MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB

(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

3rd Semester

Subject Type			Course Code	Course Name	Credit Points	Credit Distribution			Mode of Delivery		
						Th	Pr	Tu	Offline	Online	Blended
CC	CC5	CC5.1	RBEC301	Electrical Machines	4	4	0	0	✓	✓	✓
		CC5.2	RBEC391	Electrical Machines Lab	2	0	2	0	✓	✓	✓
	CC6	CC6.1	RBEC302	Microprocessors, Embedded Controllers and Real time Operating Systems	4	4	0	0	✓	✓	✓
		CC6.2	RBEC392	Microprocessors, Embedded Controllers and Real time Operating Systems lab	2	0	2	0	✓	✓	✓
	CC7	CC7.1	RBMS301	Kinematics & Dynamics of Machines	4	4	0	0	✓	✓	✓
		CC7.2	RBMS391	Kinematics & Dynamics of Machines lab	2	0	2	0	✓	✓	✓
GE		GE 3.1	RBPH301	Digital signal processing (DSP)	4	4	0	0	✓	✓	✓
		GE 3.2	RBPHT301	Digital signal processing (DSP) Lab	2	0	0	2	✓	✓	✓
SEC		SEC1.1	RBCS301	Introduction to python *	2	2	0	0	✓	✓	✓
	Semester Credits				**26**						

***Course to be completed from MOOCs Platform.**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

Semester-III

DETAILED SYLLABUS

Subject: Electrical Machines
Code: RBEC301
Contact Hours/week: 3L+1T
Credits: 4

OBJECTIVES:

- To study about basic electrical prime movers, electrical transmission and distribution systems.
- To study about the transformers
- To study about the different types of induction motors
- To study about the special machines
- To study about the power system

UNIT I D.C. MACHINES

Constructional details – EMF equation – methods of excitation – self and separately excited generators – characteristics of series, and shunt generators – principle of operation of D.C. Motor – back emf and torque equation – characteristics of series and shunt motors - starting of D.C. Motors – types of starters - speed control and braking of DC. motors.

UNIT II TRANSFORMERS

Constructional Details – Principle Of Operation – EMF Equation – Transformation Ratio – Transformer on No Load – Parameters Referred To HV/LV Windings – Equivalent Circuit – Transformer on Load – Regulation - Testing – Load Test - 3- PHASE Transformers connections.

UNIT III INDUCTION MOTORS

Construction – types – principle of operation of three-phase induction motors – equivalent circuit – starting and speed control – single-phase induction motors (only qualitative analysis). UNIT IV SYNCHRONOUS AND SPECIAL MACHINES 8 Construction of Synchronous machines-types – induced emf – brushless alternators – reluctance motor – stepper motor servo motor.

UNIT V INTRODUCTION TO POWER SYSTEM

Structure of electric power systems – generation, transmission, sub-transmission and distribution systems - EHVAC and EHVDC transmission systems – substation layout. (Concepts only).

OUTCOMES:

- Understanding the principles of operations and characteristics of DC machines
- Knowledge of electrical transformers and induction motors
- Know about the different types of induction motors
- Able to visualise the operation of synchronous motors stepper and sevo motors.
- Comprehending the power transmission and distributing systems.

TEXT BOOKS :

1. Murugesh Kumar K. , „Electric Machines Vo I", Vikas Publishing House Pvt Ltd, 2010.
2. Murugesh Kumar K. , „Electric Machines Vol II", Vikas Publishing House Pvt Ltd, 2010
3. Mehta V.K. and Rohit Mehta, „Principles of Power System", S.Chand and Company Ltd, 2003

REFERENCES:

1. Fitzgerald A.E., Charles Kingsley, Stephen.D.Umans, „Electric Machinery", Tata McGraw Hill publishing Company Ltd, 2003.
2. Gupta J.B., „Theory and Performance of Electrical Machines", S.K.Kataria and Sons, 2002
3. Kothari D.P. and Nagrath I.J., „Electric Machines", Tata McGraw Hill Publishing Company Ltd, 2002. 4. Bhimbhra P.S. , „Electrical Machinery", Khanna Publishers, 2003.

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

Subject: Electrical Machines Lab
Code: RB-EE291
Contact Hours/week: 3P
Credits: 2

OBJECTIVES:

- To impart hands on experience in verification of circuit laws and theorems
- To measure the circuit parameters, study of circuit characteristics and simulation of time response. • To expose the students to the basic operation of electrical machines and help them to develop experimental skills.
- To construct Induction Motors with Loading Arrangement
- To verify the circuit laws and theorems and measure the circuit parameters.

LIST OF EXPERIMENTS:

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. shunt motor.
4. Load test on D.C. series motor.
5. Swinburne‟s test
6. speed control of D.C. shunt motor.
7. Load test on single phase transformer
8. open circuit and short circuit tests on single phase transformer(Determination of equivalent circuit parameters).
9. Load test on single phase induction motor.
10. No load and blocked rotor tests on three phase induction motor (Determination of
11. equivalent circuit parameters)
12. Load test on Three phase induction motor.
13. Study of Starters

OUTCOMES:

- Knowledge about the basic operation of electrical machines and help them to develop experimental skills.
- Ability to verify the circuit laws and theorems and measure the circuit parameter.
- Ability to operate electrical machines.
- Ability to construct a Single Phase ,Three Phase Induction Motor with Loading Arrangement and to operate switchs
- Ability to determination the equivalent circuit parameters.

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

Subject: Microprocessors, Embedded Controllers and Real time Operating Systems
Code: RB-EC301
Contact Hours/week: 3L+1T
Credits: 4

OBJECTIVES:
The student should be made to:
- Study the Architecture of 8085 microprocessor.
- Study the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study the Architecture of 8051 microcontroller.

UNIT I 8086 MICROPROCESSOR

Architecture – Pin description – Operating modes – Registers – Interrupts – Bus cycle – Addressing modes – Typical configuration of 8086 system – Overview of Instruction set.

UNIT II 80286 MICROPROCESSOR

Functional block diagram - Modes of operation – Real and protected mode – Memory management and protection features.

UNIT III 80386, 80486 PROCESSORS

80386: Functional block diagram - Programming model - Addressing modes and instruction set overview – Address translation - Modes of operation - 80486 processor - Functional block diagram - Comparison of 80386 and 80486 processors.

UNIT IV PENTIUM MICROPROCESSOR

Introduction – Architecture – Special Pentium registers – Memory management.

UNIT V PIC MICROCONTROLLER

Architecture – Memory structure – Register File – Addressing modes – Interrupts – Timers: Modes of operation PIC PERIPHERAL FUNCTIONS AND SPECIAL FEATURES: PWM output – Analog to Digital converter – UART – Watchdog timer – RESET Alternatives – Power Down mode – I2C Bus operation

OUTCOMES:
At the end of the course, the student should be able to:
- Design and implement programs on 8085 microprocessor.
- Design and implement programs on 8086 microprocessor.
- Design I/O circuits.
- Design Memory Interfacing circuits.

- Design and implement 8051 microcontroller based systems.

TEXT BOOKS:

1. Barry B Brey, "The Intel Microprocessor 8086/8088, 80186/80188, 80286, 80386, 80486 Pentium and Pentium processor, Pentium II,III,4 , Prentice Hall of India, New Delhi, 2005.
2. Douglas V Hall, "Microprocessors and Interfacing: Programming and Hardware", McGraw Hill, New Delhi, 2005.
3. John B Peatman, “Design with PIC Microcontroller, McGraw Hill, Singapore, 1st Reprint, 2001

REFERENCES:

1. Mohammed Rafiquzzaman, "Microprocessors and microcomputer based system design", CRC Press, 2005.
2. Walter A Triebel, Avtar Singh .”The 8088 and 8086 microprocessors Programming Interfacing software, Hardware and Applications”,Pearson Education ,2009
3. Myke Pred ko, “Programming and Customising the PIC Microcontroller, “McGraw Hill, USA, 1998

Subject: Microprocessors, Embedded Controllers and Real time Operating Systems lab
Code: RBEC392
Contact Hours/week: 3P
Credits: 2

List of Experiments:

1. LED Interfacing using ARM/ATMEL/PIC microcontroller
2. LCD Interfacing using ARM/ATMEL/PIC microcontroller
3. Keyboard Interfacing using ARM/ATMEL/PIC microcontroller
4. Temperature sensor Interfacing using ARM/ATMEL/PIC microcontroller
5. Stepper Motor Interfacing using ARM/ATMEL/PIC microcontroller
6. Flashing of LEDs using ARM/ATMEL/PIC microcontroller
7. ADC Interfacing using ARM/ATMEL/PIC microcontroller
8. DAC Interfacing using ARM/ATMEL/PIC microcontroller
9. Interrupt pooling using ARM/ATMEL/PIC microcontroller
10. EPROM Interfacing using ARM/ATMEL/PIC microcontroller.
11. Real Time Clock Interfacing using ARM/ATMEL/PIC microcontroller.
12. Implementing zigbee protocol with ARM/ATMEL/PIC microcontroller.
13. Study of one type of Real Time Operating Systems (RTOS) with ARM/ATMEL/PIC microcontroller.
14. Study of basic image processing algorithm using Single board computers such as Raspberry Pi/aurdino, BeagleBone block etc.

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

Subject: Kinematics & Dynamics of Machines
Code: RB-MS301
Contact Hours/week: 3L+1T
Credits: 4

OBJECTIVES:

- To understand the basic knowledge about kinematics of machines.
- To understand the basic components and layout of linkages in the assembly of a system/ machine. • To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I KINEMATIC OF MACHINES

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.

UNIT II GEARS and GEAR TRAINS

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

UNIT III FRICTION

Sliding and Rolling Friction angle – friction in threads – Friction Drives –Belt and rope drives .

UNIT IV FORCE ANALYSIS

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D‟Alembert‟s principle – superposition principle – dynamic Force Analysis in simple machine members.

UNIT V BALANCING AND VIBRATION

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft .

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

OUTCOMES:
Upon completion of this course,
- the students be able to understand the basic knowledge of kinematics of machines
- Students can able to apply fundamentals of mechanism for the design of new mechanisms
- Able to know about the linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- Impart knowledge about the gears and gear trains.
- Ability to analyse them for optimum design.

TEXT BOOKS:
1. Ambekar A.G., "Mechanism and Machine Theory" Prentice Hall of India, New Delhi, 2007
2. Shigley J.E., Pennock G.R and Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press, 2003

REFERENCES:
1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh. A, and A.K. Mallick, "Theory and Machine", Affiliated East-West Pvt. Ltd., New Delhi, 1988. 3. Rao.J.S. and Dukkipatti R.V. "Mechanisms and Machines", Wiley-Eastern Ltd., New Delhi, 1992.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low Prices Student Edition, 1999. 5. V.Ramamurthi, Mechanisms of Machine, Narosa Publishing House, 2002.
6. Robert L.Norton, Design of Machinery, McGraw-Hill, 2004.

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

Subject: Kinematics & Dynamics Lab
Code: RB-MS 391
Contact Hours/week: 3P
Credits: 2

OBJECTIVES:
• To supplement the principles learnt in kinematics and Dynamics of Machinery.
• To understand how certain measuring devices are used for dynamic testing.

LIST OF EXPERIMENTS

1. a) Study of gear parameters. b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms. b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system. b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus. c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination. b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a)Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies. b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses. b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies. c) Determination of transmissibility ratio using vibrating table.

OUTCOMES:
- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Ability to use the measuring devices for dynamic testing.

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

Subject: Digital Signal Processing
Code: RBPH301
Contact Hours/week: 3L+1T
Credits: 4

OBJECTIVES:

- To understand the concept of information, types of channels
- To understand the capabilities of various source coding theorems and the fundamental limit of transmission over the channel.
- To understand the various concepts of signal processing with its applications.
- To understand the capabilities of various channel coding theorems.
- To develop the knowledge on pass band communication and spread spectrum.

UNIT I ARCHITECTURE OFTMS320C5X

Introduction -Bus structure-Central Arithmetic Logic unit(CALU)-Auxiliary Register ALU(ARAU)-Index register(INDX)-Auxiliary register compare register-Block move address register-,Block repeat registers-parallel logic unit-memory mapped registers-program controllers-on chip features.

UNIT II TMS320C5X PROGRAMMING

Assembly language syntax-Addressing modes, Load/store instructions-Addition/subtraction instructions-Move instructions-Multiplication instruction-NORM instruction-Program control instructions-Peripheral instructions-Instruction Pipelining inC5x-Pipeline structure, Pipeline operationNormal pipeline Operation.

UNIT III APPLICATIONS

C50 based starter kit-Programs for familiarization of the addressing modes-Program for familiarization of Arithmetic Instructions-Programs in C5x for Processing Real time signals.

UNIT IV ARCHITECTURE OF TMS320C54X

Introduction-Architecture-Buses-Memory Organization-CPU-ALU-Barrel shifter-Multiplier/Adder unitCompare, Select and store unit-Exponent Encoder-C54X pipeline-On chip Peripherals-Data Address Generation logic-Program address generation logic.

UNIT V TMS320C54X PROGRAMMING

Data Addressing-Arithmetic instructions-Move instructions-Load/Store instructions-Logical instructions-Control instructions-Conditional store instructions-Repeat instructions-I/o instructions-Bit manipulation instructions-parallel instructions-special instructions-Application programs.

OUTCOMES: Upon completion of the course, students will be able to

- Know about the various concepts of signal processing with its applications
- Discuss the representation of signals and the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals.
- Know about the capabilities of various source coding theorems and the fundamental limit of transmission over the channel.
- Design the baseband and band pass signal transmission and reception techniques.
- Explain error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.

TEXT BOOK: 1. Venkataramani B., Bhaskar M. "Digital Signal Processors: Architecture, Programming and Applications "Tata McGraw Hill, 2008

REFERENCES:

1. Sem.M.Kuo Woon-Seng.s.Gan "Digital Signal Processors: Architectures, Implementations, and Applications "Pearson Education,2005.
2. Steven W smith "Scientist and Engineer"s Guide to Digital signal processing", 200

Subject: DSP Lab
Code: RBPHT301
Contact Hours/week:
Credits: 2

Sampling and data reconstruction process. Z transforms.

Discrete linear systems. Frequency domain design of digital filters.

Quantization effects in digital filters.

Discrete Fourier transform and FFT algorithms.

High Speed convolution and its applications to digital filtering. Multi-rate filtering.

Suggested Text Books & References

Rabiner, L.R. & Gold, B., "Theory and Application of Digital signal Processing", Prentice Hall, 1989. Oppenheim & Schafer, "Digital Signal Processing", Prentice Hall, 1995.

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. In Robotics& 3D Printing (In-house)
(Effective for Students Admitted in Academic Session 2020-2021)
In CBCS Format

Subject: Introduction to python

Code: RBCS301

Contact Hours/week:
Credits: 2

UNIT 1: Motivation for Computing
UNIT 2: Welcome to Programming!!
UNIT 3: Variables and Expressions : Design your own calculator
UNIT 4: Loops and Conditionals : Hopscotch once again
UNIT 5: Lists, Tuples and Conditionals : Lets go on a trip
UNIT 6: Abstraction Everywhere : Apps in your phone
UNIT 7: Counting Candies : Crowd to the rescue
UNIT 8: Birthday Paradox : Find your twin
UNIT 9: Google Translate : Speak in any Language
UNIT10: Currency Converter : Count your foreign trip expenses
UNIT 11: Monte Hall : 3 doors and a twist
UNIT 12: Sorting : Arrange the book