B.TECH/EE/7TH SEM/ELEC 4102/2018
HIGH VOLTAGE ENGINEERING
(ELEC 4102)

**Time Allotted : 3 hrs**                                    **Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and*
*<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

## Group – A
### (Multiple Choice Type Questions)

1. Choose the correct alternative for the following:             **10 × 1 = 10**

(i)   If P is the pressure of a gas and d is the distance of separation between electrodes, the discharge voltage according to Paschen's law is directly proportional to
(a) P          (b) d          (c) $P \times d$          (d) none of these.

(ii)  Sphere gap is used for measurement of
(a) a.c voltage only                    (b) d.c voltage only
(c) impulse voltage of any wave shape   (d) all of these.

(iii) The ripple voltage in the d.c output is small if
(a) frequency of supply is small   (b) the filter capacitor is small
(c) the load current is large      (d) none of these.

(iv)  Resonance transformers are used in high-voltage testing to generate
(a) Non-sinusodial wave shape      (b)damped sine wave
(c) a pure sine wave               (d) a pulse wave.

(v)   Corona is associated with
(a) hissing noise                  (b)ozone formation
(c) bluish luminous glow           (d)all of these.

(vi)  The dielectric strength of air under normal conditions is around
(a) 30 kV per cm                   (b) 100 kV per cm
(c) 150 kV per cm                  (d) 60 kV per cm.

(vii) A standard lightning impulse voltage wave as per Indian Standard is
(a)1.5/60 micro-second             (b)1.2/50 micro-second
(c) 1/50 micro-second              (d) 1.5/100 micro-second.

(viii) Capacitance voltage divider can not be used for measuring high
(a) a.c voltage      (b) d.c voltage     (c) impulse voltage.    (d) all of these.

(ix)  Conduction in vacuum is due to
(a) presence of metallic electrodes  (b) presence of insulating surface
(c) (a) &(b)                         (d) none of these

(x)   Energy loss in solid insulation
(a) increases with increase in frequency
(b) does not depend on frequency
(c) decreases with increase in frequency
(d) is proportional to square of frequency.

## Group – B

2. (a)  Define the term gradient of voltage.
   (b)  How can a dielectric strength be defined?
   (c)  Write the difference between breakdown voltage and dielectric strength.
   (d)  The field strength on the surface of a sphere of 1 cm radius is equal to the Corona –inception gradient in air of 30 kV/cm. Find the charge on sphere which is supposed to be at its centre.
                                              **2+ 2+ 3 + 5 = 12**

3. (a)  The potential field at any point in a space connecting a dielectric material of permittivity 3 is given by $\Phi = (4x + 2y + 3y^2)$ V, where x,y,z are in meters. Calculate the volume charge density at a point p(4,4,2).
   (b)  Explain why is corona not observed in a uniform field.
                                                      **8 + 4= 12**

## Group – C

4.  State the mechanism responsible for secondary emission from the surface of solids. Define self-sustained discharge and non–sustained discharge. What are the conditions for self –sustained discharge?
                                                      **3+ 3 + 6 = 12**

5.  Briefly enumerate the various theories that explain the breakdown in commercial liquid dielectrics.
                                                               **12**

## Group – D

6.  Draw the equivalent circuit of a four-stage cascaded transformer and determine the expression for the short-circuit reactance of the transformer.
                                                      **4 + 8 = 12**

7. (a)  Explain with the help of a schematic diagram the working principle of a Symmetric voltage multiplier circuit.
   (b)  Write comparison between Selenium and Silicon rectifier.
                                                      **8 + 4 = 12**

## Group – E

8.    Explain with neat diagram the principle of operation of Peak Voltmeter developed by Davis, Bowdler and Standring. What are discharge error and recharge error?

**8+ 2 + 2 = 12**

9.    What is Rogowski coil? How is it used for measuring impulse current? How is it different from a current shunt?

**3 + 6 + 3 = 12**