Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

PROPOSED SCHEME OF TEACHING AND EXAMINATION
B.E. VI SEMESTER MECHATRONICS ENGINEERING

S. No.	Board of Study	Sub. Code	SUBJECT	PERIODS PER WEEK			Scheme of Examination Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1.	Mechatronics	367651(67)	Industrial and Power Electronics	4	1	-	80	20	20	120	5
2.	Mechatronics	367652(67)	Digital Signal Processing and its Applications	4	1	-	80	20	20	120	5
3.	Mech. Engg.	367653(37)	Machine Design II	4	1	-	80	20	20	120	5
4.	Mechatronics	367654(67)	Hydraulic and Pneumatic Control Systems	4	1	-	80	20	20	120	5
5.	Mechatronics	367655(67)	Computer Graphics and Optimization	3	1	-	80	20	20	120	4
6.	*Refer Table 1*		Professional Elective – I	4	1	-	80	20	20	120	5
7.	Mechatronics	367661(67)	Hydraulic and Pneumatic Control Systems Lab	-	-	2	40	-	20	60	1
8.	Mechatronics	367662(67)	Design of Machine Systems Lab	-	-	2	40	-	20	60	1
9.	Mechatronics	367663(67)	Digital Signal Processing Applications Lab	-	-	2	40	-	20	60	1
10.	Mechatronics	367664(67)	Computer Graphics and Optimization Lab	-	-	2	40	-	20	60	1
11.	Management	300665(76)	Managerial Skills	-	-	2	-	-	40	40	1
12.			Library	-	-	1	-	-			-
			Total	23	6	11	640	120	240	1000	34

L: Lecture	**T:** Tutorial	**P:** Practical	
ESE: End Semester Examination	**CT:** Class Test	**TA:** Teacher's Assessment	

Note: Industrial Training of eight weeks is mandatory for B.E. students. It is to be completed in two equal parts. The first part must have been completed in summer after IV semester. The second part to be completed during summer after VI semester after which students have to submit a training report which will be evaluated by college teachers during B.E. VII semester.

Table – 1: Professional Elective – I

S. No.	Board of Studies	Subject Code	Subject
1	Mechanical Engg.	367671(37)	Engineering Economics
2	Mechanical Engg.	367672(37)	Composite Materials
3	Mechatronics Engg.	367673(67)	Machine Tool Design
4	Mechatronics Engg.	367674(67)	Entrepreneurship Development
5	Mechatronics Engg.	367675(67)	Material Science
6	Mechatronics Engg.	367676(67)	Computer Network
7	Mechatronics Engg.	367677(67)	Programmable Logic Controller
8	Mechatronics Engg.	367678(67)	Fundamentals of Communication Systems

Note (1) – 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a particular academic session.

Note (2) – Choice of elective course once made for an examination cannot be changed in future examinations.

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Industrial & Power Electronics**	Code:	**367651(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**	

Course objectives:
- To understand the basics of Power Electronic Devices such as SCRs
- To obtain concepts of various types of power conditioning circuits
- To study various types of heating and welding control.
- To get knowledge of various types of a.c. power conditioners

Course Outcomes :
- The students will get knowledge of basic power electronic devices and how they differ from other electronic devices.
- To get the basic knowledge of inverter, cylo-converter, dual converter and choppers.
- The basic knowledge of heating and welding control is obtained
- The knowledge of voltage stabilizer and UPS is obtained.

UNIT I **Silicon Controlled Rectifiers:** General idea of thyristor family members. SCR- Construction, Principle of operation, characteristics & SCR Terminologies, Different methods of turning on of SCRs. Different methods of turning off of SCRs. Different methods of triggering SCR Circuits, Series & Parallel operation of SCRs, Load commutation; Forced commutation; External pulse commutation.

UNIT II **Power Conditioning Circuits:** Inverters: Line Commutated Inverters, Forced Commutated Inverters. Dual Converters: Phase controlled dual converter, Single-phase dual converter, Three phase dual converter, Circulating current type dual converter – Mid-point configuration & Dual bridge configuration. Choppers: Principle of operation, Chopper control technique, Voltage step-down & Step-up chopper, Jones Chopper.

UNIT III **Cyclo-converters & Protection Circuits**: Single phase/Single phase – Midpoint configuration & Bridge configuration, Three phase/Single phase cyclo-converter: Types-Circulating current type, Non-circulating current type. **.** Protection of devices and circuits: Cooling and heat sinks, Snubber circuits, Reverse recovery transients.

UNIT IV **Heating and Welding Control: Induction heating:** Theory, Principle, Effects of supply frequency, and Choice of frequency, Applications. **Dielectric heating**: Electronic theory, Principle, heating in materials of irregular shape, Limitations, Effect of variation of supply voltage & frequency, Applications. **Welding:** Theory of Resistance welding, Classification of Resistance welding, Scheme for AC Resistance welding**.**

UNIT V **AC Power Conditioner:** Power supply Noise: Origin, Effect on computer & Communication systems, Reduction of noise, Different forms of noise, Requirements and characteristics of the computer power supply system, Types of power line disturbances, Effects of power line disturbances on sensitive electronic equipment. Servo System: Servo Motor, Principle of Buck-Boost control Servo controlled voltage stabilizer, Servo-controlled voltage stabilizer. Constant voltage transformer UPS: On-line & Off-line.

Text Books:
1. Power Electronics: M. D. Singh, Khanchandani, TMH
2. Power Electronics: Devices. Circuit & MATLAB Simulation by Alok Jain, PENRAM publications
3. Industrial and Power Electronics : Deodatta Shingare, Electrotech Publication

Reference Books:
1. Industrial & Power Electronics: H.C. Rai, Umesh Publications.
2. Power Electronics: P.C. Sen, TMH
3. Power Electronics circuits, devices and application By M.H.Rashid. (PHI)
4. Power Electronics By Bimbra Khanna Publications.
5. Power Electronic systems: Theory and design By J. P. Agrawal (Pearson Education)

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Digital Signal Processing and its Applications**	Code:	**367652(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course objectives:
- To understand the concepts of Fourier and Z transform associated with discrete time systems.
- To receive knowledge of various linear time invariant systems.
- to realize FIR & IIR filters and its MATLAB programming
- To get knowledge of various applications of DSP

Course Outcomes :

- The students will get knowledge about application of   Fourier and Z transform with respect to Digital signal processing.
- They will receive the basic knowledge of FIR and IIR filters and its design.
- The basic knowledge of various application of DSP is obtained
- All the aforementioned design will also be studied using MATLAB.

UNIT I   Realization of Systems: Realization of digital linear system, IIR Structure: Ladder structure, Lattice Structure, state space structure, FIR structure: Linear phase FIR system, MATLAB Programming for realization of IIR & FIR Structure Only.

UNIT II   Infinite Impulse Response Filter design (IIR): Analog & Digital Frequency transformation. Designing by impulse invariance & Bilinear method. Butterworth and Chebyshev Design Method.

UNIT III   Finite Impulse Response (FIR) Filter Design: Rectangular, Triangular, Hamming, Blackman & Kaiser Window. Linear Phase and Optimal Filter.

UNIT IV   Multirate DSP: Introduction, Sampling, Sampling rate alteration, Polyphase filter structure: Polyphase decomposition, Digital filters Design, Multistage Decimator and Interpolators.

UNIT V   Applications of Digital Signal Processing: Introduction, Applications of DSP: Digital Sinusoidal Oscillators, Digital Time Control Circuits, Applications of DSP in Image Processing Applications of DSP in speech processing, Digital and binary images, Spatial image Processing and noise removal, Computer vision fundamentals, Edge detection and processing

Text Books:
1. Digital Signal Processing, Vallavaraj, Salivahanan, Gnanapriya, TMH
2. Digital Signal Processing, Proakis, Manolakis & Sharma, Pearson Education

Reference Books:
1. Digital Signal Processing, Nair, PHI
2. Discrete Time Signal Processing, Oppenheim & Schafer, Pearson - PHI
3. Digital Signal Processing by Hussain, Umesh Publications.
4. Digital Signal Processing, J. Johnson, Pearson - PHI

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechanical Engineering/Mechatronics Engineering**	Semester:	**VI**
Subject:	**Machine Design II**	Code:	**367653(37)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**

ESE Duration:	**Four Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Note: **Design data book by PSG and ISI data sheets are allowed in the examination.**

Course Objectives
- To design and analyze coil, leaf and laminated springs.
- To design and analyze spur, helical and bevel gears.
- To design and analyze rolling contact bearings.
- To design and analyze journal bearing.
  To design and analyze chain and belt drive.

Course outcomes:
- Apply knowledge of machine design for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

UNIT I **Spring:** Spring materials and their mechanical properties, equation for stress and deflection, helical coil springs of circular section for tension, compression and torsion, dynamic loading, fatigue loading, Wahl line, leaf spring and laminated spring.

UNIT II **GEARS: Spur Gears -** Gear Drives, Classification of Gears, Selection of Type of Gears, Law of Gearing, Force Analysis, Gear Tooth Failures, Selection of Material, Number of Teeth, Face Width, Beam Strength of Gear Tooth, Effective Load on Gear Tooth, Estimation of Module Based on Wear Strength, Lewis equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication.

UNIT III **Helical Gears:** Helical Gears, Terminology of Helical Gears, Virtual Number of Teeth, Tooth Proportions, Force Analysis, Beam Strength of Helical Gears, Effective Load on Gear Tooth, Wear Strength of Helical Gears.
Bevel Gears: Bevel Gears, Terminology of Bevel Gears, Force analysis, Beam strength of Bevel Gears, Wear Strength of Bevel Gears, Effective Load on Gear Tooth.

UNIT IV **Bearings: Rolling Contact Bearings -** Types of ball and roller bearings, selection of bearing for radial and axial load, bearing life, Mounting and lubrication, shaft scales – contact type and clearance type.
Journal Bearings: Types of lubrication, viscosity, Hydrodynamic theory of lubrication, Sommerfeld number, heat balance, self-contained bearings, bearing materials.

UNIT V **Chain Drives:** Chain drives, roller chains, geometric relationships, dimensions of chain components polygonal effect, power rating of roller chains.
Belt Drives: Flat and V-belts, belt constructions, geometrical relationships for length of the belt, analysis of belt tensions, condition for maximum power, selection of flat & V-belts, adjustment of belt tensions, Wire ropes, stresses in wire ropes

TEXT BOOKS:
1. Design of Machine Elements - V.B. Bhandari, TMH Publications, Delhi
2. Machine Design - Shigley – McGraw Hill, DelhiNoida

REFERENCE BOOKS:
1. Machine Design - Movnin – MIR Publishers, Moscow
2. Machine Design - Fundamental & Application – Gope –PHI, New Delhi
3. Machine Design - Sharma & Agrawal – Katson, New Delhi
4. Principles of Mechanical Design - R. Phelan – McGraw Hill, New Delhi.
5. Machine Design – Sundarajamoorthy & Shanmugum– Anuradha, Chainnai

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Hydraulic and Pneumatic Control Systems**	Code:	**367654(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course objectives:
- To understand the different types of Fluid Logic Elements
- To understand the Fluid Power System
- To study about the pumps and the actuators
- To gain knowledge about hydraulic circuits

Course Outcomes
- The students will get knowledge about Fluid Logic Elements
- They will receive the knowledge of Fluid Power System
- The knowledge of Pumps and Actuators will be obtained
- The knowledge of Hydraulic Circuits and Accumulators will be obtained.

UNIT I **Fluid Power System:** Components, advantages, applications in the field of Machine Tools, material handling, presses, mobile and stationary machines, clamping & indexing devices etc., transmission of power at static and dynamic states.
Hydraulic Fluid: Types of hydraulic fluids, properties of fluid, selection of fluids, JIC/ISO symbols for hydraulic circuits.

UNIT II **Pumps:** Types, classification, principle and working of vane, gear, radial and axial plunger pumps, power and efficiency calculations, selection of pumps for hydraulic transmission.
Actuators: Linear and rotary actuators, hydraulic motor types & construction methods of control of acceleration, types of cylinder and mountings, calculation of piston velocity, thrust under static and dynamic application.

UNIT III **Control of Fluid Power:** Principle, working types of the following valves, pressure control, direction control, flow control, relief valves, sequence values etc.

UNIT IV **Hydraulic Circuits:** Meter in, meter out circuits, Pressure control for cylinders, Flow divider circuits, Circuit illustrating use of pressure reducer valves, sequence valve, counter balance valves, unloading valves with the use of electrical control, accumulators etc.
Accumulators and Intensifiers: Types, function, application, selection and design procedure.

UNIT V **Pneumatic System:** General Features, brief system comparison between hydraulics and pneumatics, air compressor types-reciprocating, rotary and screw type, Air Dryers
Air Preparation Units: FRL Unit, Service Unit, Pneumatic Valves and Actuators, Pneumatic Circuits with Single Acting and Double Acting Cylinders , `OR`, `AND`, Quick Exhaust and Time Delay Valves
Concept of Low Cost Automation : Technologies used, Electro-Pneumatics

TEXT BOOKS:
1.Oil Hydraulic Systems-Principles and Maintenance by S.R.Majumdar, TMH
2.Hydraulic and Pneumatic Controls by R Srinivasan ,Vijay Nicole Imprints Private Limited
3.Hydraulic and Pneumatic Controls (Understanding Made Easy) by K Shanmuga Sundaram, S Chand and Company

REFERENCE BOOKS:
1. Industrial Hydraulics – Pipenger & Hicks, Mc Graw Hill Company, New York
2. Fluid Power – Goodwin
3. Hydraulics and Pneumatics – A Technician and Engineers Guide by Andrew Parr, JAICO Books

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Computer Graphics and Optimization**	Code:	**367655(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**	

Course objectives:
- To understand the different types of Computer Devices
- To understand the Geometric Modelling
- To study about CAD/CAM
- To gain knowledge about Finite Element Analysis

Course Outcomes :
- The students will get knowledge about the computer devices
- They will receive the knowledge Geometric Modelling
- The knowledge of CAD/CAM will be obtained
- The students will know the basics of Finite Element Analysis

UNIT I   **Introduction:** Input and Output Devices:- Keyboard, Mouse,Z mouse Trackball, Joysticks, Data Glove, Digitizers, Light pen, Touch Panels, Image scanners, Printers and Plotters. Video Display Devices: Refresh CRT; Raster & Random scan display; Colour CRT monitor; Flat panel display; Co-ordinate representation.

UNIT II   **Geometrical Modeling** : Output Characteristics: Aspect ratio, Aliasing and Anti-aliasing. Line Drawing Algorithms: DDA algorithm; Bresenham's algorithm, discussion extended to circle generation. Window and View port: Window and View port relationship; World co-ordinates; Normalized device co ordinates and Homogenous co-ordinates. 2D and 3D transformations: scaling, translation, rotation, mirroring, clipping. Synthetic and analytic curves, parametric representation of line and circle, Cubic splines and Bezier curves, concept of blending. Surfaces & solids – model, entities, representations, fundamentals of surface and solid modeling, B-rep, constructive solid geometry (CSG), analytical modeling, Orthographic projection, Boolean operation.

UNIT III   **Introduction CAD/CAM:** The influence of computers on manufacturing environment, Introduction of CAD/CAM, the product cycle & CAD/CAM, Reasons for implementing CAD ,conventional design vs CAD, Computer system hardware and software, applications and benefits of CAD, Concurrent engineering.

UNIT IV   **CAD System:** CAD system configuration; Hardware: Display devices, Hard-copy devices, Interactive input devices, Display processors Software: Features, Graphic standards (GKS, PHIGS, IGES, STEP, PDES). Data base: Design database concept, objectives, data structures, creation of data files in application programs and relational database management system.

UNIT V   **Optimization:** Introduction to finite element analysis, Types of elements, types of error, introduction to matrix notation, General step of the FEM, derivation equitation finite element procedure, Stress – deflection – stiffness matrix, global matrix, connectivity table, advantage of FEM, Matrix algebra and Gaussian elimination

TEXT BOOKS:
1. CAD/CAM Principles & Applications – P.N. Rao – TMH Publication
2. Introduction to Finite Elements in Engineering –T R Chandrupatla,A D Belegundu,PHI
3. CAD/CAM Computer Aided Design & Manufacturing – Mikell P. Groover, Emory W. Zimmer – Pearson Education

REFERENCE BOOKS:
1. CAD/CAM Theory & Practice – Ibrahim Zied – TMH Publication
2. CAD/CAM – Surendra Kumar & A.K. Jha – Dhanpat Rai & Company
3. Schaum's Outlines Computer Graphics -Xiang and Plastok - - TMH, 2nd Edition, 2002.
4. Computer Graphics- Harrington - - McGraw Hill
5. "Procedural Elements for Computer Graphics – Rogers-TMH
6. Computer Graphics – N. Krishnamurthy –TMH

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Hydraulic and Pneumatic Control Systems Laboratory**	Code:	**367661(67)**
Total Lab Periods:	**24**	Batch Size:	**30**
Maximum Marks:	**40**	Minimum Marks:	**20**

LIST OF EXPERIMENTS

(Any Ten to be Performed, Five of which to be performed on any Hydraulics and Pneumatics software)

1. To understand the working and construction of hydraulic components and basic circuits
2. Speed control of Hydraulic cylinder through Throttle valve/Flow Control Valve.
3. Electro Hydraulic circuit –Speed and Pressure control of double acting cylinder
4. Electro Hydraulic circuit—Sequential operation of double acting cylinder through Limit switches/Proximity Switches.
5. To control double acting hydraulic cylinder through 4/3 solenoid operated D.C. valve.
6. To understand the working and construction of pneumatic components and basic circuits
7. To carry out memory control of Double Acting Pneumatic Cylinder
8. Time dependent control of a pneumatic double acting cylinder
9. Pressure-dependent control of a pneumatic double acting cylinder
10. To understand use of Quick Exhaust & Flow control valve.
11. To control the speed of Double acting pneumatic cylinder by Flow Control valves (Meter -Out)
12. To control Double acting pneumatic cylinder through 5/2 D.C. Valve
13. To illustrate pneumatic circuit involving two pneumatic cylinders, operated by a single DC Valve
14. To understand use of Logic element 'OR' gate and 'AND' gate
15. To illustrate the use of Time Delay valve

List of Equipments required:

1. Electro-Hydraulic Trainer Kit
2. Pneumatic Trainer Kit
3. Hydraulics and Pneumatics Software

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Design of Machine Systems Laboratory**	Code:	**367662(67)**
Total Lab Periods:	**24**	Batch Size:	**30**
Maximum Marks:	**40**	Minimum Marks:	**20**

List of Experiments/Activities:

Modeling, assembly and mechanism of assembled components (any one) on any integrated design software

- Knuckle Joint

- Oldham`s Coupling

- Ball Bearing

- Roller Bearing

- Crank and Slider Mechanism

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Digital Signal Processing Applications Laboratory**	Code:	**367663(67)**
Total Lab Periods:	**24**	Batch Size:	**30**
Maximum Marks:	**40**	Minimum Marks:	**20**

List of Experiments (Minimum ten experiments):

- Program to generate discrete signal (sine, cosine, exponential, unit ramp, unit step, unit impulse).

- Program for linear convolution and circular convolution of any two sequences.

- Program for cross-correlation and autocorrelation of any two sequences.

- To sample a sinusoidal signal at Nyquist rate.

- Program for computing discrete Fourier transform.

- Program for implement inverse discrete Fourier transform.

- Program to generate fast Fourier transform of signal.

- To implement IIR filter (LP/HP/BPF) using Butterworth filter.

- To implement FIR filter (LP/HP/BPF) using any window technique.

- Program for down sampling a sinusoidal sequence by a factor M.

- Program for down sampling and up sampling the sum of two sinusoidal using inbuilt decimation and interpolation function by a factor M.

- Program for computing convolution and m-fold decimation by polyphase decomposition.

- Study of an ADPCM system implementation using a DSP simulator.

- Implementation of an ADPCM system using a DSK.

- Simulation of the CELP Speech coder using the Code Composer.

- Simulation of the ADPCM Speech coder using the Code Composer.

- Simulation of the LPC Speech coder using the Code Composer.

- Study of a clock recovery system implementation using a DSP simulator.

- Implementation of Carrier recovery system using a DSK.

List of Equipments/Machine Required:

C++ Compiler, MATLAB with Tool boxes, DSP Processor kit, Digital Storage CRO, Spectrum Analyzer.

Recommended Books:

1. Digital Signal Processing, Vallavaraj, Salivahanan, Gnanapriya, TMH

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Computer Graphics and Optimization Laboratory**	Code:	**367664(67)**
Total Lab Periods:	**24**	Batch Size:	**30**
Maximum Marks:	**40**	Minimum Marks:	**20**

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)

1.DDA Line drawing algorithm

2. Bresenham's Line drawing algorithm

3. Midpoint circle drawing algorithm

4. 2-D Transformation (Move, Rotate, Scale)

5.Introduction & different features of the CAD Software
6. Basic drawing commands example: - LINE, POLYLINE,MULTILINE, POLYGON, CIRCLE, ELLIPSE, etc.

7. Basic editing commands e.g. - COPY, MOVE, ROTATE,MIRROR, CHAMFER, FILLET and array command as well as zoom

and pan command.

8. View port setting for 3D and use of extrude command.

9. Generation of solid of revolution.

10. Assembly modeling

11. Conversion of assembly drawing from 2D to 3D.

12. Feature Modification and Manipulation

13. Detailing

14. Placement of 3D assembly drawing of stuffing box and placing views in different view ports

15. Sheet Metal Operations

16. Surface Modeling

 (These exercises may be performed by any of the Advanced CAD Software)

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. P-IV 2.6 GHz, 80 GB HDD, 256/512 SD RAM (As Compatible with CAD Software), 1.44 MB FDD, 17" Colour Monitor, Laser Scroll Mouse
2. Software – Pro-E, Solid-work, CATIA, ANSYS

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of Program: **Bachelor of Engineering**
Branch: **Common to All Branches**   Semester: **VI**
Subject: **Managerial Skills**   Code: **300665 (76)**
No. of Lectures: **2/Week**   Tutorial Period: **NIL**

Total Marks in ESE: **NIL**   Marks in TA: **40**

Minimum number of Class Tests to be conducted: **Two**

Objective:
The course is introduced to develop managerial skills tremendously and enrich the abilities to enable one to meet the challenges associated with different job levels. Managerial skills are essential for overall professional development of an individual apart from gaining technical knowledge in the subject.

Course Objectives
Upon completion of this course, the student shall be able
- To define and explain the concept of managerial, written and oral communication skill;
- To understand the leadership skill;
- To develop self-appraisal and understand distinction between leader and manager;
- To develop positive attitude and thinking; and
- To understand managerial functions and develop creativity.

UNIT I   **Managerial Communication Skills:** Importance of Business Writing: writing business letters, memorandum, minutes, and reports- informal and formal, legal aspects of business communication, oral communication- presentation, conversation skills, negotiations, and listening skills, how to structure speech and presentation, body language.

UNIT II   **Managerial skills - Leadership**: Characteristics of leader, how to develop leadership; ethics and values of leadership, leaders who make difference, conduct of meetings, small group communications and Brain storming, Decision making, How to make right decision, Conflicts and cooperation, Dissatisfaction: Making them productive.

UNIT III   **Proactive Manager:** How to become the real you: The journey of self-discovery, the path of self-discovery, Assertiveness: A skill to develop, Hero or developer, Difference between manager and leader, Managerial skill check list, team development, How to teach and train, time management, Stress management, Self-assessment.

UNIT IV   **Attitudinal Change:** Concept of attitude through example, benefits of right attitude, how to develop habit of positive thinking, what is fear? How to win it? How to win over failure? How to overcome criticism? How to become real you? How to Motivate? How to build up self confidence?

UNIT V   **Creativity**: Creativity as a managerial skill, Trying to get a grip on creativity. Overview of Management Concepts: Function of Management: Planning, organizing, staffing, controlling.

Course Outcome
- The students will be able to develop formal and informal, negotiation, written and oral communication skill;
- The students will be able to develop manage groups, resolve conflicts and leadership skill and decision making qualities;
- The students will be able to develop self-appraisal, teaching, training and managing stress and time;
- The students will be able develop positive thinking, motivating team members and winning race; and
- The students will be able to develop creativity and fundamental management functions.

Text Books:
1. Basic Managerial Skills for all by E.H. Mc Grawth, Prentice Hall India Pvt Ltd,2006
2. Basic Employability Skills by P. B. Deshmukh, BSP Books Pvt. Ltd., Hyderabad, 2014

Reference Books:
1. How to develop a pleasing personality by Atul John Rego, Better yourself bools, Mumbai,2006
2. The powerful Personality by Dr. Ujjawal Patni & Dr. Pratap Deshmukh, Fusion Books, 2006
3. How to Success by Brian Adams, Better Yourself books, Mumbai, 1969

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechanical Engineering/Mechatronics Engineering**	Semester:	**VI**
Subject:	**Engineering Economics**	Code:	**367671(37)**
	(Professional Elective – I)		

Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**
ESE Duration: **Three Hours**   Maximum Marks in ESE: **80**   Minimum Marks in ESE: **28**

Course Objectives
- To prepare engineering student to analyze cost/revenue data and carry out economic analyses in the decision making process to justify or reject alternatives/projects on an economic basis.
- To prepare engineering students to function in the business and management side of professional engineering practice.

Course Outcome:
- Be able to make intelligent comparisons of project alternatives during the planning and implementation phases.
- Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
- Be able to perform and evaluate payback period and capitalized cost on one or more economic alternatives.
- Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.

UNIT I **Introduction & Scope:** Engineers and Economics, Utility of its study, Managerial Economics, Nature and scope, basic terms and concept of economics like goods, kinds of goods, utility, value and wealth. Theory of Demand and supply, Elasticity of demand. Meaning, Characteristics, Objectives of Firm, Managerial and behavioral theories of a firm.

UNIT II **Pricing and Market Competition:** Industrial Establishments, various types of industrial establishments, Sole traders, partnership, joint stock company, types of shares, financial goals of organization. Pricing Perspective approach: Pricing policy and price influencing factors, Basic data for price fixation. Market forms & Competition – Pure and perfect competition, monopoly, monopolistic competition, price determination under perfect and monopolistic competition.

UNIT III **Economy, Monetary & Fiscal Policy:** Balance of payments – money and monetary policy, fiscal policy, Inflation, measuring employment and unemployment. Credit policies Concept and measurement of national income. Working Capital, Factors deciding Working capital, Return on investment, Financial Planning.

UNIT IV **Cost and Costing Factors:** Cost Analysis – Types and Elements of cost, cost planning and control. Relationship between Average cost & Marginal cost, Short run and long run average cost curves.

UNIT V **Depreciation & Capital Budgeting:** Depreciation and its methods of calculation, marginal costing, break – even analysis, profit planning and forecasting, Capital budgeting, cost of capital, Appraising projects profitability.

TEXT BOOKS:
1. Managerial Economics – P.L. Mehta – S. Chand and sons
2. Engineering Economics- Penneerselvam- PHI, Delhi

REFERENCE BOOKS:
1. Elementary Economics Theory – K.K. Dewett – S. Chand ,Delhi
2. Economics – Samuelson, Pauls & W.D. Nordhan – McGraw Hill ,Delhi
3. Advanced Cost Accounting – Nigam, Sharma – Himalaya Publishing House
4. Managerial Economics – Mote and Paul – TMH, Delhi
5. Macro Economics for management Students – A. Nag - Macmillan India
6. Cost Accounting – Jain & Narang - Kalyan Publishers
7. Managerial Economics - G.S. Gupta – TMH, Delhi
8. Engineering Economics – J.L. Riggs, D.D. Bedforth , Randhawa – TMH, Delhi
9. Essentials of Managerial Economics – Reddy & Ganesh – Himalaya Publishing Hosue
10. Managerial Economics – Joel Dean – PHI, Delhi
11. Economics - Michael Parkin, Addison Wesley Longman Publication, International Edition.

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechanical Engineering/Mechatronics Engineering**	Semester:	**VI**
Subject:	**Composite Materials**	Code:	**367672(37)**
	(Professional Elective – I)		

Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course objectives
- To be familiar with classification & characteristics of composite material and their application.
- To gain the knowledge about manufacturing methods, testing and environmental issue related with composite material.
- To train students to be able to design composite structures, select composite materials, conduct stress analyses of selected practical applications using laminated plate theories appropriate strength criteria.
- To be familiar with the properties and response of composite structures subjected to mechanical loading under static and cyclic conditions.

Course outcome
- Acquire knowledge and hands-on competence in applying the knowledge of composite materials in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components in the field of engineering.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

UNIT I **Introduction to Composites:** Definition, classification and characteristics of composite materials. Basic composite constituents – fiber and matrix; Properties of unidirectional long fiber and short fiber composites; Polymeric materials and polymeric composites; Honeycomb and Sandwich Composite Structure; Application areas of composites.

UNIT II **Manufacturing, Testing and Environmental Issues:** Moulding, pultrusion, filament winding, other advanced manufacturing techniques; Quality inspection and testing – uniaxial tension test, uniaxial compression test, shear test, fracture toughness testing of composites. Environmental Issues related with composite manufacturing and their applications.

UNIT III **Material Properties:** Orthotropic and Anisotropic materials; properties relating stress to strain, properties relating temperature to strain, properties relating moisture to strain, properties relating stress (or strain) to failure, Failure Criterion – Maximum Stress and Maximum Strain; Review of force tensors, stress tensors, strain tensors.

UNIT IV **Elastic Response Analysis:** Hooke's law for orthotropic and anisotropic materials; Linear Elasticity for Anisotropic Materials; Unidirectional composite laminates; Rotations of Stresses, Strains; Residual Stresses; Stress and environmental effects on composites behaviour.

UNIT V **Composite Laminates:** Thin-plate theory, classical lamination theory; Angle-ply and cross ply laminates; Static, dynamic and stability analysis for simple cases of composite plates; Interlaminar stress behaviour; Composite Joints; Design with Composites.

TEXT BOOKS:
- "Analysis and Performance of Fiber Composites"- Agarwal, B. D., and Broutman L. J.- John Wiley and Sons, New York.
- "Fiber Reinforced Composites: Materials, Manufacturing and Design" - Mallick, P.K. Marcel Dekker Inc.

REFERENCE BOOKS:
- "Mechanics of Composite Materials and Structures"- Mukhopadhyay M, University Press, India.
- "Primer on Composite Materials, Analysis" Halpin, J. C., Techomic Publishing Co.
- "Composite Materials Technology: Processes and Properties"- Mallick, P. K. and Newman, S., Hansen Publisher, Munish.
- "Stress Analysis of Fiber – Reinforced Composite Materials"- Hyer, M. W. - McGraw-Hill, New York.
- "Engineering Mechanics of Composite Materials", Issac M. Daniel and Ori Ishai - Oxford University Press-2006, First Indian Edition – 2007.

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**		Semester:	**VI**
Subject:	**Machine Tool Design** **(Professional Elective – I)**		Code:	**367673(67)**
Total Theory Periods:	**40**		Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**		No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**	

Course objectives:
- To understand the different types Cutting Tools
- To understand the Metal Cutting Process
- To design machine tool elements
- To design speed gear box and feed gear box

Course Outcomes :
- The students will get knowledge on cutting tools and metal cutting tool process
- They will receive the knowledge design of machine tool elements
- The students will be able to design speed gear box and feed gear box
- The students will be able to perform the geometrical check of machines

UNIT I   **Cutting Tool –** types, requirements, specification & application
                    Geometry of Single Point Cutting Tool - tool angle, Tool angle specification system, ASA, ORS and NRS and inter-relationship.
                    Mechanics of Metal Cutting: Theories of metal cutting, Chip formation, types of chips, chip breakers, Orthogonal and Oblique cutting, stress and strain in the chip, velocity relations, power and energy requirement in metal cutting.

UNIT II   **Machinability:** Concept and evaluation of Machinability, Mechanism of Tool failure, Tool wear mechanism, Tool life, Tool life equation, Machinability index, factors affecting machinability.
                    Thermal Aspects in Machining and Cutting Fluid: Source of heat in metal cutting and its distributions, temp measurement in metal cutting, function of cutting fluid, types of cutting fluid.

UNIT III   **Design of Machine Tool Element:** Design of Lathe bed, Material and construction feature, various bed section, analysis of force under headstock, tail stock and saddle, torque analysis of lathe bed, bending of lathe bed, designing for torsional rigidity, use of reinforcing stiffener in lathe bed. Design of Guide ways, Material and construction features, over turning diagram, Antifriction guide ways.

UNIT IV   **Design of Speed Gear Box:** Drives in Machine Tool, classification, selecting maximum and minimum cutting speeds, speed loss, kinematic advantage of Geometric progression, kinematic diagrams, design of Gear Box of 6,9,12 and 18 speed.

UNIT V   **Design of Feed Gear Box:** Elements of feed gear box, classification-Norton drive, draw key drive, Meander's drive, Design of feed gear box for longitudinal and cross feed and for thread cutting.
                    Machine Tool Installation and Maintenance: Machine Tool installation, Machine Tool Maintenance, lubrication, reconditioning of machine tool.
                    Machine Tool Testing: Testing, Geometrical checks, measuring equipment for testing, acceptance test for Lathe and Radial drilling machines.

TEXT BOOKS:
1. Machine Tool Engineering – G.R. Nagpal – Khanna Publishers, New Delhi
2. Fundamentals of Metal Cutting & Machine Tool – B.L. Juneja, G.S. Sekhan, Nitin Sethi – New Age Publishers – New Delhi

REFERENCE BOOKS:
1. Production Engineering – P. C. Sharma – S. Chand & Company – New Delhi
2. Production Technology – R.K. Jain – Khanna Publisher – New Delhi
3. Principle of Metal Cutting - G.C. Sen, A. Bhattacharya – New Central Book Agency (P) Ltd., Calcutta
4. Machine Tool Practices – Kibbe Richard R – PHI, New Delhi
5. Principles of Machine Tool – G.C. Sen, A. Bhattacharya – New Central Book Agency, Calcutta

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Entrepreneurship Development**	Code:	**367674(67)**

	(Professional Elective – I)		
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course objectives:
- To understand Entrepreneurship and Economic Development
- To understand the forms of entrepreneurship
- To know about the generation of business ideas and plans
- To know about Financial organizations and NGO`s

Course Outcomes :
- The students will get knowledge on cutting tools and metal cutting tool process
- They will receive the knowledge of design of machine tool elements
- The students will be able to design speed gear box and feed gear box
- The students will be able to perform the geometrical check of machines

UNIT I Entrepreneurship – Entrepreneurship and its Relationship with the Economic Development, Barriers to Entrepreneurship (Factors affecting Growth of Entrepreneurship), Theory of Achievement Motivation, McClelland's Experiments, Women Entrepreneur's.
Entrepreneurship Development in India: Issues and Opportunities, Small-Scale Sector in India.

UNIT II Entrepreneurship Trends - Forms of Ownerships, Franchising, Types of Entrepreneurship, Career Planning, Choice of Entrepreneurship as a Career, Cases from Indian Industry. The ED Cycle, Identifying & Developing Entrepreneurial Potential, Techno-economics innovation and entrepreneurship, Socio-psychological factors influencing entrepreneurship development.

UNIT III Business Idea and Business Plan -, Creativity and Innovation, Business Ideas Generation Process, Evaluation of Business Idea. Building the Business Plan, Venturing an Enterprise, Financial Considerations (Cash Flow Management, Financial Plan, Business Plan). Role of chamber of commerce, industries associations and other bodies like, FICCI, CII, TIE, DICCI etc.

UNIT IV Registration of new venture and Support Systems - Steps and processes involved in setting up a manufacturing unit and a service unit. Process of registration and formalities; Activities of SIDBI, EDI, NIESBUD, DIC, NABARD Government policy, Agency supporting entrepreneurial development Industrial estates. Role of MSME, MITCON, MIDC and MCED.

UNIT V The Industry and Ancillarization: Role of Intrapreneurship in Indian industry; Success cases, Ancillarization - Ancillarization in India, Ancillaries & Industrial Development, Ancillary Opportunities in different Economic Sectors: Agro Industries, Logistics, BPO, Banking and Finance, Sub-contracting System, Supplier Organization Network Global Aspect of Entrepreneurship. NGOs and entrepreneurship.

TEXT BOOK:
1. Entrepreneurial Development- S.S. Khanka- S. Chand & Co.

REFERENCE BOOKS:
1. Entrepreneurship 6th Edition. Robert D Hisrich , Tata McGraw-Hill.
2 - Entrepreneurship - A Contemporary Approach, Kuratko -Thomson Learning Books
3. Small-Scale Industries and Entrepreneurship. Desai, Vasant (2003). Himalaya Publishing House, Delhi.
4. Business Gurus speaks - Chary – Macmillan
5. Exploring Entrepreneurship - Blundel & Lockett, Oxford University Press
6. Entrepreneurship, Roy, Oxford University Press
7. Entrepreneurship - Barringer & Ireland, Pearson Publication
8. Entrepreneurship Small Business Enterprises, Charantimath, Pearson Publication

Name of the Programme: Bachelor of Engineering   ::::   Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Material Science (Professional Elective – I)**	Code:	**367675(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course objectives:
- To understand the structure of solids
- To understand the elastic and plastic deformation process
- To know about phase diagrams
- To know about heat treatment processes

Course Outcomes :
- The students will get knowledge on material structure and its solidification
- They will receive the knowledge on elastic and plastic deformation
- The students will know about Phase diagrams
- The students will know about heat treatment

UNIT I **Structure of Materials:** Crystalline structure of solid: Concept of unit cell and space lattice, Miller Indices, Crystal structure determination by X-ray diffraction, Crystal imperfections.
Solidification of Metals and Alloys: Mechanism of solidification, nucleus formation and crystal growth, Metal ingot structure-dendritic and columnar grains, grain boundaries, grain growth, effect of grain size on properties of metals, polytropic transformation.

UNIT II **Elastic and Plastic Deformation:** Material properties like strength, hardness, toughness, ductility, brittleness etc. and their importance in manufacturing. Quantitative evaluation of these properties with destructive testing methods. Mechanism of plastic deformation, role of dislocations, slip and twinning. Strain hardening, Seasons cracking, Bauschinger effect, yield point phenomena and related effects, Cold working and Hot working processes, effect on properties like recovery, recrystallization, grain growth, grain size etc.

UNIT III **Phase Diagrams:** Phase and phase equilibrium : solidification of pure metals and alloys, phase diagrams of monotectic Eutectic, eutectiod, Peritectic and peritectoid & other systems. Allotropy of iron and Fe-C diagram.

UNIT IV **Heat Treatment:** Introduction, purpose of heat treatment, T-T-T curve and micro constituents in steel heat treatment processes like hardening, tempering, annealing, normalizing, Effects of heat treatment on properties of materials. Surface treatment processes.

UNIT V **Engineering Materials:** Classification, structure, general properties and applications of Cast Iron, Steel, brass, Bronze, bearing metals, light metal alloys, sintered carbide.

TEXT BOOKS:
1. Engineering Physical Metallurgy – Lakhtin – CBS Publishers & Distributors
2. Materials Science- Narang – CBS Publishers & Distributors

REFERENCE BOOKS:
1. Elements of Material Science & Engg. - Van Vlack. – Addison – Wesley longman, 6th Edn., New York
2. Physical Metallurgy - Clark & Varney, East West Edn., New Delhi
3. Engineering Materials - Woulf series.
4. Material Science & Engg. – A first course – V. Raghavan – PHI (P) Ltd., Delhi, 2003
5. Physical Metallurgy Principles – Robert E Reed Hill – Affiliated East-West Press Pvt. Ltd., New Delhi, 2004
6. A Text Book of Material Science & Metallurgy – O.P. Khanna – Dhanpat Rai & Sons – New Delhi

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Computer Network (Professional Elective – I)**	Code:	**367676(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course objectives:
- To understand the concepts of basic computer networks.
- To study various layers of OSI model in detail.
- To get knowledge about various local area networks
- To get knowledge of various high speed networks

Course Outcomes :
- Understanding Data Communications & Networks
- Developing and applying OSI model.
- Getting knowledge of various layers of OSI model.
- The student will get knowledge of various network topologies.

UNIT I **NETWORK TOPOLOGIES AND PHYSICAL LAYER:** Transmission modes, Categories of network, The OSI model, DTE-DCE interface, Null Modem, OSI Physical Layer Components, FSK and PSK Modems, Balanced Modulator, V.34 and V.90 Modems

UNIT II **NETWORK TOPOLOGIES AND PHYSICAL LAYER**: Basics of - Data Link Layer: Flow Control: Stop & Wait, Sliding Window, Error control: CRC, ARQ, Stop & Wait ARQ, Sliding Window ARQ, HDLC.

UNIT III **LOCAL AREA NETWORKS:** Basics of - IEEE802.1, LLC, MAC, PDU; ETHERNET: Access Method: CSMA/CD, Addressing, Electrical Specification, Frame format, Implementation, Switched Ethernet, Fast Ethernet, Gigabyte Ethernet; Token Bus; Token Ring; FDDI; Wireless LAN-IEEE802.11.

UNIT IV **OTHER OSI LAYERS:** Basics of - Network Layer, Transport Layer, Session Layer, Presentation Layer,Application layer; Principles of Internetworking, Internet Protocol: IP Addresses, Transport services, TCP services, TCP Header format.

UNIT V **HIGH SPEED NETWORKS:** Basics of – High Speed LAN, Fast Ethernet systems, Gigabit Ethernet, FDDI ,100VG – Any LAN

TEXT BOOKS:

1. "Data Communication and Computer Networking", B.A. Forouzan, Tata McGraw Hill, 2nd Edition.
2. "Data and Computer Communications", William Stalling; Pearson Education.

REFERENCE BOOKS:

1. "Understanding Data Communications & Networks", William A. Shay, 2nd. Ed., Thomson-Vikas
2. "Computer Networks – A Systems Approach", LL Peterson & BS Davie, 3rd Ed., Elsevier
3. "Computer Networks – Fundamentals and Applications", Rajesh, Easwarakumar, Balasubramanian,Thomson-Vikas
4. "Data and Network Communications", Michael A. Miller, Thomson-Vikas

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Programmable Logic Controller**	Code:	**367677(67)**

(Professional Elective – I)

Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course objectives:
- To study PLC and its application in industry
- To understand basic programming languages of PLC
- To study how timer and counter works with PLC
- To study various applications of PLC

Course outcomes:
- The students will come to know how PLCs play an vital roll in the field of automation
- They will also come to know about programming of PLCs for performing specific tasks, mostly related with industrial applications .

UNIT I   **Programmable Logic:** Introduction, programmable Logic structures, Programmable Logic Arrays (PLAs), Programmable Array Logic (PALs), Programmable Gate Arrays (PGAs), Field Programmable Gate Arrays (FPGAs) ,Sequential network design with Programmable Logic Devices (PLDs), Design of sequential networks using ROMs and PLAs ,Traffic light controller using PAL.

UNIT II   **Programmable Logic Controllers (PLCs):** Introduction, Parts of PLC, Principles of operation, PLC sizes ,PLC hardware components, I/O section ,Analog I/O section ,Analog I/O modules, digital I/O modules ,CPU. Processor memory module ,Programming devices ,Diagnostics of PLCs with Computers.

UNIT III   **PLC programming**: Simple instructions ,Programming EXAMINE ON and EXAMINE OFF instructions ,Electromagnetic control relays ,Motor starters ,Manually operated switches ,Mechanically operated and Proximity switches ,Output control devices, Latching relays, PLC ladder diagram ,Converting simple relay ladder diagram in to PLC relay ladder diagram.

UNIT IV   **Timer:** Instructions ON DELAY timer and OFF DELAY timer, counter instructions ,Up/Down counters ,Timer and Counter applications ,program control instructions, Data manipulating instructions ,math instructions.

UNIT V   **Applications of PLC:** Simple materials handling applications ,Automatic control of warehouse door, Automatic lubricating oil supplier ,Conveyor belt motor control ,Automatic car washing machine, Bottle label detection. Process control application.

Text Books:
- " Fundamentals of Logic Design ", Charles H. Roth, Jr, Fourth Edition, Jaico Publishing House.
- " Programmable Logic Controllers ", Frank D. Petruzella ,McGraw- Hill book, company.

Reference Books:
- An Engineering Approach to Digital Design , William I. Fletcher, Prentice, Hall of India Ltd.
- Programmable Logic Controllers: Principles & Applications, Webb & Reis, Prentice Hall of India.
- Programmable Logic Control: Principles & Applications, NIIT, Prentice Hall of India.
- Siemens " PLC Handbook ".

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Mechatronics Engineering**	Semester:	**VI**
Subject:	**Fundamentals of Communication Systems**	Code:	**367678(67)**

	(Professional Elective – I)		
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course objectives:
- Gaining basic concepts of communication.
- Gaining the knowledge of digital and analog communication.
- Getting the knowledge of information theory
- Learning advance communication techniques.

Course Outcomes :
- Students will come to know about the involvement of communication in todays scenario.
- They will come to know that how the knowledge is shared to a remote area through basic trends in communication
- They will come to know that how the knowledge is shared to a remote areas through advance communication techniques
- Students will get the knowledge of fiber optics

UNIT I **Amplitude Modulation System:** Need for Modulation, Amplitude Modulation, Amplitude Modulation Index, Modulation Index for Sinusoidal AM, Frequency spectrum for Sinusoidal AM, Average power for Sinusoidal AM, Effective voltage and current for sinusoidal AM, Balanced Modulator, The Square law demodulator, Non-sinusoidal modulation, DSBSC Modulation, SSB modulation and generation, VSB, FDM.

UNIT II **Angle Modulation System:** Phase and frequency modulation and their relationship. Frequency deviation, spectrum of FM Signal, BW of FM Signal, Effect of modulation on BW, constant BW, FM phasor diagram, Narrow band F.M. Armstrong and Parameter variation methods of FM generation and FM demodulators.

UNIT III **Digital Communication:** Sampling theorem, Pulse Modulation: PAM, PPM, PWM. Quantization of Signals, Quantization error, Pulse Code Modulation (PCM) and the system, Time division multiplexing (TDM), DPCM, DM, ADM,PSK FSK and DEPSK.

UNIT IV **Elements of Information Theory:** Average Information, Entropy, Information Rate. Communication Channel. Discrete and Continuous channel, Shannon-Hartley Theorem and its Implications, Channel capacity, Gaussian channel. Bandwidth s/n trade off.

UNIT V **Advanced Communication Techniques:** *Satellite Communication*: Components and Block diagram of Satellite communication system, Transponders, Up-link and Down- link budget calculations.
Fiber Optic Communication: Principles of light propagation in optical fiber, Losses in fibers, Dispersion, Connectors and splices, Fiber optic communication link.

Text Books:
1.Communication Systems: Analog and Digital by Sanjay Sharma, Publisher: S.K. Kataria & Sons (2012)
2.Electronic Communications by Roddy & Coolen, PHI.
3.Electronic Communication System by Kenedy & Davis, TMH

Reference Books:
1. Principles of Communication system by H.Taub and K.L. Shiling.
2. An Introduction to the Principle of Communication Theory by J.C. Hancock, Mc-Graw Hill.
3. Signal Processing, Modulation and Noise-by Betts, English University Press, London.
4. Communication System-by A.B. Carlson ,Mc-Graw Hill.