INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**MASTER OF TECHNOLOGY in ELECTRICAL ENGINEERING**
SEMESTER	**2**
COURSE TITLE	**DSP BASED CONTROL OF EV CONVERTERS**
COURSE CODE	**01EV1208**
COURSE CREDITS	**2**

Objective:

1 Student will be able to develop algorithms in the DSP controller for control of Power Electronics based systems.

Course Outcomes: After completion of this course, student will be able to:

1 Develop Program to control different General Purpose I/O peripherals (Apply)

2 Differentiate among the applications of peripherals of DSP controller(Analyze).

3 Develop a program to Acquire signal through ADC (Apply).

4 Design an algorithm for Power Electronics based system and control of Motor(Create).

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
0	0	4	0	0	0	50	50

Contents : Unit	Topics	Contact Hours
1	**Introduction** Interfacing of I/O devices, Timer/Counter operation and their role in power electronic control,, Interrupts operation and their role in control, Introduction to TMS320F28335 DSP controller, architecture,, peripherals, IQ math and use of DSP controller for IQmath, Boot ROM configuration	8

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Contents : Unit	Topics	Contact Hours
2	**DSP controller and peripherals** General Purpose Input Output pins, Introduction, Multiplexing of I/O pins, Input qualification, Use of GPIO for control for converter, Analog to Digital Conversion, Introduction, Internal structure of ADC in TMS320F28335 Auto conversion Sequencer Principle of Operation, Sequential Sampling Mode,, Simultaneous Sampling Mode, Uninterrupted Autosequenced Mode, ADC Clock Prescaler, ADC Calibration, Offset Error Correction, Event Manager:, Operation of Timer in various modes, ePWM Units and HRPWM and their operation, eCAP Capture unit, eQEP circuit and their operation and other feature of Event Manager, Communications Peripherals:, Serial Communications Interface, Serial Peripheral Interface, Inter-Integrated Circuit (I2C) Module	20
3	**PWM Control of Power Electronic Converter** Implementation of DSP algorithm in buck, boost and buck-boost converters, interfacing circuits, Control of VSI in six-step mode,, implementation of various ePWM schemes with DSP controller, Implementation of SVPWM algorithm using ePWM unit	12
4	**Digital Motor Control Algorithms** Development of Clarke and Park Transformations, Three Phase Voltage calculation module,, Ramp control module, Volt per Hertz Profile, Speed Calculator based on Frequency and Period Measurement, SVPWM generation	16
Total Hours		**56**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment No. 01** Write a program to toggle I/O pins of DSP controller	4
2	**Experiment No. 02** Write a program to read ADC in sequential sampling mode and analyze the effect of ADC Prescaler on ADC reading	4
3	**Experiment No. 03** Write a program to read ADC in simultaneous sampling mode with ADC calibration	4
4	**Experiment No. 04** Write a program to operate timer in Up, Down and Up-Down mode and generate PWM of fixed duty cycle.	8
5	**Experiment No. 05** Develop a program for sine PWM scheme using sine table of Boot ROM space	4
6	**Experiment No. 06** Write a program to calculate the duty cycle and/or frequency of the signal using eCAP unit	4

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
7	**Experiment No. 07** Write a program to perform exchange a byte using serial communication	4
8	**Experiment No. 08** Write a program to operate Serial Peripheral Interface (SPI) in loopback mode	4
9	**Experiment No. 09** Write a program to generate Pulses for DC-DC converter in High Resolution PWM mode	4
10	**Experiment No. 10** Write a program to calculate the speed of the motor using eCAP/eQEP module.	8
11	**Experiment No. 11** Write a program to transform three phase quantities to two phase quantities using Clarke and Park Transformation	4
Total Hours		**52**

Textbook :

1 TMS320x2833x Analog-to-Digital Converter (ADC) Module Reference Guide, Texas, Texas Instruments, 2007

2 TMS320x2833x, 2823x Boot ROM, Texas, Texas Instruments, 2007

3 TMS320x2833x, 2823x Enhanced Capture (eCAP) Module Reference Guide, Texas, Texas Instruments, 2007

4 TMS320x2833x, 2823x Enhanced Pulse Width Modulator (ePWM) Module Reference Guide, Texas, Texas Instruments, 2007

5 TMS320x2833x, 2823x Enhanced Quadrature Encoder Pulse (eQEP) Module Reference Guide, Texas, Texas Instruments, 2007

6 TMS320x2833x, 2823x System Control and Interrupts Reference Guide, Texas, Texas Instruments, 2007

7 TMS320x2833x, 2823x Serial Communications Interface (SCI) Reference Guide, Texas, Texas Instruments, 2007

8 TMS320x2833x, 2823x Serial Peripheral Interface (SPI) Reference Guide, Texas, Texas Instruments, 2007

9 Digital Motor Control Software Library', Digital Control Systems (DCS) Group, Texas, Texas Instruments, 2018

References:

1 TMS320F28335 DSP Controller, TMS320F28335 DSP Controller, Texas, Texas Instruments, 2018

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
5.00	10.00	15.00	30.00	20.00	20.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc

2 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory

3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

1 https://archive.nptel.ac.in/courses/108/105/108105186/

2 https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/modeling-and-digital-implementation-of-power-electronic-converters-for-renewable-applications/?v=c86ee0d9d7ed

3 https://archive.nptel.ac.in/courses/108/105/108105180/