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CINEC CAMPUS
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Faculty of Engineering & Technology

Department of Electrical and Electronics Engineering

BSc. Hons. (Eng.) in Automotive Engineering/ Civil Engineering/ *Electronic & Telecommunication Engineering / Mechatronics Engineering/ Mechanical Engineering*

Semester 1 Re Sit - Final Examination 2026

Batch: 8

Module Code: EE1315	**Module Title: Electricity**
Date: 15^{th} July 2026	**Duration: 3 hours**
Examiner 1: Eng Shasiprabha Mihihansi	

Instructions to Candidates: (This is only a sample, instructions may change)

- *This is a closed book examination. No reference materials are allowed unless specified.*
- *This paper consists of five (05) questions and 06 pages. Answer all questions.*
- *The marks allocated to each question are listed in the column on the far right. Final mark of the question paper will be calculated out of 100.*
- *Use only the provided answer booklet, additional sheets, and graph papers for your answers.*
- *Write clearly and legibly. Use a blue or black pen only.*
- *Write your student number on all sheets.*
- *Start each question on a new page in the answer booklet, answer sheets. Clearly indicate the question number at the top of the page.*
- *If parts of the same question are written discontinuously in non-consecutive sheets, ensure that each part is relevantly labelled with its corresponding question number.*
- *If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.*

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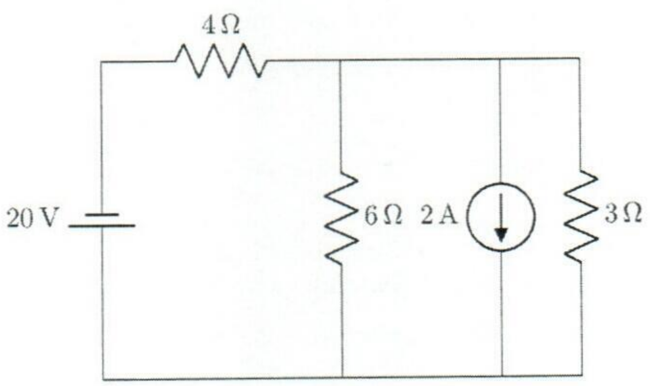
Q1	Answer the following questions considering the fundamentals of Electrical Engineering.		
	i)	Define electric charge and electric current, stating their respective SI units.	[02]
	ii)	Explain the significance of the International System of Units (SI) in maintaining consistency and accuracy across electrical engineering designs and measurements.	[04]
	iii)	A single-loop circuit contains a 24 V DC voltage source connected in series with a 6 Ω resistor, a 4 Ω resistor, and an opposing 4 V DC voltage source. Calculate the current flowing through the loop and find the voltage drop across each resistor.	[04]
	iv)	Three resistors with values 10 Ω, 15 Ω, and 30 Ω are connected in parallel. This entire parallel combination is then connected in series with a 5 Ω resistor. Calculate the total equivalent resistance of this network.	[05]
	v)	Two capacitors of 12 μF and 6 μF are connected in series. This combination is then placed in parallel with a 4 μF capacitor. Find the total equivalent capacitance of the network.	[05]
		Total	[20]
Q2	Answer the following paying close attention to network theorems and circuit laws.		
	i)	State Kirchhoff's Voltage Law (KVL) and explain its relationship with the law of conservation of energy.	[03]
	ii)	For the DC circuit shown in Figure 1, formulate the mesh equations using Kirchhoff's laws and solve for the branch currents.  **Figure 1**	[07]

	iii)	State the Superposition Theorem as applied to linear bilateral DC circuits, detailing how independent voltage and current sources are treated during analysis.	[03]
	iv)	A circuit contains a 15 V independent voltage source and a 5 A independent current source driving a network of three 5 Ω resistors as in Figure 2. Using the Superposition Theorem, calculate the individual contributions of each source to the current flowing through the load resistor, and find the total current.	[07]

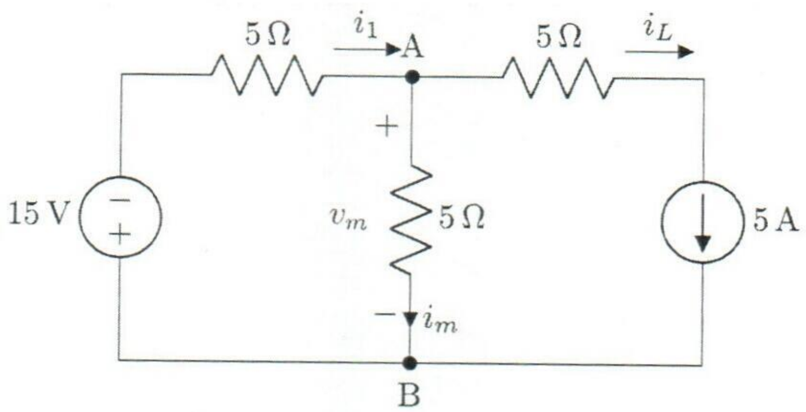


Figure 2

		Total	[20]
Q3	Answer the following questions regarding AC Circuit Theory.		
	i)	Given the sinusoidal voltage expression v(t) = 50 sin (100πt - 30°)V, determine its: (a) Amplitude, (b) Phase angle, (c) Angular frequency (d) Time period (e) Frequency	[05]
	ii)	Calculate the phase difference between the two sinusoidal signals $v_1(t)$ = 15 cos (ωt + 45°) and $v_2(t)$ = 10 sin (ωt - 15°.) Clearly state which waveform is leading.	[03]

	iii)	The voltage applied across a single-phase load and the resulting current drawn are; $v(t) = 230 \cos(100\pi t - 10^\circ)$V $i(t) = 5 \cos(100\pi t + 35^\circ)$A. Calculate the: (a) Real power (P) (b) Reactive power (Q) (c) Apparent power (S) delivered to the load.	[06]
	iv)	Determine the power factor of the load from part (iii) and state whether it is leading or lagging.	[03]
	v)	Find the total load impedance (Z) in rectangular form, and identify the values of the components (R, L, or C) that comprise the load.	[03]
		Total	[20]
Q4	Answer the following questions based on Electrical Measurements and Electrical Installations.		
	i)	A permanent-magnet moving-coil (PMMC) instrument has a full-scale deflection current of 2 mA and an internal resistance of 100 Ω. Explain the operational reason why a multiplier resistor must be connected in series to extend its range to measure voltage.	[03]
	ii)	Calculate the precise value of the series multiplier resistance required to convert the PMMC meter described above into a 0-20 V voltmeter.	[04]
	iii)	Explain why the TN-S earthing system is widely favored for domestic public electricity supply networks, contrasting it briefly with the limitations of an IT system.	[03]
	iv)	Describe the primary protective purpose and detailed principle of operation of a Residual Current Circuit Breaker (RCCB) in a residential wiring system.	[05]
	v)	Explain the functional role of a fuse in an electrical circuit, and contrast two key operational or structural differences between a fuse and a Miniature Circuit Breaker (MCB).	[05]
		Total	[20]

Equations

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$
$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin(\omega t \pm 180^\circ) = -\sin \omega t$$
$$\cos(\omega t \pm 180^\circ) = -\cos \omega t$$
$$\sin(\omega t \pm 90^\circ) = \pm \cos \omega t$$
$$\cos(\omega t \pm 90^\circ) = \mp \sin \omega t$$

$$S = V_{\text{rms}} I_{\text{rms}}$$

$$R_n = \frac{I_m}{I_{\text{fs}} - I_m} R_m$$

$$\varepsilon = - N \times |d\Phi/dt|$$

$$B = (\mu_0 I) / (2 \pi r)$$

Real Power $P = V_{rms} I_{rms} \cos(\theta_v - \theta_i)$

Reactive Power $Q = V_{rms} I_{rms} \sin(\theta_v - \theta_i)$

Power Factor $= \cos(\theta_v - \theta_i)$

$$R_n = \frac{V_{fs}}{I_{fs}} - R_m$$

$$Z_C = \frac{1}{j\omega C} = \frac{-j}{\omega C} \quad , Z_L = j\omega L$$

$$H = \frac{I}{2\pi r}$$

$$B = u_0 H$$

End of the Question Paper

Q5	Answer the following questions considering Magnetic Fields and Electromagnetic Induction.		
	i)	State the Biot-Savart Law for the magnetic field produced by a current-carrying element.	[02]
	ii)	Compute the magnitude of the magnetic field intensity (H) and magnetic flux density (B) at a radial distance of 0.5 meters from a long, straight conductor carrying a steady current of 2 A in free space. ($u_0 = 4\ \pi \times 10^{-7}$ H/m).	[05]
	iii)	An ideal single-phase step-down transformer has 800 turns on its primary winding and 200 turns on its secondary winding. If a primary voltage of 240 V AC is applied, calculate: (a) The turns ratio (b) The resulting secondary open-circuit voltage.	[05]
	iv)	A flat coil consisting of 150 turns is positioned perpendicular to a uniform magnetic field. The magnetic flux linking the coil drops uniformly from 0.08 Wb to 0.02 Wb over a time interval of 0.03 seconds. Calculate the magnitude of the electromotive force (EMF) induced in the coil.	[04]
	v)	If the magnetic flux into the plane of the page is uniformly decreasing, determine whether the induced current inside a closed conducting loop facing the page flows in a clockwise or counterclockwise direction. Justify your answer using Lenz's Law.	[04]
		Total	[20]