MUTAH UNIVERSITY
Faculty of Engineering
Department of Electrical Engineering

Course Syllabus
Study Plan 2021: Power and Control Track

Course Code	Course Name	Credits	Contact Hours
0401597	Machines Drive Systems	3	3 T

INSTRUCTOR/COORDINATOR	
Name	Dr. Ziyad Almajali
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Office Hours	10:00-11:00 (Sun, Tues)
Classroom/Time	Hall 1 / 08:00 – 09:30 (Mon, Wend.)

TEXTBOOK	
Title	Electric Motors and Drives Fundamentals, Types and Applications
Author/Year/Edition	Austin Hughes . 2006. Third edition. Newnes
Other Supplemental Materials	
Title	Modern Power Electronics & Ac drives
Author/Year/Edition	B.K. Bose, Pearson Education.

SPECIFIC COURSE INFORMATION

A. Brief Description of the Content of the Course (Catalog Description)

This course is an introductory course in electric drives, covering topics such as the concept and classifications of electric drives, load types, four-quadrant drives, dynamics of motor-load combinations, steady state stability, load equalization, multi-quadrant operations of DC and AC motors, energy relations during starting and braking, solid-state controlled drives including single-phase and three-phase configurations, regeneration and braking through power converters, control of three-phase induction motors, energy-efficient drives, losses in electrical drive systems, and energy conservation in electric drives.

B. Pre-requisites (P) or Co-requisites (C)

0401464 Power Electronics **(P)**
C. Course Type (Required or Elective)
Required
SPECIFIC GOALS
A. Course Learning Outcomes (CLOs)
By the end of this course, the student should be able to: **CLO1: Understand the components of electric machines drives and learn their key characteristics [1].** **CLO2: Understand the basic operation, and efficiency of the electric machines drives [1].** **CLO3: To establish a foundation for evaluating the performance of diverse industrial drives, taking into account factors such as energy efficiency, power quality, economic viability. [2].** **CLO4**: Understand the application requirements and practical feasibility of electric machines drives [2].
B. Student Learning Outcomes (SOs) Addressed by the Course

1	2	3	4	5	6	7
✓	✓					

BRIEF LIST OF TOPICS TO BE COVERED		
List of Topics	**No. of Weeks**	**Contact Hours**
Electric Drive: Concept, classification, and advantages of electrical drives. Types of Loads, Components of load toques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. Determination of moment of inertia, Steady state stability, Transient stability. Multi-quadrant operation of drives.	2	6
Motor power rating: Determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors.	2	6
Starting of Electric Drives: Effect of starting on Power supply, motor and load. Methods of starting of electric motors. Acceleration time Energy relation during starting, methods to reduce the Energy loss during starting.	1	3
Braking of Electric Drives: Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking,	1	3
DC motor drives: Modeling of DC motors, State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor,	1.5	4.5

supply harmonics and ripple in motor current chopper controlled DC motor drives.		
Induction motor drives: Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control.	2.5	7.5
Synchronous motor drives: Variable frequency control, Self Control, Voltage source inverter fed synchronous motor drive, Vector control.	1	3
Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor drive	1	3
Industrial application: Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.	2	6
Total	*14*	*42*

EVALUATION		
Assessment Tool	**Due Date**	**Weight (%)**
Mid Exam	According to the university calendar	30
Course Work (Homeworks, Quizzes, Projects, …etc.)	One week after being assigned	20
Final Exam	According to the university calendar	50

ABET's Students Learning Outcomes (Criterion # 3)		
	Relationship to program outcomes	
ABET 1-7		**Engineering Student Outcomes**
1	√	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	√	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3		an ability to communicate effectively with a range of audiences.
4		an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5		an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6		an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7		an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.