*Ref. No.* EX/EE/5/T/111/2018(S)(Old)

**BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) FIRST YEAR FIRST SEMESTER (OLD) SUPPLEMENTARY EXAMINATION, 2018**

**SUBJECT : PRINCIPLES OF ELECRICAL ENGINEERING**

**Time : Three hours** **Full Marks -100 (50 marks for each part)**

**Use a separate Answer-Script for each part**

| No. of question | **Part I** **Answer any three questions.** **Two marks reserved for neatness and well organized answer.** | Marks |
|---|---|---|
| 1. a) | Determine magnetic field strength and flux density (i) around a long straight conductor, (ii) within a solenoid using Ampere's Law. | 10 |
| b) | Briefly explain Hysteresis loss and eddy current loss. Also mention how these losses can be minimized. | 6 |
| 2. a) | Explain similarities and dissimilarities between electric circuit and magnetic circuit. | 8 |
| b) | An iron ring has a mean diameter of 20 cm and a cross sectional area of 5 $cm^2$. It is wound with a coil of 1000 turns. An air gap of 1.5 mm width is cut in the ring. Determine the current required in the coil to produce a flux of 0.5 mWb in the air gap. Consider the relative permeability of iron under this condition as 800. Neglect leakage and fringing. | 8 |
| 3.a) | Define Coulomb's Law for force between two point charges and hence give the definition of unit of charge. Define electric field intensity at a point. | 8 |
| b) | Determine capacitance per unit length between two coaxial cylinders with the assumption that +q charge is on the outer surface of the inner cylinder and the outer cylinder is earthed. | 8 |
| 4. a) | The magnetic field due to a current carrying circular loop of radius 10 cm at its centre is $0.5 \times 10^{-4}$T. Find the magnetic field due to this loop at a point on the axis at a distance of 7 cm from the centre. | 8 |
| b) | State and prove Gauss's Law. | 8 |
| 5.a) | Derive the expression of lifting force of a magnet in a medium of relative permeability $\mu$. | 8 |
| b) | Write short notes on "Hysteresis Loop". | 8 |

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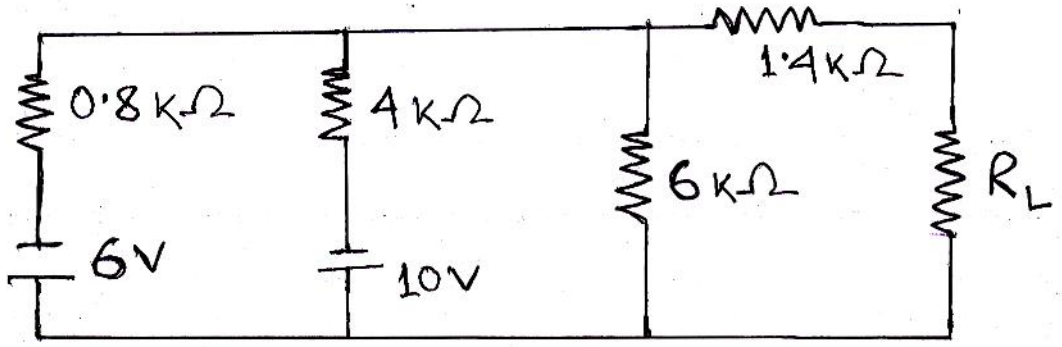
**PART-II (50 marks)**
**Answer any Three Questions**
**(Q. No. 1 carries 18 marks)**

1. a) State and explain Kirchhoff's laws with suitable diagram. 6

b) A circuit consists of resistance $R$, and capacitive reactance of 25Ω connected in series. Determine the value of $R$ for which the power factor of the circuit is 0.8. Also draw the phasor diagram. 6

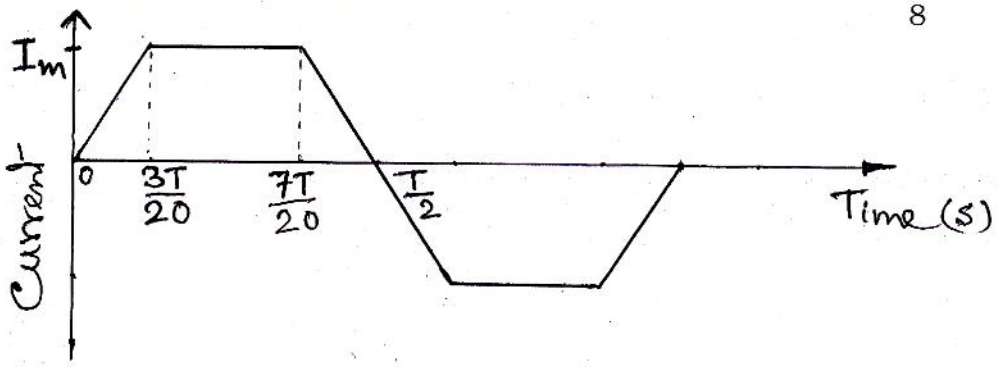
c) Find the Thevenin's equivalent circuit for the given network. 6




2. a) State and explain Norton's theorem. 4

b) Why are the *r.m.s.* values of alternating quantities more important than their *average* values? 4

c) Find the *r.m.s.* and *average* value of current wave as shown below- 8



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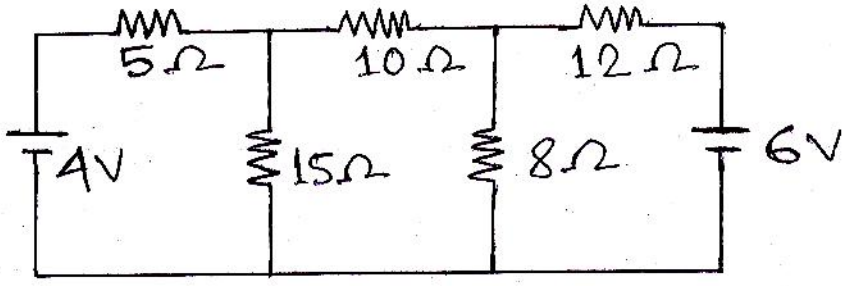
3. a) Prove that an ideal capacitor does not consume any power over the full cycle of applied sinusoidal voltage. 4

b) In a series R-L-C circuit, discuss the effect of frequency on circuit impedance and power factor. 4

c) Using Superposition theorem, finds the value of current passing through 8Ω resistor in the given network. 8




4. a) Deduce the condition at which an RLC series circuit draws maximum current. 4

b) A series circuit consists of a resistance of 30Ω, a capacitance of $320\mu F$ and an inductance of $0.18H$. A supply of $230V, 50Hz$ is connected across it. Calculate i) the current in the circuit, ii) the potential differences across each element and iii) the frequency at which the current would have unity power factor. 8

c) What are the various methods used for the power factor correction. 4

5. a) Show that the maximum power transfer occurs for a resistive load when the load voltage and current are one-half their maximum possible values. 5

b) A voltage of $e = 110\sin(100\pi t)V$ has been applied to a circuit to supply a current of $i = 5\sin(100\pi t - 30°)A$. Determine the *active* and *reactive power* drawn by the circuit. 4

c) A coil of resistance $10\,\Omega$ and inductance $0.1\,H$ is connected in series with a $150\mu F$ capacitor across a $230V, 50Hz$ supply. Calculate the voltage across the coil and capacitor respectively. 7