

Reg No.: .....

Name: .....

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIRST/SECOND SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018**

**Course Code: EE100**

**Course Name: BASICS OF ELECTRICAL ENGINEERING**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each question carries 4 marks.*

Marks

- |    |    |   |     |
|----|----|---|-----|
| 1  | a) | What is the difference between current source and voltage source?   | (2) |
|    | b) | Draw the VI or IV characteristics of ideal & practical voltage and current sources.   | (2) |
| 2  | a) | How much more current can be safely drawn from a 120 V outlet fused at 15 A, if a 600 W curling iron and a 1200W hair dryer are already operating in the circuit?   | (2) |
|    | b) | A certain light bulb with a resistance of $95\ \Omega$ is labelled ' $150\ W$ '. Was this bulb designed for use in a 120V circuit or a 220V circuit? Justify your answer.   | (2) |
| 3  | a) | An ideal mutual inductor is made from a primary coil of inductance 5mH and a secondary coil of inductance 10mH. Find the value of the mutual Inductance.  | (2) |
|    | b) | A DC source of 20V is applied to a series combination of a $5k\Omega$ resistor and a 4mH inductor. Find the equilibrium value of the energy stored in the magnetic field.   | (2) |
| 4  |    | Derive the relation between line current and phase current when a balanced 3-phase three wire supply is fed to a 3-phase delta connected pure resistive load ( $R\ \Omega$ of equal value connected in each arm). | (4) |
| 5  | a) | Define renewable energy.  | (1) |
|    | b) | Enumerate major types of geothermal renewable energy resources.   | (3) |
| 6  |    | What do you mean by distribution system? How feeder is different from distributor?  | (4) |
| 7  |    | Derive the emf equation of transformer.   | (4) |
| 8  |    | What is the principle of operation of a DC motor? What are the constructional differences between series and shunt field windings?  | (4) |
| 9  |    | Distinguish between squirrel cage and slip ring rotors of 3-phase induction motor.  | (4) |
| 10 |    | Compare three-phase and single-phase induction motors.  | (4) |

**PART B**

**MODULE (1-4)**

*Answer any four questions, each question carries 10 marks.*

- |    |    |   |     |
|----|----|---|-----|
| 11 | a) | Obtain the voltage drops across all resistor of the circuit shown in Fig. 1 using nodal analysis. All the values of the resistances are in $\Omega$ . | (6) |
|----|----|---|-----|

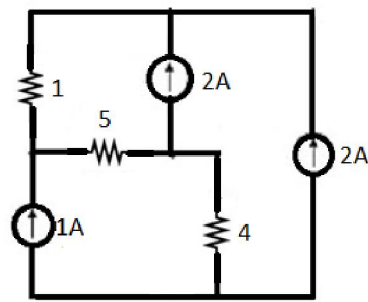


Figure 1.

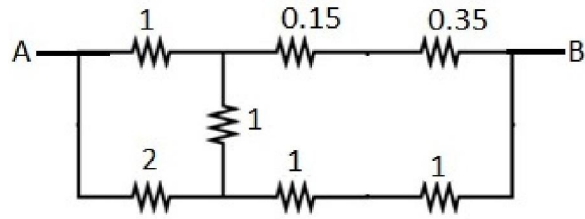


Figure 2.

- b) Use star-delta/ delta- star transformation to determine the equivalent resistance between the points A and B of the circuit shown in Fig. 2. All the values of the resistances are in  $\Omega$ . (4)
- 12 a) A closed magnetic circuit of cast steel contains a 6cm long path of cross-sectional area  $1 \text{ cm}^2$  and a 2cm path of cross-sectional area  $0.5 \text{ cm}^2$ . A coil of 200 turns is wound around the 6 cm length of the circuit and a current of 0.4 A flows through it. Determine the flux density in the 2 cm path of the magnetic circuit. Relative permeability of cast steel is 750. (6)
- b) Derive an expression for dynamically induced emf in a moving conductor in terms of magnetic flux density ( $B$ ), length of the conductor ( $l$ ), velocity ( $v$ ) and the angle between  $B$  and  $v$  (4)
- 13 a) Tabulate the similarities and dissimilarities of electrical circuits and magnetic circuits (6)
- b) A hollow air cored inductor coil consists of 500 turns of copper wire which produces a magnetic flux of 10mWb when passing a DC current of 10 A. (4)
- (i) Calculate the self-inductance of the coil in mH.
- (ii) calculate the value of the self-induced emf produced in the same coil after a time of 10ms.
- 14 a) Find the total voltage across the terminals A and B of the circuit shown in Fig. 3. Draw the waveforms of the voltages  $3\angle 0^\circ$ ,  $4\angle 180^\circ$  and  $V_{AB}$ . (3)

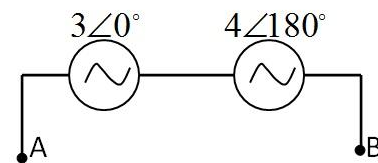


Figure 3.

- b) A series circuit consisting of a capacitor of  $2 \mu\text{F}$  and a resistance of  $500 \Omega$ . An AC source is connected to the circuit which draws a current of  $50\angle 0^\circ \text{ mA}$ . The angular frequency of AC source is  $400\pi$ . (i) draw the circuit and find the source voltage (ii) find the voltage across the capacitor and resistor (iii) draw the voltage phasor diagram. (7)
- 15 a) A three-phase load consumes 100 kW, and 50 kVAR. Determine the apparent power and the power factor angle. (2)

- b) A star connected balanced three phase load of  $(10+j10) \Omega$  is supplied from a star connected balanced three phase supply with  $V_{AB} = 100\sqrt{3}\angle 0^\circ$  V. Two single phase wattmeters are connected to measure three phase power. Determine: -i) Wattmeter readings of  $W_A$  and  $W_C$  ii) Three phase real power iii) Three phase reactive power (8)
- 16 With neat sketches, describe the main components of a nuclear power plant. (10)

### MODULE 5

*Answer any one full question, carries 10 marks.*

- 17 a) How back emf is generated in a DC motor? What is the significance of back emf? (3)
- b) With electrical circuit diagram, give detailed description of various types of DC motors. Elaborate the characteristics of each type. (7)

### OR

- 18 a) A 200 kVA rated transformer has a full-load copper loss of 1.5 kW and an iron loss of 1 kW. Determine the transformer efficiency at full load and 0.85 power factor. (6)
- b) How hysteresis and eddy current losses are minimized in a transformer? (4)

### MODULE 6

*Answer any one full question, carries 10 marks.*

- 19 a) Define the terms: (4)
- i) synchronous speed ii) slip iii) slip speed iv) rotor speed.
- b) A 3-phase 50Hz induction motor has a full load speed of 960 rpm. Find the: (6)
- i) Slip
  - ii) Number of poles
  - iii) Frequency of rotor induced emf
  - iv) Speed of rotor field with respect to rotor
  - v) Speed of rotor field with respect to stator
  - vi) Speed of rotor field with respect to stator field.

### OR

- 20 a) List out any four types of single phase induction motors. (2)
- b) Write down the constructional details and working of capacitor start induction motor. Draw relevant phasor diagram. (8)

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