

# Indian Institute of Engineering Science and Technology, Shibpur

B. Tech 2<sup>nd</sup> Semester (Gr V/Gr VI/Gr VII/Gr VIII)

End-Semester Examinations, July 2021

## Basic Electrical Engineering (EE1201)

Full Marks: 50

Time: 1:30 Hour

(i) Use a single answer-script for all the questions

(ii) All parts of a question MUST be answered together

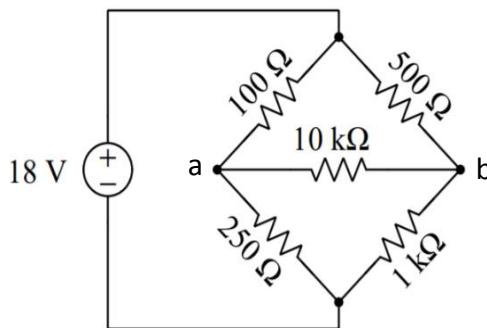
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### Part - A

(Answer ANY TWO questions)

- 1 a) State and prove the Maximum Power Transfer Theorem for DC networks.
- b) Using Thevenin's theorem, determine the voltage drop across the 10 kΩ resistance in the circuit below.

[6+6.5]



- 2 a) Write short notes on: (i) Reluctance and permeability (ii) Fringing and Leakage Flux and (iii) Hysterises and Eddy Current loss
- b) A cast-steel electromagnet has an air-gap of 1.6mm and iron path of length 29cm. Find the MMF required to produce a flux density of 0.8 wb/m<sup>2</sup> in the air-gap. Given H = 730 AT/m at B = 0.8 wb/m<sup>2</sup> for cast-steel. Neglect all kind of losses.

[6+6.5]

- 3 a) Explain the principle of operation of a single-phase transformer and derive its emf equation.
- b) An 8-pole dc generator has 400 armature conductors and a flux of 0.05 Wb per pole. What will be the emf generated if it is lap connected and runs at 1200 rpm.? What must be the speed at which it is to be driven produce the same emf if it is wave wound?

[6.5 + 6]

**Part – B**  
**(Answer ANY TWO questions)**

- 4.a) Briefly describe the deflecting torque, controlling torque and damping torque acting on electromagnetic indicating instruments.
- b) A voltage source,  $V = \sin(\omega t + 30^\circ)$  supplies a current,  $I = \cos(\omega t - 30^\circ)$  to a load connected to it.
- Find out the phase angle between voltage  $V$  and the current  $I$ .
  - Determine the impedance of the load in rectangular co-ordinates form.
  - Find out the power consumed in the load.

[6+(2+2.5+2)]

- 5.a) A 100 V, 50Hz, sinusoidal voltage is applied to a circuit comprising of a resistance  $15 \Omega$ , an inductance 50 milli-Henry and a capacitance 100 micro-Farad connected in series.
- Determine the voltage drop across the resistor, inductor and capacitor.
  - Draw the phasor diagram of the voltages and the current.
  - Find out the total power consumed in the circuit.
- b) Deduce the relationship between line voltage and phase voltage of a 3-phase, 4-wire system.

[(4+3+2)+ 3.5]

6. a) State the principle of operation of a 3-phase induction motor.
- b) A 3-phase, 4-pole, 50Hz, squirrel-cage induction motor has a slip of 1% at no-load and 3% at full-load. Determine
- Synchronous speed of the motor.
  - No-load speed of the motor
  - Full-load speed of the motor
  - Frequency of the rotor e.m.f. at stand-still
  - Frequency of the rotor e.m.f. at full-load.

[7.5+ (1+1+1+1+1)]

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