Module (Course Syllabus) Catalogue

2022-2023

College/ Institute	**Erbil Technology College**	
Department	**Department of Electricity**	
Module Name	**DC machine**	
Module Code	**DEC302**	
Degree	**Technical Diploma**	
Semester	**3**	
Qualification	**Ms.c**	
Scientific Title	**Assistant Lecture**	
ECTS (Credits)	**8**	
Module type	**Core**	
Weekly hours	**6**	
Weekly hours (Theory)	**(2)hr Class**	**(118) Total hrs Workload**
Weekly hours (Practical)	**(2)hr Class**	**(64) Total hrs Workload**
Number of Weeks	**12**	
Lecturer (Theory)	**Abubaker aziz ahmed**	
E-Mail & Mobile NO.	**abubaker.ahmed@epu.edu.iq 07504889179**	
Lecturer (Practical)	**Mustaq talib ,yousif ,Zahra**	
E-Mail & Mobile NO.		
Websites		

Course Book

Course Description	**DC Generators**: Classification of DC generator, Brush drop, EMF equation, Derivation of generated emf, Losses in DC generator, Power stages, Condition for maximum efficiency, Armature reaction, Demagnetising and cross, magnetising conductors, Demagnetising ampere, turns per pole, Cross, magnetising ampere,t urns per pole, Compensating windings, Commutation, Value of reactance voltage, Methods of improving commutation, Equalizer rings, Characteristic of DC generators, Voltage build up of shunt generators, Conditions for build-up of shunt generator, Voltage regulation, Parallel operation of DC generators, Applications of DC generators. **DC Motors:** Voltage equation, Back emf, Condition for maximum mechanical power, Armature torque of a motor, Relation of speed with back emf and flux, Characteristic of DC motors, Speed control of DC motors, Ward-Leonard control (Voltage control), Necessity of starter for starting of DC motor, Three point starter, Four point starter, DC shunt motor starter design, Electric breakings of DC shunt and series motors, Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test or back to back test, Retardation test or Running test, Field's test. Uses of DC motors.
Course objectives	• **Course objective:** ❖ DC machines objective is to familiarize electric department students with basic structure, function, operation, characteristics and if any mathematical and practical problems associated with electrical DC machines. That will help electric department students to have a better understanding of the DC electrical machine subject. ❖ Briefly the course structure will involve mainly the following topics. ✓ DC Machines i. **DC. Generators**: Principle of D.C. generator and motor, construction, types of generators, E.M.F. equation, and voltage build up process, critical resistance and speed, characteristics of generators, performance equation and efficiency, No load & load characteristics. Performance of shunt, series and compound generators. ii. **DC motors**: Type of motors, torque equation, characteristics, losses and efficiency, starters: Necessity of starter, Three point & four point starter. Introduction to soft starter. Torque-speed characteristics of shunt, series & compound motors,

	Speed control: Basic concept of Static speed control of DC machines, Ward Leonard method. Losses & efficiency in DC. machines by direct load test and swinburne test
Student's obligation	The students should attend the theoretical lectures and study them very well to understand them and ask about any part which is not clear, also the students should have daily examinations about the previous lecture and solve the homework questions. For the practical part the students should attend in time every week to make the experiment and prepare a report about it, in addition the students should have daily exams about the previous experiment and of course there will exams at the end of each term At the end of the semester the students should have both practical and theoretical examinations. Missed classes will not be compensated including the quizzes and the scheduled assignments. The students will lose marks on unattended classes with quizzes unless a legal document or authorized leave is presented which should explain the excuse of the absence. However, the absent student should take the responsibility for making up the missed lecture. 1. Regular attendance to classes.(must not be exceed to 10%) 2. Written tests clearly linked to learning objectives.
Required Learning Materials	• **Forms of teaching** **Lecturing style in theory and laboratory in practice.** Methods of delivering the course (teaching method): The teaching method used to deliver the course material does varies, but mainly using data show (power point). Variety methods are implemented, whenever necessary, to bring about a better understanding of the electrical machine material to the students. Power point slides contain a simplified notes (appropriate method which is suitable for students to understand more easily), sometimes via animations, videos, tables, diagrams and figures. Power point is a modem teaching method, that is both time and money saving. Speed teaching is less boring for student, and encouraging students to participate in the subject, via asking questions on the subject. **Means of explanation:** 1. Data show and power point 2. White board 3. Laboratory exercise model. 4. Video lessons (recorded by the lecturer), inserted in Moodle program on line

	NOTE: Due to the health condition, we are using Zoom In software to trample theory

	Task		Weight (Marks)	Due Week	Relevant Learning Outcome
Evaluation	Paper Review				
	Assignments	Homework	14%		
		Class Activity	2%		
		Report			
		Seminar	10%		
		Essay			
		Project			
	Quiz		4%		
	Lab.		14%		
	Midterm Exam(P+T)		16%		
	Final Exam (P+T)		40%		
	Total		100%		

Specific learning outcome:

Student learning outcome:

- **Explain construction and operation principle of dc motors and dc generators**

1. Describe the working principle of a DC motor and a DC generator.
2. List and describe the main components of a DC generator.
3. Describe the operation of, and factors affecting output and direction of current flow in DC generators.
4. Describe the operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors.

Describe the difference between motors and state the use of series wound, shunt wound and compound DC motors

Course References:

Key references:

i. A text book of Electrical Technology by Thiraja
ii. Electrical Engineering ,U.A. Bakshi @V.A Bakshi
iii. Electrical Technology, U.A. Bakshi @V.A Bakshi

- **Useful references:**

i. Electrical Machines, U.A. Bakshi @V.A Bakshi
ii. Direct current Machine, R.K. Rajput

	iii. Electrical Machines, S.N. Ali ▪ **Magazines and review (internet): *open*.** Students are free to use the above course books or any alternative electrical machine books of their own

Course topics (Theory)	Week	Learning Outcome
• Introduction to DC machines • Principle of operation of a D.C Generator and its construction • Different types of pitches • Types of winding: Lap winding vs. Wave winding	1	
• Types of D.C Generators • EMF equation of a D.C Generator • Different types of losses and condition for maximum efficiency	2	
• D.C Generator Characteristics and concept of critical field resistance and critical speed • Condition for Maximum Efficiency Generator	3	
• Armature reaction, its effect and control • Commutation, its effect and control • Parallel operation of D.C Generators	4	
• Inter pole winding • Compensating winding • Solution problem about different type of generator	5	
• Introduction to D.C. Motors. • Structure and application of D.C. Motors. • Principle of operation of a D.C motor • Back emf, voltage equation of a D.C motor, Condition for maximum power developed	6	
• Speed regulation of a D.C motor • D.C motor characteristics • Application of different types of D.C motors	7	
• Armature torque of D.C motor and factors affecting it • Different methods for speed control of D.C motors • Losses and efficiency in D.C. Motors	8	
• Back emf and torque equation driving.	9	

• Solution problem about emf of DC motor	10	
• Solution problem about speed and torque of DC motor • Solution problem about speed regulation of DC motor	11	
• Speed control of shunt motor. • Permanent magnet D.C. motor. • Compounded D.C. motor. • Reversing the direction of rotation	12	
Practical Topics: The laboratory will involve experiments on the laboratory bench kits, along with the corresponding subject in the lectures. A brief outline of the experiments to be done are as follows:	**Week**	**Learning Outcome**
• Type of D.C machine, Determine leads of DC machine windings	1	
• Magnetization characteristic of D.C generator (separately exited)	2	
• Magnetization characteristic of D.C generator (self-exited)	3	
• Relationship between voltage & speed and critical resistance (separately exited) Generator	4	
• Relationship between voltage & speed and critical resistance (self-exited) Generator	5	
• Load characteristic for (separately exited) Generator (load curve) and internal and external characteristic	6	
• Load characteristic for (self-exited) Generator (load curve) and internal and external characteristic	7	
• Load characteristic (Differential of cumulative)	8	
• Speed control (voltage control of field control) of DC motor	9	
• Load characteristic of D.C shunt motor (Torque & of efficiency)	10	
• Load characteristic of D.C series motor (Torque & of efficiency)	11	
• Determine of efficiency and loss in D.C motor.	12	

Questions Example Design

1-Compositional:

Q/What the main function of the following parts in dc machine?

1. Armature core
2. Commutator
3. Inter pole winding

2-Multiple choices:

Q/ choose the most correct answer and *(prove your chosen with aide of equation):*

1- The emf generated in DC generator is directly proportional to:
a- flux/pole b- speed of armature c- number of pole d- all of the above

2- In DC series motor torque is approximately proportional to:
a- I^2a b- Ia c- V d- V^2

3-Problems
A DC series motor runs at **500 rpm**. On **220V** supply drawing a current of **50A**.the total resistance of the machine is **0.15Ω**; **calculate the value of the extra resistance** to be connected in series with the motor circuit that will reduce the speed to **300rpm**.The load **torque being half of the previous value**. *Assume flux proportional to the current.*

Extra notes:

External Evaluator

- This course book have been reviewed, resigned and approved by (Hilmi Fadhil Ameen.) former lecturer of this subject.

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Erbil Technology College

Program: Diploma (120 ECTS)

Total No. of Weeks/Semester: **20 weeks**

(12 weeks active lecturing + 2 weeks T&P Mid Term Exam + 2 weeks T&P Final Exam + 1 week Final & Re-sit exam GAP + 2 weeks Re-sit Final T&P exam + 1 week Breaks and Holidays = 20 weeks)

Department name:	Department of Electricity	1.0 ECTS =	27	working hours
Module Name:	DC Electrical Circuits	X	Y	Z
Module Code:	DEC302	2	2	0

ECTS Workload Calculation Form

Activity	S	Description		Activity Type	No.	Time Factor	Workload
Course	1	Theory	In class	f	12	**2**	24
	2		Online	f		**2**	0
	3	Preparation (1.5 theory)		h	12	**3**	36
	4	Practical		f	12	**2**	24
	5	Preparation (1.0* practical)		h	12	**1**	12
	6	Tutorial		f	12	**0**	0
Site Visists and Lab Experiments	7	Scientific/Field Trips		f	1	6	6
	8	Practical/Lab Reports		h	8	1.25	A
Assignment	9	Homework		h	5	2	10
	10	Report		h	0	2	0
	11	Seminar		h	1	5	5
	12	Paper		h	0	12	0
	13	Essay		h	0	8	0
	14	Project/Poster		h	0	10	0
Assessment	15	Quiz		h	4	1	4
	16	Mid Term	Theory	f	1	2	2
	17		Preparation	h	1	**6**	6
	18		Practical	f	1	1	1
	19		Preparation	h	1	**4**	4
	20	Final	Theory	f	1	2	2
	21		Preparation	h	1	**8**	8
	22		Practical	f	1	2	2
	23		Preparation	h	1	**6**	6
Face to face hours (f)/12 week				Face to face hours (f)			61
Home hours (h)/16 week				Home hours (h)			101
Total hours/16 week				Total hours			162
ECTS (Total hours/ 27)							6.000