



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## B.Tech (Mechatronics)

SUBJECT CODE	Category	SUBJECT 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				
BTMT601		SCADA System and Applications	60	20	20	0	0	3	0	0	3

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; Q/A - Quiz/Assignment/Attendance, MST Mid Sem. Test.

\***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. To know about the types of transducers and display systems associated with it.
2. To understand the function of Data Acquisition system.
3. To gain information about data acquisition, data logging and application of sensors in condition based monitoring.
4. To learn about communication devices used in Data Acquisition system.

### Course Outcomes (COs):

The students will be able to

1. Identify different elements of SCADA.
2. Interpret the functionality of various elements of SCADA.
3. Control process parameters of given process using SCADA

### Syllabus

#### UNIT I

7hr

**Introduction to SCADA and PLC:** SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. PLC: Block diagram, programming languages, Ladder diagram, Functional Block diagram, Applications, Interfacing of PLC with SCADA.

#### UNIT II

8hr

**SCADA system components:** Schemes, Remote Terminal Unit, Intelligent Electronic Devices, Communication Network, SCADA server.

#### UNIT III

8hr

**SCADA Architecture-**Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems.

#### UNIT IV

9hr

**SCADA Communication-**Various industrial communication technologies- wired and wireless methods and fiber optics, open standard communication protocols.

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## UNIT V

10hr

**Operation and control** of interconnected power system-Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, state estimation.

**SCADA applications** Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water. Case studies, implementation, simulation exercises.

### Text Books:

1. M Stuart A Boyer: SCADA supervisory control and data acquisition, 2009.
2. Gordon Clark, Deem Reynders, Practical Modem SCADA Protocols, 2004.

### References:

1. Green, J. N, Wilson, R, "Control and Automation of Electric Power Distribution Systems", Taylor and Francis, 2007

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## B.Tech (Mechatronics)

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTMT602		Mechatronics System Design	60	20	20	30	20	3	1	2	5

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; Q/A - Quiz/Assignment/Affendance, MST Mid Sem. Test.

\***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. To present architecture of the mechatronics system design
2. To study on broad spectrum characteristics of the mechanical and electrical actuators and their selection for mechatronic systems.
3. Development of process plan and templates for design of mechatronic systems.

### Course Outcomes (COs):

On completion of the course the students will be able to:

1. Interface sensor and actuator for a mechatronic system.
2. Indigenously design and develop a mechatronic system.
3. handle Motion control of driver and motion converter

### Syllabus

#### UNIT I

8hr

Introduction to mechatronics systems. Basic building blocks of mechatronic systems. Mechatronics key elements, Mechatronics in home, office and industry automation, Scope of Mechatronics. Advantages of Mechatronics, pre-requisites for Mechatronics

#### UNIT II

9hr

Mechanical translation and rotational systems, Fluid systems, guide ways, Mechanism used in mechatronics (High resolution scanning mechanisms, Indexing mechanisms), compliant mechanisms, Assembly techniques, Hydraulic and pneumatic actuators, micro actuators. Piezoelectric actuators.

#### UNIT III

10hr

Electrical systems, Electrical actuators, brushless permanent magnet DC motor, Interfacing of DC motors, stepper motor, interfacing of stepper motors, AC servomotor, Drive selection and its applications. Analog to Digital Conversion, Digital to Analog conversion. Performance characteristics of sensors and transducers. Selection criteria for sensors and actuators, interfacing of sensors and actuators.

#### UNIT IV

10hr

**Generalized Mechatronics Design Process:** Recognition of the Need, Conceptual Design and Functional Specification, First principle Modular Mathematical Modeling, Sensor and Actuator

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Selection, Drivers for Actuators, Control System Design, Design Optimization, Prototyping Hardware in-the-loop Simulation, Deployment/Life Cycle, Deployment of Embedded Software.

## UNIT V

8hr

**Real Time Interfacing:** Real time interface – Introduction, Elements of a data acquisition and Control system, overview of I/O process, installation of I/O card and software – Installation of the application software – over framing.

### Text Books:

1. Alciatore, David G., Hystand, Introduction to Mechatronics and Measurement Systems, Tata McGraw-Hill, 4<sup>th</sup> edition, 2011.
2. Ahmad Smaili & Fouad Mrad, Applied Mechatronics, OXFORD university press, 2008
3. Devdas Shetty & Richard A. Kolk, Mechatronics System Design, 2<sup>nd</sup> edition CENGAGE Learning India, 2012.
4. Bolton, Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering, 2<sup>nd</sup> Edition, Addison Wesley Longman Ltd., 1999.

### References:

1. Dan Neculescu, Mechatronics, 1<sup>st</sup> edition, Pearson education, published 2015.
2. Bolton W. , Electronic Control Systems in Mechanical Engineering, 5<sup>th</sup> edition, Pearson education, 2011
3. Singh M.D & Joshi J.G., Mechatronics, 1<sup>st</sup> edition, PHI, 2006
4. Krassimir Georgiev, Modeling and Design of Mechatronic Systems, VDM Verlag, 2010.

### List of Experiments:

1. To study of mechatronics systems and elements of mechatronics systems.
2. To study and analysis of Mechatronics products and systems in manufacturing.
3. To perform various PLC Ladder logics through Siemens PLC kit and Step-7 Micro/Win software.
4. To design and develop networks for control valve study on H- simulator and P- simulator
5. To perform experiment using Electro pneumatic kit.
6. To perform function of X-Y table and conveyer belt using PLC interface with PC.
7. Analysis of Speed control stepper and servo motor using micro processor kit.
8. Design program for Pic and Place Robot.
9. To make ladder logic for Automatic door opening and closing.
10. To study and perform control valves function on electro pneumatic trainer kit.

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SEMESTER VI

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			L	T	P	CREDITS	THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTMEMT610	--	CNC MACHINING TECHNOLOGY	3	1	2	5	60	20	20	30	20

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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Course Educational Objectives (CEOs):

Use of CNC machine tools has become very common in the manufacturing industries(A)A lot of developments have taken place in the CNC machine tools thanks to the developments in the microprocessors and electronics(B)The main objective of the course is to provide the student with an understanding of the construction of the modern CNC machine tools and their programming methods (C) In the programming (D)effort will be made to develop some of the industry standard programming methods such as those used for Fancu controls (E)In the end the student should be able to develop reasonably complex programs using either manual or computer aided part programming methods.

Course Outcomes (COs):

After completion of this course the students are expected to be able to

1. Understand evolution and principle of CNC machine tools
2. Describe constructional features of CNC machine tools
3. Explain drives and positional transducers used in CNC machine tools
4. Write simple programs for CNC turning and machining centers
5. Generate CNC programs for popular CNC controllers
6. Describe tooling and work holding devices for CNC machine tools

Syllabus

Unit - I

INTRODUCTION TO CNC MACHINE TOOLS:

Evolution of CNC Technology, principles, features, advantages, applications; CNC and DNC concept; classification of CNC Machines – turning centre, machining centre, grinding machine, EDM; types of control systems; CNC controllers, characteristics, interpolators– Computer Aided Inspection.

Unit - II

STRUCTURE OF CNC MACHINE TOOL:

CNC Machine building, structural details, configuration and design; guide ways – friction, anti friction and other types of guide ways; elements used to convert the rotary motion to a linear

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## SEMESTER VI

motion – Screw and nut, re-circulating ball screw, planetary roller screw, re-circulating roller screw, rack and pinion, spindle assembly; torque transmission elements – gears, timing belts, flexible couplings, Bearings.

### Unit - III

#### DRIVES AND CONTROLS:

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle; DC and AC servomotors; Open loop and closed loop control; Axis measuring system – synchrony, synchrony-resolver, gratings, moiré fringe gratings, encoders, inductosyn, laser interferometer.

### Unit - IV

#### CNC PROGRAMMING:

Coordinate system, structure of a part program, G & M Codes; tool length compensation, cutter radius and tool nose radius compensation; do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles; programming for machining centre and turning centre for well-known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM packages.

### Unit-V

#### TOOLING AND WORK HOLDING DEVICES:

Introduction to cutting tool materials – Carbides, Ceramics, CBN, PCD–inserts classification-PMK, NSH, qualified, semi qualified and preset tooling; tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.

### References

1. Radhakrishnan P, "Computer Numerical Control Machines", New Central Book Agency, 2002.
2. Rao P.N., "CAD/CAM", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.
3. HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
4. Warren Seamers, "Computer Numeric Control", Fourth Edition, Thomson Delmar, 2002
5. James Madison, "CNC Machining Hand Book", Industrial Press Inc., 1996.
6. Ken Evans, John Polywka & Stanley Gabrel, "Programming of CNC Machines", Second Edition, Industrial Press Inc, New York, 2002
7. Peter Smid, "CNC Programming Hand book", Industrial Press Inc., 2000
8. Berry Leathan – Jones, "Introduction to Computer Numerical Control", Pitman, London, 1987.

### List of Experiments

1. Preparatory activity:



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**SEMESTER VI**

- a. Collect mechanical components manufactured on CNC machines and show difference compared to conventional machining
- b. Identify operations on those components.
- c. Prepare conventional process plan for at least two components.
2. Demonstrate constructional features and modes of operations of CNC
3. Demonstrate inserts, holders and tool management systems.
4. Develop and simulate CNC turning part program (at least five) and identify errors and manufacture on CNC turning machine.
5. Develop and simulate CNC milling part program (at least five) and identify errors and manufacture on CNC milling machine.
6. Prepare part program with CAD/ CAM software (like master cam, NX) and interface with CNC machine.

*W. C. Chaudhary*

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTMT61 1		Robotics and Automation	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; Q/A - Quiz/Assignment/Attendance, MST Mid Sem. Test.

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### Course Educational Objectives (CEOs):

To impart knowledge of:

1. The Area of Robotics & Automation Engineering.
2. Basic concepts of robotics and automation.
3. Ethical implications of the field of robotics.

### Course Outcomes (COs):

Upon completion of the course, Students will be able to understand:

1. The basic concepts of robotics and automation.
2. The history and direction of the field of robotics.
3. The ethical implications of the field of robotics.
4. The basic components in most robots.
5. About the field of Robotics and Automation.

### Syllabus

#### UNIT I

10hr

Introduction of Robotics: Definition, Classification of Robots, Geometric classification and control classification. Robot Elements: Drive systems, Control systems, sensors, End effectors, Gripper actuators and gripper design. Robot drives and power transmission system, Robot drive mechanisms.

#### UNIT II

12hr

Robot Coordinate Systems and Manipulator Kinematics: Representation, Transformation, Homogeneous transforms and its inverse. Manipulators, Kinematics, Parameters of links and joints, Kinematic Chain, Dynamics of kinematic chains, Trajectory planning and control, Advanced techniques of kinematics.

#### UNIT III

12hr

Robot Control: Fundamental principles, Robot Programming: Level of robot programming, Language based programming, task level programming, robot programming for foundry, press work and heat treatment etc., Collision free motion planning.

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## UNIT IV

09hr

Introduction: Automated Manufacturing System, Reasons of Automation, levels of automations, Types of Automations, Industrial Robotics and Mechatronics System: Introduction, Robot Anatomy and Related Attributes, Robot Control Systems, End Effectors, Sensors in Robotics, Industrial Robot Applications.

## UNIT V

10hr

Pneumatic System Design: Introduction, pneumatics system components, pneumatics actuators, application of pneumatics system in automation.

Hydraulics System Design: Introduction, Hydraulic system components, hydraulic actuators, application of hydraulic system in automation.

### Text Books:

1. Deb, Sankha "Robotics Technology and Flexible Automation", Tata McGraw Hill, 2010
2. John J. Craig, "Introduction to Robotics", Pearson, 2009.
3. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.

### References:

1. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover, P.H.I. Learning Private Limited 2007.
2. Hydraulics and Pneumatics by Andrew Parr, JAICO Publishing Home, Ahmedabad 2010. Industrial Automation and Robotics by Er. A. K. Gupta and S. K. Arora, University Science Press, Laxmi Publishing Pvt. Ltd. 2007
3. Robotics and Control by R. K. Mittal and I. J. Nagrath, McGraw Hill Education (India) 2009.
4. Robotic Technology (Vol. I-V) Phillippe Collet Prentice Hall India, 2005.
5. Robotics K.S. Fu, R.C. Gonzalez & CSG Lee New York McGraw Hill International, 1987.

### List Of Experiments

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots.
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world
6. Estimation of accuracy, repeatability and resolution.
7. Various Robot programming exercises.
8. Control of speed, direction and number of revolutions of a stepper motor using PC/PLC.
9. Development of an obstacle avoidance robot using servo motors, ultrasonic and touch sensors.
10. Controlling a variable speed drive through PLC/SCADA.

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SEMESTER VI

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			L	T	P	CREDITS	THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTMEMT611	--	THERMODYNAMICS PRINCIPLES AND APPLICATIONS	3	1	2	5	60	20	20	30	20

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

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**Course Educational Objectives (CEOs):**

(A)To gain knowledge of Basic Concepts of thermodynamics. (B)To study of First law of Thermodynamics. (C)To gain knowledge of Second law of thermodynamics. (D)To gain knowledge of Entropy and Entropy. (E)To study of Gas Power cycles. (F)To study of Properties of gases and gas mixtures.

**Course Outcomes (COs):**

After learning the course, the students should be able to

1. Understand basic terms used in thermodynamics.
2. Understand laws of thermodynamics and its applications.
3. Comprehend the concept and applications of energy, entropy and exergy.
4. Understand various gas and vapor power cycles.
5. Understand the properties of gas mixtures.

**Syllabus**

**Unit - I**

**Basic Concepts:** Microscopic & macroscopic point of view; thermodynamic system and control volume; thermodynamic properties, processes and cycles, work and heat; Thermodynamic equilibrium, Quasi-static process; work transfer and heat transfer processes.

**First law of Thermodynamics:** First law for a closed system undergoing a cycle and change of state; energy, PMM1, first law of thermodynamics for steady flow process, steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, heat exchanger and throttling process, filling and emptying process.

**Unit - II**

**Second law of thermodynamics:** Limitations of first law of thermodynamics; Kelvin-Planck and Clausius statements and their equivalence; PMM2, causes of irreversibility; Carnot theorem, corollary of Carnot theorem, thermodynamic temperature scale.

*A. C. Chak*

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## SEMESTER VI

### Unit – III

**Entropy:** Clausius theorem; property of entropy, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy, entropy change for non-flow and flow processes; third law of thermodynamics.

### Unit - IV

**Energy:** Energy of a heat input in a cycle, exergy destruction in heat transfer process, exergy of finite heat capacity body, exergy of closed and steady flow system; irreversibility and Gouy-Stodola theorem and its applications; second law efficiency.

### Unit-V

**Gas Power cycles:** Recapitulation of Carnot, Otto and Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycles, air standard efficiency, mean effective pressure, brake thermal efficiency, relative efficiency; Brayton cycle, effect of reheat, regeneration, intercooling and turbine and compressor efficiency on Brayton cycle.

**Properties of gases and gas mixtures:** Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties; law of corresponding states, compressibility chart, Gibbs-Dalton law, internal energy; enthalpy and specific heat of gas mixtures.

### Reference Books:

1. *Engineering Thermodynamics* by P.K. Nag, McGraw-Hill Education, 2005.
2. *Thermodynamics* by J.P. Holman, McGraw-Hill, NY, 1998.
3. *Fundamentals of Thermodynamics* by Borgnakke & Sonntag, 7th Ed. Wiley India (P) Ltd, 2009.
4. *Thermodynamics – an Engineering Approach* by Yunus Cengel & Boles, McGraw-Hill Education, 2006.
5. *Engineering Thermodynamics* by Gordon Rogers and Yon Mayhew, Pearson Education Ltd., 2002.
6. *Engineering Thermodynamics* by Jones and Dugan, PHI Learning Pvt. Ltd, 2003.

### List of Experiments:

1. Study of positive displacement work (PdV work) and Heat transfer for various processes.
2. Study of First Law of Thermodynamic.
3. Study of second Law of thermodynamic.
4. Determination of efficiency of Otto cycle.
5. Determination of efficiency of Diesel cycle.
6. Study of Properties of gases and gas mixtures.
7. Study of entropy of system.
8. Study of steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, heat exchanger and throttling process.

  
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# Shri Vaishnav Vidyapeeth Vishwavidyalaya

B. Tech., B. Tech. + M. Tech. and B. Tech. + MBA (Information Technology)

Choice Based Credit System (CBCS) 2018-19

## SEMESTER IV

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment *	END SEM University Exam	Teachers Assessment *
BTIT502	UG	Computer Networks	3	1	2	5	60	20	20	30	20

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

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### COURSE OBJECTIVES

The student should be made to:

1. Understanding the fundamental concepts of computer networking.
2. Creating students interest in the basic taxonomy and terminology of the computer networking area.
3. Applying advanced networking concepts for student knowledge.
4. Creating the student for entry Advanced courses in computer networking.

### COURSE OUTCOMES

Upon completion of the subject, students will be able to:

1. Understanding basic computer network technology.
2. Understanding and explain Data Communications System and its components.
3. Evaluating the different types of network topologies and protocols.
4. Remembering the layers of the OSI model and TCP/IP.
5. Evaluating the different types of network devices and their functions within a network.

### SYLLABUS

#### UNIT-I

**Computer Network:** Definitions, Goals, components, Architecture, Classifications & Types. Layered Architecture: Protocol hierarchy, Design Issues, Interfaces and Services, Connection Oriented & Connectionless Services, Service primitives, Design issues & its functionality. ISO-OSI Reference Model: Principle, Model, TCP/IP model overview, Descriptions of various layers and its comparison with TCP/IP. Network standardization.

#### UNIT-II

**Data Link Layer:** Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol: Elementary & Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Bit oriented protocols: SDLC, HDLC, BISYNC, LAP and LAPB.

#### UNIT-III

**MAC Sublayer:** Overview of MAC Layer, MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted- ALOHA), CSMA/CA, CSMA/CD Ethernet, token bus, token ring, (IEEE 802.3, IEEE 802.4, IEEE 802.5, IEEE 802.11 wireless Communication.



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B. Tech., B. Tech. + M. Tech. and B. Tech. + MBA (Information Technology)

Choice Based Credit System (CBCS) 2018-19

SEMESTER IV

## UNIT-IV

**Network Layer:** Need, Services Provided, Design issues, Routing and congestion in network layer, wired & wireless routing protocol examples, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multi cast Routing. IP protocol, IP Addresses, subnetting, Comparative study of IPv4 & IPv6, Mobile IP.

## UNIT-V

**Transport Layer:** Overview, Design Issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management. **Session layer:** Overview, Authentication, Session layer protocol. **Presentation layer:** Overview, Data conversion, Encryption and Decryption, Presentation layer protocol (LPP, Telnet, X.25 packet Assembler/Disassembler). **Application Layer:** Overview, WWW and HTTP, FTP, SSH.

## TEXT BOOKS:

1. Andrew S Tanenbaum, Computer Networks, 6th Edition, Pearson Education, 2016.
2. Behrouz A. Forouzan, TCP/IP-Protocol suite, 4<sup>th</sup> edition, McGraw-Hill, 2010.
3. William Stallings, Data and Computer Communication, 10<sup>th</sup> edition Pearson, 2014.
4. Comer, Internet working with TCP/IP Volume one, Addison-Wesley, 2015.
5. W. Richard Stevens, TCP/IP Illustrated, Volume 1, 2<sup>nd</sup> Edition Addison-Wesley Professional Computing Series.

## REFERENCES:

1. Kaveh Pahlavan, Prashant Krishnamurthy, Networking Fundamentals, Wiley Publication, 2009.
2. Michael A. Gallo & William M. Hancock, Computer Communications & Networking Technologies, Cengagepearson publications, 2001.
3. Dimitri Bertsekas, Robert Gallager, Data Networks, PHI Publication, Second Edition, 1992.
4. Uyles Black, Computer Networks, PHI Publication, Second Edition, 1993.

## LIST OF EXPERIEMNTS:

1. Demonstrate Different Types of Network Equipment's.
2. Color coding standard of CAT 5, 6, 7 and crimping of cable in RJ-45.
3. LAN installations and Configurations.
4. Experiment with basic network command and Network configuration commands.
5. Examine network IP.
6. Write a program to implement various types of error correcting techniques.
7. Write a program to implement various types of farming methods.
8. Implement & simulate various types of routing algorithm.
9. Installation of ONE (Opportunistic Network Environment) Simulator for High Mobility Networks.
10. Simulate STOP AND WAIT Protocols on NS-2.
11. Simulate various Routing Protocol on NS-2.
12. Simulate various Network Topologies on NS-2.
13. Configuring routers, bridges and switches and gateway on NS-2.



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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTEI603		Process Control Engineering	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; Q/A - Quiz/Assignment/Attendance, MST Mid Sem. Test.

\*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 make the students familiar, understand and analyze the process control & Instrumentation engineering problems.

### Course Outcomes (COs):

Student will be able to

1. Describe dynamics of various processes.
2. Learn and analyze the effect of various control actions.
3. Impart knowledge on the final control elements.
4. Use evaluation criteria and tuning techniques of controllers.
5. Apply ladder logic programming on PLC.

### Syllabus

#### UNIT I

8hr

Basic concept and objectives of process control, types of control & their application. Concept of automatic control & its classification, Degree of freedom, Classification of variables, Process characteristics, Process lag, load disturbance and its effects - Self regulating, interacting and non-interacting process.

#### UNIT II

10hr

Control Modes: Definition, Characteristics and comparison of on-off, proportional, integral, Derivative, PI, PD, PID, Methods of controller tuning, Ziegler-Nichols continuous cycling, Cohen-Coon Method.

#### UNIT III

8hr

Realization of PID controllers: Electronic controllers, Hydraulic controllers & Pneumatic controllers.

#### UNIT IV

10hr

Actuators: Hydraulic, Pneumatic actuators, Solenoid, E-P converters, control valves, Types, Functions, Quick opening, Linear and equal percentage valve, valve application and selection, Control valve sizing.

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## UNIT V

8hr

Introduction to advanced control system like Cascade, Feed forward, Ratio, Selective, Override, Split range and Auctioneering control, Introduction to PLC and its basic ladder logic.

### Text Books:

1. Curtis.D. Johnson, "Process control Instrumentation Technology "Prentice Hall Inc., 2007.
2. Bella G. Liptak, "Process control and Optimization", Instrument Engineers Handbook, volume 2, CRC Press and ISA, 2005
3. D.E. Seborg, T.F. Edgar, and D.A. Millichamp, 'Process Dynamics and Control', John Wiley and Sons, II Edition, 2004.

### References:

1. D.R. Coughanour, "Process system analysis and control", McGraw-Hill International, 2<sup>nd</sup> Edition 2004.
2. Shinskey, "Process Control Systems", 4th Edition, McGraw Hill, Singapore, 1996.

### List of Experiments:

1. Experimental analysis of PID controller response on a level loop.
2. Controlling of Temperature of water by continuous controllers (P, I, D, PI, PD, PID).
3. Designing of continuous electronics controllers, (P, I, D, PI, PD, PID).
4. Performance of Electro - Pneumatic Trainer kit and Pneumatic control valves.
5. Performance of P to I converter and its Interfacing to electro-pneumatic kit.
6. Performance of I to P converter and its Interfacing to electro-pneumatic kit.
7. Design of PLC and ladder diagram programming.
8. Controlling of Bottling plant through PLC.
9. Perform Controlling of Water level through PLC.
10. Implementation of traffic light control through PLC.

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## B.Tech (Mechatronics)

SUBJECT CODE	Category	SUBJECT 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				
BTEC606		Technical Communication and Soft Skills	0	0	50	0	0	1	0	0	1

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; Q/A - Quiz/Assignment/Attendance, MST Mid Sem. Test.

\***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. To give students introduction of Information design and development.
2. To provide students understanding of Technical writing.
3. To introduce students to carrier planning.
4. To make student aware of Ethics in Industries.

### Course Outcomes (COs):

The students will be able to:

1. Design different technical documents.
2. To set goals for carrier planning.
3. To correlate Ethics with Industrial environment.

## SYLLABUS

### UNIT I

3hr

Information Design and Development: Different kinds of technical documents, Information development life cycle, Organization structures, Information design and writing for print and for online media.

### UNIT II

4hr

Technical Writing, Grammar and Editing: Technical writing process, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language, study of advanced grammar

### UNIT III

3hr

Self Development and Assessment: Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning.

### UNIT IV

3hr

Communication and Technical Writing: Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, official notes, business letters.

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## UNIT V

3hr

Ethics: Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs.

### Text Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey, New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.

### References:

1. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN:07828357-4)
2. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
3. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

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SEMESTER VI

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			L	T	P	CREDITS	THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTMEMT612	--	CAD MODELING AND MECHANISM LAB	0	0	2	1	0	0	0	30	20

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; Q/A - Quiz/Assignment/Attendance, MST Mid Sem Test.

**Course Objectives:-**

The primary objective of the course is to (A) Describe the Design concepts with the help of computer Application, (B) Provides comprehensive Knowledge of computer applications including geometric, Modeling, Assemblies of parts and Mechanism concepts.

**Course Outcomes:-**

After completion of this course:

1. Student will be able to understand the various Design concepts with the help of computer application.
2. Students would be able to get familiarized with the computer graphics application in design and understand the basic 2D & 3D commands of CAD and distinguish the CAD from manual paper drafting, in current industrial & product development scenarios.
3. Students would be able to understand the Solid and Assembly modeling tools to develop virtual product for manufacturing in various experiments & real life.
4. On completion of this course the students will be able to acquire knowledge of the applications of computers in design, parts creation & assembling, mechanism and manufacturing activity.

**Course Contents:-**

**Unit-I INTRODUCTION TO DESIGN CONCEPTS**

Introduction to CAD , Why CAD Software ,Scope, objective, benefit , limitation & evaluation; Engineering design, Engineering Design process; Types of designs; Considerations of a good design; Formulation of the design problem; Importance, Conceptual Design, Product Design Cycle, Total life cycle, Digital Prototyping, Product development today.

**Unit-II GRAPHICS FUNDAMENTALS**

Definition, Software configuration of a Graphic system, Functions of a Graphics package; CAD Interface, Coordinate system; Creating Basic Drawings, Creating Additional Drawing Objects, Altering Objects, Drawing Organization and Inquiry Commands, Modify and Manipulating Objects; Construction and Reference Geometry, Hatching Objects; Utility Commands, Layers & Blocks, Text, Table & Dimensions , Introducing Printing, Plotting, and Layouts. Mechanical tolerance: Tolerance concepts, Geometric tolerance, Types of geometric tolerances, Location tolerances, Drafting practices in dimensioning and Tolerance.

  
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SEMESTER VI

**Unit-III GEOMETRIC MODELING**

Introduction of Geometric Modeling; Types of models; Construction of 3D Solid Primitives, Create 3D Solids from Objects, Extrude, Revolve, Sweep, Loft, Combine or Slice 3D Objects, Move Rotate & Scale 3D Objects; Object Sectioning, Save and Publish Section Objects Wire frame Models, Wire frame Entities.

**Unit-IV PARTS ASSEMBLY, MECHANISM, VISUALIZATION & GRAPHICS STANDARDS**

Mechanical Assembly: Introduction, Assembly Creation Methods, Design for Assembly (DFA)

Assembly Modeling - Parts Modeling & Representation, Generation of Assembling Sequences - Precedence Diagram, Assembly Constraints; Mechanism & Mechanism Analysis, Connections, Servo & Force Motors; Mass Properties and Creating Visual styles; Materials and Texture, Light Effect, Camera & Animation.

Data exchange standards – IGES – STEP – CALS – DXF – STL

**References**

1. "CAD/CAM/CIM" by P. Radhakrishnan, Subramanian S and Raju V; New Age Pub., 2008.
2. "Principles of CIM", by S. Kant Vajpay; PHI, 1995.
3. "CAD/CAM" by Rao PN; TMH, 2010.
4. "CAD/CAM Computer Aided Design and Manufacturing", by Mikell P. Groover and Emory W. Zimmer, 2008.
5. "Computer Integrated Design and Manufacturing" by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe, McGraw-Hill, 1991.
6. "Mastering CAD" by George Omura with Brian Benton Autodesk, 2004.
7. "PTC Creo Parametric 3.0 for Designers" by Tickoo S, Textbooks Published by BPB, 2015.
8. "SOLIDWORKS 2017 for Designers", by Tickoo S, Textbooks Published by BPB, 2017.
9. "CATIA V5-6R2016 for Designers", by Tickoo S, Textbooks Published by BPB, 2017.
10. "Autodesk Inventor Professional 2017 for Designers", by Tickoo S, Textbooks Published by BPB, 2017

**List of Experiments**

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.
2. Layout drawing of a building using different layer and line colours indicating all Building details. Name the details using text commands, Make a title Block.
3. To Draw Orthographic projection Drawings (Front, Top and side) of safety valve, knuckle joint, cotter joint & Plummer block etc.
4. Make an Isometric dimensioned drawing from orthographic drawings.
5. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
6. Draw 3D models by extruding, revolve, sweep, loft & other 3D Modelling commands in AutoCAD.
7. Assembly drawing using CAD Software's.

  
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