

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: BE101-03

Course Name: INTRODUCTION TO ELECTRICAL ENGINEERING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks.

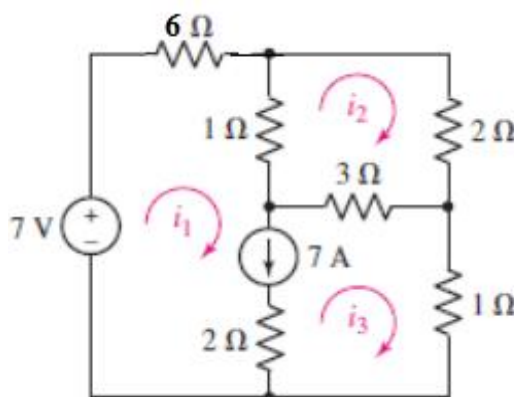
- | | | Marks |
|----|--|-------|
| 1 | Deduce an expression for the energy stored in a magnetic field? | (4) |
| 2 | A coil of 160 turns is linked with a flux of 0.02 Wb when carrying a current of 12A. Calculate the inductance of the coil. If the current is uniformly reversed in 0.02 s, calculate the induced emf. | (4) |
| 3 | State and explain Kirchhoff's voltage and current laws. | (4) |
| 4 | Distinguish between self and mutual inductances. Derive an expression for the self inductance of a coil. | (4) |
| 5 | Express $i(t) = 20 \sin(628t - 30^\circ)$ in polar and rectangular forms. | (4) |
| 6 | Prove that the power consumed by a purely capacitive ac circuit is zero. | (4) |
| 7 | Distinguish between (i) apparent power, (ii) active power, and (iii) reactive power. | (4) |
| 8 | Prove that average power in an ac circuit is $VI \cos\phi$, where V is the RMS value of voltage, I is the RMS value of current and $\cos\phi$ is the power factor. | (4) |
| 9 | Calculate the line currents, power factor and power consumed in a three phase star connected load consisting of three equal impedances of $(20 + j10) \Omega$ connected across a three phase source of 400V, 50Hz. | (4) |
| 10 | Write any four advantages of three phase systems over single-phase systems. | (4) |

PART B

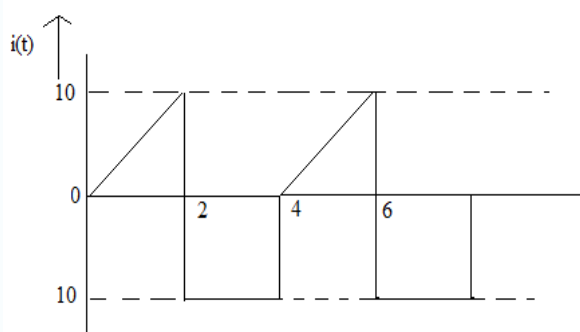
Answer any four full questions, each carries 10 marks.

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|----|--|------|
| 11 | a) State and explain Faraday's laws of electromagnetic induction. | (4) |
| | b) A coil of 800 turns is wound on a ring of silicon steel, having mean diameter of 9 cm and relative permeability of 1100. Its cross sectional area is 12 cm^2 . When a current of 6 A flows through the coil, find | (6) |
| | i. Flux in the core | |
| | ii. Inductance of the coil | |
| | iii. Induced emf if the flux falls to zero in 20ms. | |
| 12 | Use Mesh analysis to determine currents I_1 , I_2 , I_3 and current through the 3Ω | (10) |

resistor in the circuit below.



- 13 An iron ring has a diameter of 21 cm and a cross sectional area of 10 cm^2 . The ring is made up of semicircular sections of cast iron and cast steel with an air gap of 0.2 mm. Find the ampere turns required to produce a flux of 8 mWb. The relative permeability of cast steel and cast iron are 800 and 166, respectively. (10)
- 14 a) Compare (by writing both similarities and differences) electric and magnetic circuits. (6)
- b) Derive the equivalent reluctance of two magnetic circuits in parallel. (4)
- 15 Determine the RMS and average values of the current waveform shown below. (10)



- 16 A non inductive resistor of 10Ω is connected in series with a choke coil having an internal resistance of 1.2Ω and is fed from a 200 V, 50 Hz supply. The current flowing through the circuit is 8 A. Calculate (i) Inductance of the choke coil (ii) Voltage across the choke coil (iii) Power absorbed by the choke coil (iv) Power absorbed by the non-inductive resistor (v) Phasor diagram of voltage. (10)

PART C

Answer any one full question from each module, each carries 10 marks.

Module V

- 17 A 50Hz sinusoidal voltage of $(40+j30) \text{ V}$ is applied to a series RL circuit resulting in a current of $(4+j1) \text{ A}$. Calculate (i) Impedance of the circuit (ii) (10)

Power consumed in the circuit (ii) Power factor of the circuit.

- 18 a) an R-L-C series circuit with $R=10\ \Omega$, $L=0.1\text{ H}$ and $C=10\ \mu\text{F}$ is excited with an alternating voltage source. Determine the impedance (i) at resonant frequency, (ii) 10 Hz above resonant frequency and (iii) 10 Hz below resonant frequency. (8)
- b) Draw the variation of impedance with respect to frequency of an R-L-C series circuit. (2)

Module VI

- 19 a) Compare star and delta connected three phase power supply systems. (4)
- b) A three-phase delta connected load consists of three similar impedances of $(10+12j)\ \Omega$. Find the line current and total power absorbed if it is connected to a 415V, 50Hz supply. (6)
- 20 a) Calculate the phase and line currents and the load impedance parameters in a balanced delta connected load which consumes a power of 25 kW at 0.866 power factor lag fed from a three phase 400V, 50 Hz supply. (6)
- b) A balanced three phase load consumes a power of 10 kW at 0.9 pf lag. If the power is measured by two wattmeter method, calculate the readings of the two watt-meters. (4)
