester Regular Examinations, January – 2024

HIGH VOLTAGE ENGINEERING

(Electrical & Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

*****

UNIT - I

1 a) Describe the diffusion coefficients and distribution of electron energy with relevant to collision process? [7]

b) Draw and analyze Paschen's curve with necessary equations? [7]

(OR)

2 a) Describe the process of ionization by collision with neat circuit diagram? [7]

b) In an experiment in a certain gas it was found that steady state current is 5.4×10^{-8}A at 7.5kV at a distance of 0.5cm between the plane electrodes. By keeping the field constant and reducing the distance to 0.2cm results in a current of 5.4×10^{-9}A. Find the Townsend's primary ionization coefficient α? [7]

UNIT – II

3 a) Elaborate the operation of liquid purification system with neat diagram? [7]

b) What is composite insulation? How does short-term breakdown differ from long-term breakdown? [7]

(OR)

4 a) Describe the cavitation and bubble theory with relevant relations? [7]

b) Describe the properties and outcomes of thermal break down of solids with an example? [7]

UNIT - III

5 a) Analyze the role of cascaded voltage doubler circuit in high DC voltage generation with waveforms? [7]

b) Explain the charge moment on the insulated belt of vande graaff generator with neat sketch? [7]

(OR)

6 a) Derive and analyze the expression for the voltage drop on load and regulation of voltage multiplier circuit? [7]

b) What is Tesla coil? How are damped high frequency oscillations obtained from a tesla coil? [7]

Code No: **R204102G** **R20** **Set No. 4**

UNIT - IV

7 a) Explain the stage to stage voltages and durations of standard impulse waveforms? [7]

b) Derive the expression of the duration for one half cycle of damped oscillatory wave of the impulse current generator. [7]

(OR)

8 a) Derive the roots of the second order equation obtained from the RLC series impulse generator circuit? [7]

b) A model impulse generator has a capacitance of 1.6 micro farad rated at 11kV and uses series R-L-C circuit to produce 1/50 micro second voltage wave (CR=70.6 and LC=11.6).

i) Find the resistance and inductance needed to produce the same and the output voltage across the resistance 'R'?

ii) If the same circuit is to be used to produce 8/20 micro seconds impulse wave (LC=65). Determine the other parameters. [7]

UNIT - V

9 a) Derive the expression for the r.m.s current of the generating voltmeter? [7]

b) Draw the phasor diagram and analyze under resonance condition of the capacitive voltage transformer? [7]

(OR)

10 a) Describe the role of sphere gaps in the high voltage measurements? [7]

b) Describe the role and operation of Rogowski coils in the measurement of impulse quantities? [7]