Module(Course Syllabus)Catalogue

2023-2024

College/ Institute	Erbil Technology College	
Department	Renewable Energy	
Module Name	Electrics	
Module Code	ELE305	
Degree	Technical Diploma * Bachelor High Diploma Master D	
Semester	3rd. Semester	
Qualification	MSc. In Electrical Engineering	
Scientific Title	Assistant Lecturer	
ECTS (Credits)	6	
Module type	Prerequisite Core Assist. *	
Weekly hours	4	
Weekly hours (Theory)	(2)hr Class	(162)Total hrs Workload
Weekly hours (Practical)	(2)hr Class	(162)Total hrs Workload
Number of Weeks	12	
Lecturer (Theory)	RONAK AHMAD SAEED	
E-Mail& Mobile NO.	ronak.saeed@epu.edu.iq	
Lecturer (Practical)	RONAK AHMAD SAEED	
E-Mail & Mobile NO.	ronak.saeed@epu.edu.iq	
Websites		

Course Book

Course Description	This course will give the principals of the electrical engineering with all the fundamentals of electrical in such a way that they will gain theoretical and practical experience of about the fundamental concepts of electrical and electronic including circuit components, basic DC and AC circuit analysis techniques, transformers and electric motors, the capability to use abstractions to analyze and design simple electronic circuits.
Course objectives	Students must demonstrate the ability to: • Clarify the principals of electrical. • Clarify the main electrical laws. • Clarify how to apply these principals practically.
Student's obligation	• Class attendance is important, and attendance will be taken every lecture. • The student submits a weekly report about what have done in the Lab section. For examination, there are semester exam and final exam for the practical and the theory parts. During the class hours there will be some quizzes.
Required Learning Materials	White board, data show.

	Task		Weight (Marks)	Due Week	Relevant Learning Outcome
Evaluation	Paper Review				
	Assignments	Homework	5		
		Class Activity	2		
		Report	5		
		Seminar	5		
		Essay			
		Project			
	Quiz		8		
	Lab.		10		
	Midterm Exam		25		
	Final Exam		40		
	Total		100		
Specific learning outcome:	1- This course will help the student will have sufficient knowledge about different calculations of the most important electrical quantities and circuits. 2-Demonstrate the ability to obtain appropriate service information on electrical circuit construction, DC Circuit and AC Circuit. 3- The knowledge which they will gain helps them to get jobs in engineering projects, electrical installations, counting electrical tariffs ,doing electrical measurements ,fixing some idle apparatus and reading electrical plans. 4- Students will be capable to write the important formulas which they need in their study.. well as their career in the future 5- Be able to understand the function and applicability on electric machines (AC motor , transformers) 6- Understand the basic characteristics, theory of operation and applications of semiconductor devices (e.g diodes BJT and circuits)				

Course References:	Electrical Technology (Edward Hughes) 2-Basic circuits (A .M. F. Brooks) Pergaman Press. 3-Introduction to electric circuits (M.Romanwitz) John Willy. 4-Basic Electrical Engineering(Fitzgerald & Rlgginborthan) M.C. – Graw - Hill 5-5-Electrical technology(.B L. THERAJA) 6-ANY BOOK ABOUT ELECTRICAL CIRCUITS ▪Useful references: 1--تكنولوجيا الهندسة الكهربائية(المهندس محمدالطالب بني ياسين) 2-الدوائر الكهربائية (م . دعاء سعيد الخطيب) . (م .هلا احمد جابر) 3 - مبادئ علم الهندسة الكهربائية.الدكتور محمد زكي-الدكتور مظفر انور النعمة. 4-دووائر و قياسات كهربائية (كتاب منهجي) ▪Magazines and review (internet): 1-Magazines and review (Internet) 2. www.Google .com 3-wwwcircuits theory.com 4-WWW.KUTUB.INFO

Course topics (Theory)	Week	Learning Outcome
Electrical quantities and units, symbol of electrical quantities and the symbol of their units. Defining the units of voltage, current and resistance and writing their equations. The elements of electrical circuits, transmission elements and control elements. Ohm's Law, defining the Ohm's Law, drawing the relationship between the potential difference (V) to the current (I), the equation of Ohm's Law, finding the slop. Solving examples.	1	
Types of connecting resistances, connecting resistances in series, Parallel, compound finding the total resistances, voltages, currents and power. The equations of voltage divider rule. Solving examples.	2	
Kirchhoff's Laws, defining Kirchhoff's Current Law (KCL) and Kirchhoff' Voltages Law (KVL). Equations of the two Laws. Solving examples.	3	
Electromagnetism ,Magnetic force and magnetic circuits	4	
Induction Motors- Three phase induction motors – construction – working principle. Synchronous speed example	5	
Single phase induction motors – Types of single phase motors	6	
Transformer principles-construction – working principle- types of Transformer.	7	
AC circuits. AC voltage generation. Introduction to Alternating current and voltage. Producing the sinusoidal voltage. Phase and Phase angle	8	
(RL – Circuit) series in Alternating Current, (RC – Circuit) series in Alternating Current.	9	
(RLC – Circuit) series in Alternating Current.	10	
Introduction, Semiconductors, conductors and insulators, Semiconductor material, Doping, N-Type and P-Type Semiconductors, p--n Junctions.	11	

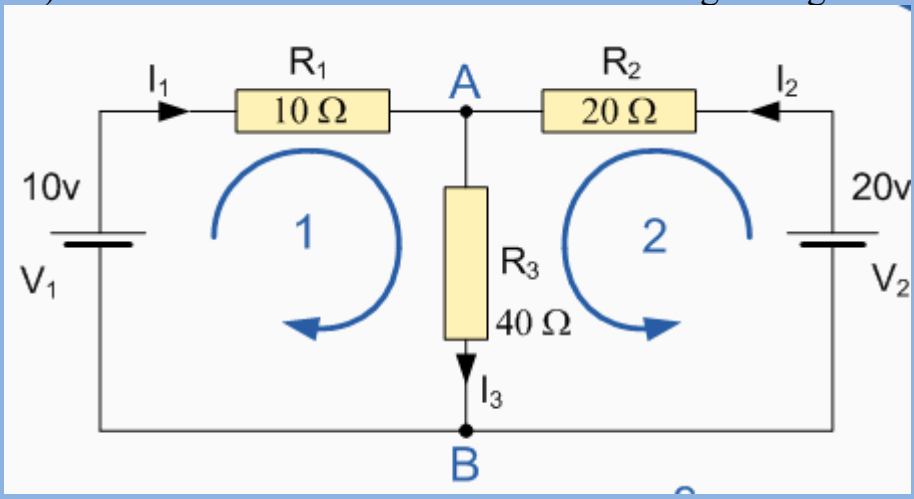
Diodes – Diodes characteristics. Rectifiers – Half wave rectifier full wave centre tape full wave bridge.	12	
Practical Topics	**Week**	**Learning Outcome**
Defining the working system in laboratory and how to doing the report And using the apparatus.	1	
Using multi-meter (Amp, volt, ohm, etc.) and Using (DC) power supply, Wattmeter, oscilloscope and function generator.	2	
Verification the Ohm's Law practically.	3	
Connecting resistances in series and parallel.	4	
Verification the Two Kirchhoff's Law (KCL) and (KVL) practically.	5	
Measurement of Power in Single Phase AC Circuits by Wattmeter.	6	
Forward/Reverse Three Phase Induction Motor Operation.	7	
Open circuit test single phase transformer	8	
(RL – Circuit) series in AC circuit	9	
(RC – Circuit) series in AC circuit	10	
Diode Characteristics	11	
Half wave rectifier	12	

Questions Example Design

Q1/A) Define the following:

(The Ohm's Law, Power, Frequency, Permeability , Faraday's Law)

B) Determine the values of the current flowing through each of the resistors.



Q2/A) Choose the one alternative that best completes the statement or answers the question

1- A kilowatt × hour is a unit of

a power
b force
c. current
d. energy

2- A 5 ohm and a 2 ohm resistor are connected in parallel. What is the total resistance?

a $\frac{10}{7}$ Ω
b $\frac{7}{10}$ Ω
c $\frac{10}{6}$ Ω
d $\frac{6}{10}$ Ω

3-Electric motors works on principle of

a capacitors
b friction
c couple
d torque

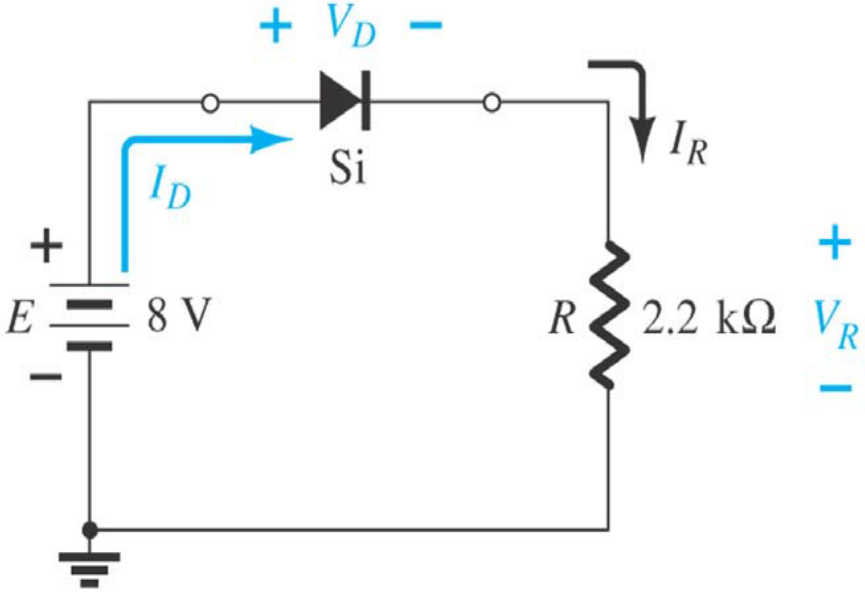
4- Which of the following is an example of a passive component?

a Diode
b Transistor

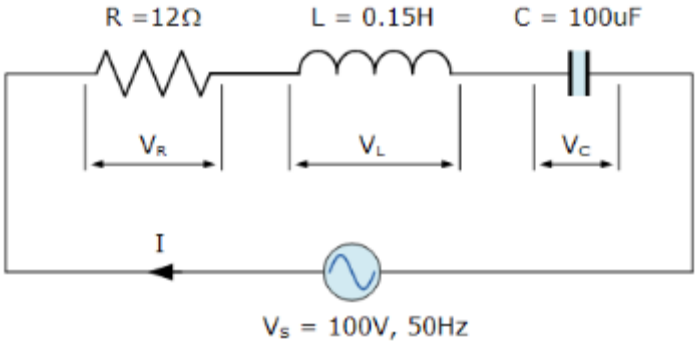
c Integrated Circuit
d Resistor
e All of the above

5- In transformer primary coil is connected to
a Ac source
b Dc source
c resistor
d inductor

B) For the diode below determine VD, VRand ID



Q3/A) Calculate the total circuit impedance, the circuits current, power factor and draw the voltage phasor diagram.



B) A 3Phase, 50Hz 6pole induction motor has a full load percentage slip of 3% find :

1- Synchronous speed

2- Actual Speed

Q4/ A) Steel circle has length l=(0.47)m and area(4×10^{-4}) m2 , number of turn(60), the magnetic field inside the solenoid is given(500)μwb , Magnetic Field Intensity (1500)(A-T)/m,

Permeability($\pi4 = 0\mu \times10^{-7}$, $\mu r = 370$)

Find : :

1) The Magnetic Field Density (B)
2) Current(I)
3) Reluctance ($\mathcal{R}$)
4) Magnetic Field Intensity (H)
5) Inductance (L)

B) What are the various methods of speed control in three phase induction motors?

Answers:

Q1/A)

The Ohm's Law

The potential difference across a conductor is directly proportional to the current flowing through the conductor, the temperature of the conductor remaining constant. The constant of proportionality is R, the resistance.

Power

Power is defined as the work done per unit time.
Unit: Watts (W).

Frequency (f) is the number of cycles that a sine wave completes in one second.

$$f = 1/T$$

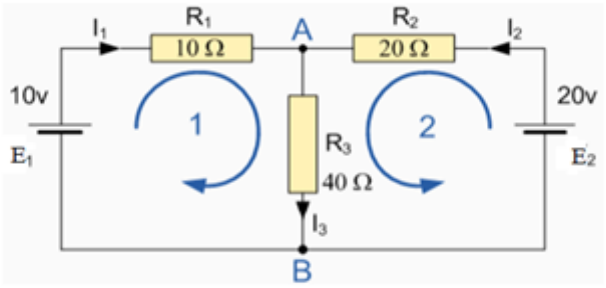
Permeability

Is the ability of a material to conduct flux.

Faraday's Law

The amount of voltage emf, induced across a coil is proportional to the product of the number of turns in the coil times the rate of change of the magnetic flux.

B)



At node A : $I_1 + I_2 = I_3$
At node B : $I_3 = I_1 + I_2$

Loop 1 is given as : $E_1 - R_1 I_1 - R_3 I_3 = 0$
$E_1 = R_1 I_1 + R_3 I_3$
$10 = 10I_1 + 40I_3$.....(1)

Loop 2 is given as : $E_2 - R_2 I_2 - R_3 I_3 = 0$
$E_2 = R_2 I_2 + R_3 I_3$
$20 = 20I_2 + 40I_3$..... (2)

$I_3 = I_1 + I_2$

Eq. No 1 : $10 = 10I_1 + 40(I_1 + I_2)$
$10 = 50I_1 + 40I_2$

Eq. No 2 : $20 = 20I_2 + 40(I_1 + I_2)$
$20 = 40I_1 + 60I_2$

$I_1 = -0.143$ Amps
$I_2 = +0.429$ Amps
$I_3 = I_1 + I_2$
$I_3 = -0.143 + 0.429 = 0.286$ Amps

Q2/A)

1. d
2. a
3. d
4. e
5. a

B)

$$V_D = 0.7V$$

Using equivalent circuit and KVL

$$V_R = E - V_D = 8V - 0.7V = 7.3V$$

$$I_D = I_R = \frac{V_R}{R} = \frac{7.3V}{2.2k\Omega} = 3.32mA$$

Q3/A)

Inductive Reactance, X_L.

$$X_L = 2\pi fL = 2\pi \times 50 \times 0.15 = 47.13\Omega$$

Capacitive Reactance, X_C.

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 50 \times 100 \times 10^{-6}} = 31.83\,\Omega$$

Circuit Impedance, Z.

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$Z = \sqrt{12^2 + (47.13 - 31.83)^2}$$

$$Z = \sqrt{144 + 234} = 19.4\Omega$$

Circuits Current, I.

$$I = \frac{V_S}{Z} = \frac{100}{19.4} = 5.14\text{Amps}$$

Voltages across the Series RLC Circuit, V_R, V_L, V_C.

$$V_R = I \times R = 5.14 \times 12 = 61.7 \text{ volts}$$

$$V_L = I \times X_L = 5.14 \times 47.13 = 242.2 \text{ volts}$$

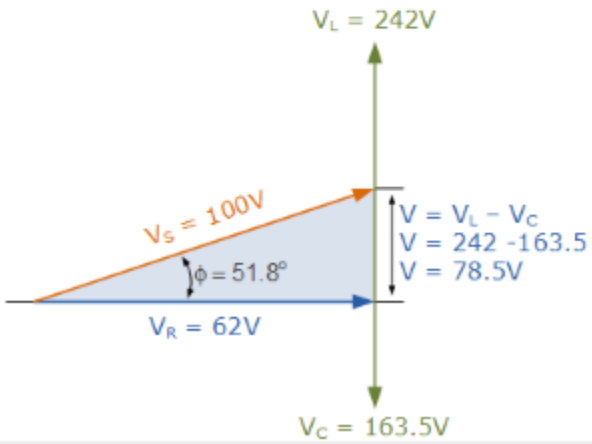
$$V_C = I \times X_C = 5.14 \times 31.8 = 163.5 \text{ volts}$$

Circuits Power factor and Phase Angle, θ.

$$\cos\phi = \frac{R}{Z} = \frac{12}{19.4} = 0.619$$

$$\therefore \cos^{-1} 0.619 = 51.8^{\circ} \text{ lagging}$$

Phasor Diagram.



B)

Q4/A)

Solution

$$N_s = \frac{120f}{P} = \frac{120 \times 50}{6} = 1000\text{rpm}$$

$$S = \frac{Ns - N}{Ns} \times 100\%$$

$$0.03 = \frac{1000 - N}{1000},\ N = 970\text{rpm}$$

$$B = \frac{\Phi}{A} = \frac{500\times10^{-6}}{4\times10^{-4}} = 1.25\ \text{T}$$

$$H = \frac{MMF}{\ell} = \frac{NI}{\ell}$$

$$I = \frac{H\times\ell}{N} = \frac{1500\times0.47}{60} = 11.8A$$

$$\mathcal{R} = \frac{\ell}{\mu o \mu r A}$$

$$\mathcal{R} = \frac{0.47}{4\Pi\times10^{-7}\times370\times4\times10^{-4}} = 1.416\times10^{6}\ AT/W$$

$$L = \frac{N\Phi}{I} = \frac{60\times500\times10^{-6}}{11.8} = 0.00254\text{H}$$

B)

(i) Control from stator side

1. By changing the supply frequency
2. By changing the number of stator poles
3. By changing the supply voltage

(ii) Control from rotor side

1. By inserting resistance in rotor circuit
2. By various ways of cascade connection
3. By injecting EMFs in the rotor circuit

Extra notes:

External Evaluator

This course book is reviewed by (**Rizan Ahmed Ali).**

The course book assessed and approved all content of the Electrical Engineering subject as she admitted the course book well organized and is almost covered the several terms of Electrical aspects.

Rizan Ahmed Ali

Msc Electrical Engineering