Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
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Choice Based Credit System (CBCS) Scheme in light of NEP-2020
B. Tech/B.Tech+MBA in Mechanical Engineering
(2021-2025)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME402	DCC	**THEORY OF MACHINES**	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

This course provides comprehensive knowledge of (A) Mechanism and machine (B) Kinematics of plane motion, (C) Cam and Follower, (D) Gears and Gear Train, (E) Gyroscope.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Students will be able to define systematically design and develop mechanisms to perform a specified task and demonstrate an understanding of the concepts of various mechanisms and pairs.
2. Students will be able to do the velocity and acceleration analysis of simple mechanisms.
3. Students will be able to explain effectively present written, oral, and graphical solutions to design problems & develop ability to come up with innovative ideas and design a layout of cam for specified motion.
4. Students will be able demonstrate an understanding of principle of gears.
5. Students will be able to synthesis simple gyroscopic forces and couple, and gyroscopic effect in airplanes, ship and vehicle.

Syllabus

Unit – I **(9 Hrs)**

Mechanisms and Machines: Mechanism, machine, plane and space mechanism, kinematic pairs, kinematic chains their classification, degrees of freedom, Grubler's criterion, kinematics inversions four bar mechanism and slider crank mechanism, equivalent linkages, pantograph, straight line motion mechanism, Devis and Ackermann's steering mechanism, Hooke;s joint.

Unit – II **(10 Hrs)**

Motion: kinematics of Plane motion, Absolute & Relative motion, Displacement, Velocity and Acceleration Analysis by Graphical & Analytical methods, Velocity image, Velocity of rubbing, Kennedy's Theorem, Acceleration image, Acceleration polygon, Coriolis acceleration component, Klein's construction, Velocity and Acceleration Analysis using complex Raven's methods..

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BTME402	DCC	THEORY OF MACHINES	60	20	20	30	20	3	1	2	5

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Unit – III **(9 Hrs)**

Cams: Classification of Cams and Followers, Radial Cam Terminology, Analysis of Follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), Pressure Angle, Radius of Curvature, Cam Profile for radial and offset followers Synthesis of Cam Profile by Graphical Approach.

Unit – IV **(9 Hrs)**

Gears: Classification of gears and its type, Gear Terminology, Law of gearing, Tooth profiles, velocity of sliding, Path of contact, Arc of contact, Contact Ratio, Interference and Undercutting, Conjugate action.

Gear Trains: Simple, compound, reverted and epi-cyclic gear trains. Velocity ratio and torque calculation in gear trains

Unit – V **(8 Hrs)**

Gyroscope: Gyroscopic Action in Machines, Angular Velocity and Acceleration, Gyroscopic torque/ couple, Gyroscopic effect on Naval Ships, Stability of Two and Four Wheel Vehicles, Rigid disc at an angle fixed to a rotating shaft.

Text and Reference Books:

1. "Mechanism and Machine Theory" by Ambekar AG; PHI. Eastern Economy Edition 2015
2. " Theory of machines & Mechanism " by Uicker & Shigley, Second Edition, Oxford University Press, 2010.
3. "Theory of Machines" by S.S. Ratan, 3rd Ed., TMH, 2012.
4. "Theory of Machines" by Dr. Jagdish Lal; Metropolitan Book Co; Delhi, 2015
5. " Mechanism and Machine Theory "by Rao J S and Dukkipati; New Age, 2014
6. "Mechanics of Machines" by V. Ramamurti, 3rd Ed. Alpha Science, 2010.

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BTME402	DCC	**THEORY OF MACHINES**	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

List of Experiments

1. To synthesize and demonstrate the inversion of four bar mechanism through animation and model.
2. To synthesize and demonstrate the inversion of single slider and double slider crank mechanism through animation and model.
3. To construct and demonstrate the steering mechanism based on Davis & Ackermann's Steering mechanisms principles.
4. To find out velocity & acceleration of slider crank mechanism by Klein's Construction.
6. To draw Involutes profile of a gear by generating method.
7. To find out velocity ratio of various gear trains.
8. To study working of sun and planet epicycle gear train mechanism using models
9. To study various types of belt drives & find out the velocity ratio of the drive.
10. To finds out gyroscopic couple

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BTEE503	DCC	Control System Engineering	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
The course will provide understanding of control system and mathematical modeling of the system

Course Outcomes (COs):
After the successful completion of this course students will be able to

1. Demonstrate the understanding of basic element and modeling of the control system.
2. Analyze the stability in time domain and frequency domain
3. Design the controller and compensators for the system

Syllabus

UNIT I **8 Hrs**

Introduction: Basic Elements of Control System, Open loop and Closed loop systems, Differential equation, Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph, Constructional and working concept of ac servomotor.

UNIT II **9 Hrs**

Time Domain Analysis: Standard test signals, Time response of first order systems, Characteristic Equation of Feedback control systems, Transient response of second order systems ,Time domain specifications , Steady state response , Steady state errors and error constants , P, PI, PD and PID Compensation

UNIT III **8 Hrs**

Stability Analysis and Root locus: The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

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BTEE503		Control System Engineering	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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UNIT IV **8 Hrs**

Frequency domain Analysis: Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots, Stability analysis. Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain

UNIT V **8 Hrs**

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Textbooks:

1. I.J.Nagrath and M.Gopal," Control System Engineering", New Age International Pu blishers, 7th Edition, 2021.
2. Richard C Dorf; Robert H Bishop, "Modern control system", Pearson Education, 13th Edition, 2017.

References:

1. M F Golnaraghi and Benjamin C Kuo, "Automatic control systems", New York McGraw-Hill Education, 9th Edition, 2017.
2. M.Gopal, Digital Control and State Variable Methods, Tata McGraw- Hill 4th Edition, 2014.
3. Joseph J DiStefano, Allen R Stubberud and Ivan J Williams, Schaum's Outline Series, "Feedback and Control Systems", Tata McGraw- Hill, 2nd Edition 2014.
4. John J.D'azzo & Constantine H.Houpis, 'Linear control system analysis and design', Tata McGraw-Hill., 8th Edition.

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BTEE503	DCC	Control System Engineering	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

List of Experiments:

1. Perform step response of a transfer function
2. Perform impulse response of a transfer function
3. Perform ramp response of a transfer function
4. Analyze torque speed characteristics and determine the transfer function of a DC servomotor.
5. Analyze characteristics of a small AC servomotor and determine its transfer function.
6. Perform the transient and frequency response of a second order network.
7. Perform the performance of various types of controllers used to control the temperature of an oven.
8. Draw nyquist plot from a transfer function
9. Draw root locus from a transfer function
10. Draw bode plot from a transfer function

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTECIOT501	DCC	Communication Systems	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
To provide the fundamentals, principles, concepts of communication systems and various modulation techniques of analog and digital communication systems.

Course Outcomes (COs):
After completion of this course the students will be able to:

1. Analyze various analog modulation and demodulation techniques and apply suitable modulation techniques for various applications.
2. Analyze various digital modulation and demodulation techniques and apply suitable modulation techniques for various applications.
3. Understand different types of source and channel coding techniques.

Syllabus:

UNIT I **9 Hrs.**

Amplitude modulation Techniques: Need of modulation, Amplitude modulation: mathematical representation of AM, modulation index, frequency spectrum, single tone and multi tone AM, generation of AM (square law modulator, switching modulator), Detection of AM (Square law detector, envelope detector),
Power distribution, DSB-SC: generation and detection techniques, SSB: generation and detection techniques, VSB.

UNIT II **8 Hrs.**

Angle modulation Techniques: Frequency and phase modulation, spectrum and bandwidth, Narrowband FM, Wideband FM, FM Modulators: Direct and Indirect method of frequency modulation, FM Detectors: Slope Detector, Foster Seeley Discriminators, Ratio-Detectors and PLL detectors, AFC, Pre-Emphasis and De-Emphasis filters.

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BTECIOT501	DCC	Communication Systems	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT III **9 Hrs.**

Digital conversion of Analog Signals: Sampling theorem, types of sampling, signal reconstruction and reconstruction filters, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position modulation, Quantization, quantization error, Pulse Code Modulation, Companding, TDM-PCM, Differential PCM, Delta modulation, Adaptive Delta modulation.

UNIT IV **9 Hrs.**

Digital Modulation Techniques: Phase shift Keying (PSK)- Binary PSK, differential PSK, differentially encoded PSK, Quadrature PSK, M-ary PSK and associated Prob. of Error. Frequency Shift Keying (FSK)- Binary FSK (orthogonal and nonorthogonal), M-ary FSK and associated Probability of Error. Comparison of BPSK and BFSK, Quadrature Amplitude Shift Keying (QASK), Minimum Shift Keying (MSK).

UNIT V **8 Hrs.**

Information Theory & Coding: Introduction to Information Theory, Channel Capacity, Source Coding, Entropy Codes: Huffman Coding & Shannon-Fano Coding, Linear Block Codes, Hamming Weight and Distance Properties, Syndrome Decoding, Cyclic Codes, Convolutional Codes.

Text Books:

1. B.P. Lathi and Zhi Ding, "Modern Digital and Analog Communication System"; 4thEdition, Oxford University Press, 2011.
2. Herbert Taub, Donald L Schilling, Gautam Saha, "Principles of Communication Systems, McGraw Hill Education; 4th Edition, 2013.

References:

1. Simon Haykin, Michael Moher, "Communication System", John Wiley, 5th Edition, 2010.
2. R.P. Singh and S.D. Sapre, "Communication Systems: Analog and Digital", McGraw Hill Education; 3rd Edition, 2012.

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BTECIOT501	DCC	Communication Systems	60	20	20	30	20	3	1	2	5

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3. H P. Hsu: "Schaum's Outline Analog and Digital Communications", McGraw Hill Education, 4th Edition, 2019.
4. John G. Proakis, Masoud Salehi, "Fundamental of Communication Systems", Pearson Edition, 2nd Edition, 2014.

List of Experiments:

1. To synthesize the Fourier series for periodic Signals.
2. To generate the Frequency Spectrum of various signals using Spectrum Analyzer.
3. To analyze characteristics of AM modulator & Demodulators and calculate the modulation Index.
4. To analyze characteristics of FM modulators & Demodulators.
5. To study signal reconstruction and aliasing and calculate sampling frequency for various signals.
6. To observe the waveforms of PAM, PPM and PWM.
7. To analyze the waveform of PCM signal and reconstruct the baseband signal by synchronizing the transmitter and receiver clock.
8. To analyze the Delta modulation waveform and observe the distortion.
9. To analyze Adaptive delta modulation waveform and compare the waveform with DM waveform.
10. To generate the ASK, PSK and FSK modulated signals and their reconstructed signals.

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COURSE CODE	CATE-GORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTRA401	DCC	Power Electronics and Drives	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1. Comprehensive introduction to various power electronic devices, their structure, operating principle, and characteristics.
2. Give exposure to various topologies, working principle and analysis of controlled rectifiers and ac controllers
3. Detailed knowledge on Classifications, structure, operating principle of dc choppers and Inverters
4. Overview on dc and ac drives and their control using power electronic circuits.

Course Outcomes (COs):

After the successful completion of this course students will be able to:

1. Explain various devices and their structure, operating characteristics in the field of electronics.
2. Classify, analyze and design, Control rectifier, chopper and inverter.
3. Apply power electronic circuits for the control of popular applications.
4. Design and analyze Power Electronics circuit using simulation software.

Syllabus

UNIT I **8 Hrs.**

Power Semiconductor Devices and Characteristics: Operating principle and switching Characteristics: Power diodes, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, GTO, MCT, Thyristor: protection, triggering and commutation circuits, Selection of device, Simulation tools.

UNIT II **8 Hrs.**

Controlled Rectifiers and AC Controllers: Single phase ,Three phases, Half controlled , Fully controlled rectifiers, Dual converters , Effect of source and load inductance, AC voltage controllers, Introduction to Cycloconverters.

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BTRA401	**DCC**	**Power Electronics and Drives**	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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UNIT III **9 Hrs.**

DC to DC Converters and Inverters: Step up and Step down Chopper, Chopper classification , quadrant of operation, Switching mode Regulators ,Buck, Boost, Buck-Boost, and Cuk Regulators, Voltage source Inverters , Half bridge , Full bridge

UNIT IV **10 Hrs.**

Introduction to Drives: Basic Elements of Drive , Load characteristics, Static and Dynamic equations of dc and ac machines , Electrical breaking , Rectifier and chopper control of DC drives , Principles of v/f control of AC drives , Open loop and Closed loop schemes for DC and AC drives(Block diagram approach only) , Introduction to vector control of AC drives.

UNIT V **8 Hrs.**

Drives for Robotics & Automation: Thyristor D.C. Drives, Chopper-Fed D.C. Motor Drives, D.C. Servo Drives, Stepper Motor Drive, BLDC Motor Drive, A.C. Servo Drives – Salient features and application, Comparison of all drives, Motor/Drive Selection.

Text Books:

1. Rashid, M.H., "Power Electronics – Circuits, Devices and Applications", PHI, 4th Edition, 2017.
2. Mohan, Udeland and Robbins., "Power Electronics Converters Applications and Design", John Wiley and Sons, New York, 3rd Edition, 2007.

References:

1. Singh, M.D., and Khanchandani, K.B., "Power Electronics", 2nd Edition., Tata McGraw-Hill, 2011.
2. Bose, B.K., "Modern Power Electronics and AC Drives", Pearson Education, 2002.
3. Bimbra, P.S., "Power Electronics", Khanna Publishers, 2006.
4. Hughes, Austin "Electric Motors and Drives Fundamentals, Types and Applications", Elsevier, 2006

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BTRA401	**DCC**	**Power Electronics and Drives**	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

List of Experiments:

1. Study of characteristics of SCR, MOSFET, IGBT.
2. Study of Gate firing circuits
3. To analyze Pulse Width Modulation techniques
4. To analyze Single Phase Half wave controlled converter with R, RL &RLE Load (for firing angles 30,60,90) with/without FD.
5. To analyze Single Phase Half controlled converter with R, RL & RLE Load (for firing angles 30,60,90) with/without FD.
6. To analyze Single Phase Full controlled converter with R, RL & RLE Load (for firing angles 30,60,90) with/without FD.
7. To analyze Study of Thyristor based dc to dc converter (dc chopper)
8. To analyze Speed control of dc motor using closed loop and open loop.
9. To analyze MOSFET based dc to dc converter (buck, boost and buck-boost types with non-isolated output voltage.
10. Study of thyristors controlled DC Drive
11. Study of Chopper fed DC Drive.

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Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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(2021-2025)

COURSE CODE	CATE-GORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTEC405	**AEC**	**Programming with Arduino**	0	0	0	30	20	0	0	4	2

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
The objective of this course is to-
1. Being one of the fundamental courses of Electronics stream its prime objective is to make the students capable of analyzing given electrical network composed by passive element and some active element.
2. To make the students learn how to synthesize an electrical network from a given impedance/admittance function

Course Outcomes (COs):
After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes:
1. Apply the fundamental concepts in solving and analyzing different Electrical networks.
2. Select appropriate and relevant technique for solving the Electrical network in different conditions.
3. Apply mathematics in analyzing and synthesizing the networks in time and frequency domain.
4. Estimate the performance of a particular network from its analysis.

Syllabus

Study of Arduino and various programs based on Arduino.

Experiment List

E.N.	Aim
1.	Understanding Arduino IDE and Arduino board family.
2.	Understanding I/O access on ATMega328p
3.	Interfacing LED and Seven Segment.
4.	Interfacing Switch and Keypad.

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5.	Program based on Timers.
6.	Experimenting data transfer using SPI Communication.
7.	Establishing i2c interface with ATMega328p
8.	Program based on Interrupts.
9.	Program based on Serial Communication.
10.	Interfacing GSM, RFID, Wi-Fi.

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