FACULTY OF ENGINEERING

Scheme of Instruction & Examination

and

Syllabi

B.E. V and VI Semesters

of

Four Year Degree Programme

in

PRODUCTION ENGINEERING

(With effect from the Academic Year 2018 – 2019)
(As approved in the Faculty Meeting held on 26th June 2018)

Issued by
Dean, Faculty of Engineering
Osmania University, Hyderabad 500 007
2018

SCHEME OF INSTRUCTION & EXAMINATION
B.E. V - Semester
(PRODUCTION ENGINEERING)

S.No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1.	PC501MP	Metal Forming Technology	3	-	-	3	30	70	3	3
2.	PC502MP	Machine Tool Engineering	4	-	-	4	30	70	3	4
3.	PC501ME	Dynamics of Machines	4	-	-	4	30	70	3	4
4.	PC503ME	Machine Design	4	-	-	4	30	70	3	4
5.	PC505ME	Operations Research	3	-	-	3	30	70	3	3
6.	PC506ME	CAD/CAM	3	-	-	3	30	70	3	3
7.	MC901EG	Gender Sensitization	3	-	-	3	30	70	3	0
Practical/Laboratory Courses										
8.	PC551MP	Metal Forming Technology Lab	-	-	2	2	25	50	3	1
9.	PC552MP	Computer aided Production Drawing Lab	-	-	2	2	25	50	3	1
10.	PC553ME	Dynamics Lab	-	-	2	2	25	50	3	1
Total			**24**	**-**	**6**	**30**	**285**	**640**		**24**

PC: Professional Course **MC**: Mandatory Course
L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete his experiment

Course Code	Course Title						Core/Elective
PC501MP	**METAL FORMING TECHNOLOGY**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**--**	**--**	**--**	**30**	**70**	**3**

Course Objectives:

- To familiarize with plasticity, work hardening and cold and hot working of metals.
- To understand the concept of yielding, plane stress-strain conditions.
- To know the sheet metal operations and corresponding machinery of sheet metal working.
- To understand the metal forming operations such as drawing, extrusion, forging and rolling etc., and related forming machines.

Course Outcomes:

- To understand work hardening of metals and explain hot working and cold working operations.
- To distinguish between engineering stress-strain and true stress-strain, and identify the different yield criterion.
- To estimate forces for sheet metal shearing operations and classify various presses and dies used.
- To discuss the working principles and operations of forging, rolling, drawing and extrusion processes.

UNIT-I

Theory of Plastic Deformation: Crysto plasticity and thermo plasticity, work hardening of metals, plasticity cycle. Advantages and disadvantages of cold working and hot working Stress strain relations, Yielding criteria, yielding under uni-axial, bi-axial and tri-axial states of stress. Plane stress and plane strain conditions, examples.

UNIT-II

Sheet Metal Working: Classification of presses, specifications and their applications. Sheet metal working operations-shearing, blanking, piercing, bending, drawing and squeezing operations, estimation of loads and energy required for these operations. Simple, compound, progressive and combinational tools

UNIT-III

Drawing and Extrusion: Loads required for drawing and extrusion. Homogenous deformation, maximum reduction in drawing and extrusion, Effect of friction, die angles, deformation speeds, die materials and lubricating in these operations. Stretch forming spinning and flow forming

UNIT-IV

Forging: Methods of heating and furnaces Open and closed die forging. Hammers, presses and forging machines, their principles of operation and applications Examples, of the design of the forging dies for drop forging, Machine forging and press forging Isothermal forging and hot isostatic pressing

UNIT-V

Rolling: Principle of metal rolling, Classification and description of rolling equipment and rolling mills Roll load, roll torque and mill power following homogenous deformation technique. Rolling procedure for typical shapes Powder rolling and Roll bending.

Suggested Reading:

1. Serope Kalpakjian, "Manufacturing Engineering and Technology" Addison-Wesley Publishing Company.
2. George. E. Dieter, "Mechanical Metallurgy" SI Metric Edition, McGraw-Hill Book Company.
3. Jain, R.K and Gupta, S.C., "Production Technology" Khanna Publications, 1995.
4. Roy A. Liudberg, "Materials and Processes of Manufacture" Prentice Hall of India, 1995.
5. P.N. Rao, Manufacturing Technology, Tata McGraw Hill Publ., 2nd edition, 1990.
6. Pakirappa, "Production Technology" Durga Publishing House, Hyderabad, 2015.

Course Code	Course Title						Core/Elective
PC502MP	**MACHINE TOOL ENGINEERING**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**4**	**--**	**--**	**--**	**30**	**70**	**4**

Course Objectives:

- To familiarize with cutting mechanisms and cutting forces on lathe, drilling, milling and grinding machines.
- To know the tool wear theories, tool life equation, SPCT design and tool signature etc.
- To understand the cutting forces and kinematics schemes of machine tools of lathe, milling, drilling, gear cutting and grinding machine tools.
- To familiarize with NC features, manual part programming using G and M codes, APT, CNC, DNC, Adoptive control systems and FMS etc.

Course Outcomes:

- To differentiate between various machines tools & their specifications, recognize the mechanism of metal cutting, and evaluate the forces required in machining operations.
- To recognize the tool wear mechanism and estimate the tool life under the given set of conditions.
- To describe the various machine tools used in manufacturing industry, distinguish their working principles and recognize the various machining operations performed on these machine tools.
- To recognize the importance of Computer Aided Manufacturing and prepare a simple part program to perform machining on a CNC machine.

UNIT-I

Orthogonal and Oblique Cutting: Cutting forces in turning, drilling, milling and grinding. Merchant's analysis, Shear angle, friction angles Experimental methods for estimation of shear angle, cutting forces and power of chips. Built up edge phenomena and its effects Chip breakers Sources of heat and distribution and measurement Different types of cutting fluids

UNIT-II

Tool Wear and Tool Life: Criteria for tool wear, flank and crater wear theories, criteria for tool life in roughing and finishing, Measurement of tool wear, Taylor's tool life equation, factors effecting tool life, Machinability.

Single Point Cutting Tool Design: Geometry, tool nomenclature, American, DIN, max. rake system. Interrelation between normal rake and orthogonal rake, tool signature, effect of basic tool angles on its performance Selection of size and angles of S.I.Tools, form tools Design feature of multi point cutting tools.

UNIT-III

Outline of cutting forces involved and kinematic scheme for each type of machine tool.

Lathe: Types of constructional features, size of lathe, various operations on lathe. Bar work and chuck work and tool holding devices.

Thread Production: Taps and dies, chaser, thread rolling and thread cutting machines.
Drilling Machines: Types and constructional features, and their applications

UNIT-IV
Milling Machines: Classification and operations on milling machines, UP and DOWN milling Types of milling cutters and bars Dividing head and its application, single and differential indexing
Gear Cutting Machines: Methods of gear cutting, Types and classification of gear hobbing and gear shaping machines, bevel gear cutting

UNIT-V
Grinding Machines: Classification and operations on grinding machines Abrasives and bonds used for grinding wheels Specifications and selection of grinding wheel
Computer Aided Manufacturing: Features of NC, Positional, paraxial and contouring types. Manual part programming G and M codes, canned cycles Introduction to APT and types of statements Introduction to CNC, DNC, Adaptive Control Systems, Group Technology-Part families, CAPP, FMS and CIMS

Suggested Reading:

1. P. N. Rao, "Manufacturing Technology (Metal Cutting & Machine Tools", Tata McGraw Hill Book Company, 2010.
2. B.I. Juneja and Shekon, "Fundamentals of Metal Cutting & Machines Tools", Wiley Eastern Ltd., 1987.
3. M. C. Shaw, "Metal Cutting Principles", Clarendon Press, Oxford, 1984.
4. Pakirappa "Metal Cutting and Machine Tool Engineering" Durga Publishig House Hyderabad 2015.
5. Yoram Koren, "Computer Control of Manufacturing Systems", Mc Graw Hill Int,New York, 1994.
6. Hajra Choudary, "Workshop Technology", Vol. II, Media Publ. New Delhi.

Course Code	Course Title						Core/Elective
PC501ME	**DYNAMICS OF MACHINES**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**4**	**--**	**--**	**--**	**30**	**70**	**4**

Course Objectives:

- To know effect of inertia of links, and external forces on the input torque, and forces developed at joints in typical mechanisms in motion; understand the gyroscopic couple and its effect on vehicles in motion.
- To know the working principles and characteristics of typical governors, as also the function of flywheels.
- To know the concept of unbalancing rotating and reciprocating masses in single and multi-cylinder in line and radial engines.
- To understand the phenomena of free of free and forced, including the effect of damping for single d.o.f systems, and concepts of isolating vibration.
- To determine natural frequencies of undamped, damped and forced vibrating systems of one, two and multi degree freedom systems.

Course Outcomes:

- To understand various methods of static and dynamic analysis of planar and spatial mechanisms
- To understand and apply the gyroscopic effects in ships, aero planes and road vehicles.
- To analyze balancing problems in rotating and reciprocating machinery
- To apply the concepts of free and forced vibrations of single degree freedom systems in real time systems
- To analyze and design various types of governors like Watt, Porter, Proell, Hartnell governors

UNIT-I

Static and Dynamic Force Analysis: Force analysis of four bar and slider crank mechanisms Study of Dynamically Equivalent System Inertia forces on Connecting Rod

Gyroscope: Gyroscopic Couple, gyroscopic effects in vehicles.

UNIT-II

Governors: Classification of governors, Watt, Porter, Hartnell and Hartung governors, Controlling Force, Stability, Isochronism, Sensitivity, Power and Effort of governors

Flywheels: Functions, Differences between flywheel and governor. Turning moment diagrams, flywheel analysis for I-C Engines and presses

UNIT –III

Balancing of Forces: Forces on bearings due to rotating shaft carrying several masses in several planes. Determination of balance masses from the forces on the bearings, Shaking forces in single cylinder engine, partial balancing of reciprocating engine balancing of multi cylinder in line engines balancing of radial engines by direct and reverse cranks method

UNIT –IV

Vibrations: Vibrations of Single degree, freedom system (axial, transverse and torsional), Equivalent system of combination of springs, Stepped shaft, Whirling speed of shafts.

Damped Vibrations: Types of damping, Vibrations with viscous damping
Forced Vibrations: Vibrating with harmonically .applied force with viscous damping Dynamic magnifier, Resonance, Vibration isolation and Transmissibility

UNIT –V
Vibration Analysis of Multi Degree Freedom Systems: Torsional Vibrations of Two rotor, three rotor and Geared systems. Natural frequencies of two degree freedom systems Modes of vibration Approximate methods for determining natural frequencies: Dunkerley's method, Rayleigh's method and Holzer's method for multi rotor system

Suggested Reading:

1. S.S. Rattan, *"Theory of Machines"*, McGraw Hill, 2010
2. Thomas Bevan, "*The Theory of Machines, CBS Publishers & Distributors*", 2004.
3. John J.Uicker, Jr.Gordon R.Pennock, Joseph E.Shigley, "*Theory of Machines and Mechanisms*", Oxford University Press, 2003.
4. I.S. Rao and Gupta, "*Theory and Practice of Mechanical Vibrations*", Prentice Hall, 1984.
5. R.L.Nortan, "*Kinematics and Dynamics of Machinery*", Tata McGraw Education Pvt. Ltd , New Delhi, 2009.
6. Ghosh and Mallik, "*Theory of Mechanisms nd Machines*", Affiliated Est-West Press, 1988.

Course Code	Course Title						Core/Elective
PC503ME	**MACHINE DESIGN**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**4**	**--**	**--**	**--**	**30**	**70**	**4**

Course Objectives:

- To know the design of helical and leaf springs for various load considerations from stress and energy consideration;
- To understand the design of gears such as spur, bevel and worm gears from strength and wear considerations; types of gear failure and preventive measures;
- To understand the types of bearings used in different applications and classification;
- To know the application of different design concept to the design of the various components of an IC engine such as a piston connecting rod.

Course Outcomes:

- Classify different types of springs and their applications, and to design the springs for static and fluctuating loads according to working environment.
- Distinguish different types of gears and to design spur, helical, bevel and worm gears under strength and wear considerations.
- Identify different types of tooth failures with their remedial measures and design spur and helical gears under dynamic considerations for suitable applications.
- Understand the principles of hydrostatic and hydrodynamic lubrication, and estimate the load carrying capacity of bearings for axial and thrust loads, subjected to static and cyclic loads.
- Practice design of IC engine components like pistons, crank shafts, connecting rod and flywheels subjected to both mechanical and thermal loads.
- Differentiate between curvature and straight beams and apply the design principles for the crane hooks, C-clamp and machine frames.

UNIT-I

Mechanical Springs: Types of springs and materials used Design of helical springs on stress, deflection and energy considerations Design for fluctuating loads Concentric springs

Leaf Springs: Stresses and Deflection. Principles of Limit design. Nipping of Leaf springs

UNIT-II

Gears: Types of gears and materials used. Standards for gear specifications Design of Spur, Helical, Bevel and Worm Gears - Strength and Wear consideration Types of failure of gear tooth and preventive measures

UNIT-III

Bearings: Materials used for Bearings Classification of Bearings Viscosity of Lubricants Theory of Hydrostatic and Hydrodynamic lubrication. Design of sliding contact bearings - for axial and thrust loads

Rolling Contact Bearings: Different types of rolling element bearings and their constructional details Static and Dynamic load carrying capacity, Load-life relationship Design for cyclic loads

UNIT-IV

I.C. Engine Parts: Design of piston, connecting rod and crank shafts (single throw and overhang). Design of Flywheels for I.C. Engines and presses

UNIT-V

Theory of bending: Theory of bending of members with initial curvature - rectangular, circular and Trapezoidal sections. Design of crane Hooks, Machine flames and C-clamps.

Suggested Reading:

1. M.F. Spotts, "*Design of Machine Elements*", Pearson Edu, 7th Edn. 2003.
2. V. B. Bhandari, "*Machine Design*", Tata McGraw-Hill Publ, 2010.
3. P.C.Sharma & D.K. Aggarwal, "*Machine Design*", S.K. Kataria & Sons, 10th Edn, 2003.
4. P. Kannaiah, "*Machine Design*", Sci- Tech Publ., 2009.
5. J.E. Shigley & Charles R. Mischke, " *Mechanical Engineering Design*", Tata McGraw-Hill., 6th ed. 2003.

Course Code	Course Title						Core/Elective
PC505ME	**OPERATIONS RESEARCH**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**--**	**--**	**--**	**30**	**70**	**3**

Course Objectives:

- To use variables for formulating complex mathematical models in management science, industrial engineering and transportation models.
- To use the basic methodology for the solution of linear programming problems.
- Understand the mathematical tools that are needed to solve optimization problems like Transportation models and Assignment models.
- To understand the replacement models with change in money value considering with time and without time.
- Model a system as a queuing model and compute important performance measures

Course Outcomes:

- To prepare the students to have the knowledge of Linear Programming Problem in Operations Research at the end students would be able to understand the concept and develop the models for different applications.
- To make students understand the concept Replacement models at the end students would able to explain various features and applications of replacement models in real time scenario.
- To prepare the students to understand theory of Game in operations research at the end students would able to explain application of Game theory in decision making for a conflict
- To prepare the students to have the knowledge of Sequencing model at the end student would able to develop optimum model for job scheduling.
- To prepare students to understand Queuing theory concepts and various optimization techniques at the end students would able to develop models for waiting line cases.

UNIT-I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions.

UNIT -II

Duality: Definition, Relationship between primal and dual solutions, Economic Interpretation, Post optimal of sensitivity analysis, Dual Simplex Method.

UNIT -Ill

Transportation Models: Finding an initial feasible solution - North West corner method, least cost method, Vogel's Approximation method, Finding the optimal solution, optimal solution by stepping stone and MODI methods, Special cases in Transportation problems - Unbalanced Transportation problem.

Assignment Problems: Hungarian method of Assignment problem, Maximization in Assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.

UNIT -IV

Replacement Models: Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail suddenly - Individual replacement policy, Group replacement policy.

Game Theory: Introduction, 2 person zero sum games, Maximin - Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for 2 x n and m x 2 games.

UNIT -V

Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, processing 'n' jobs through m machines, Processing 2 jobs through m machines

Queuing Theory: Introduction, single channel - poisson arrivals - exponential service times with infinite population & finite population, Multi channel - poisson arrivals - Exponential service times with infinite population.

Introduction to optimization Techniques: Single objective & Multi objective optimization Techniques like G.A, NSGA, P.Q.O & MPSO Techniques.

Suggested Reading:

1. Hamdy, A. Taha," *Operations Research-An Introduction*", Sixth Edition, Prentice Hall of India Pvt. Ltd., 1997.
2. S.D. Sharma, "*Operations Research*", Kedarnath, Ramnath & Co., Meerut,2009.
3. Hrvey M. Wagner, " *Principles of Operations Research*", Second Edition, Prentice Hall of India Ltd., 1980.
4. V.K. Kapoor, "*Operations Research*" , S. Chand Publishers,New Delhi, 2004.
5. R. Paneer Selvam, "*Operations Research*" , Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008.
6. Data Reconciliation by Prof. Shanker Narasimha.

Course Code	Course Title						Core/Elective
PC506ME	**CAD/CAM**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**--**	**--**	**--**	**30**	**70**	**3**

Course Objectives:

- To know the basic design process, design criteria to find alternative solution; understand parametric representation of cubic spline, Bezier and B-spline curves along with concepts of NURBS.
- To understand the concepts of surface modeling, analytical surface, solid modeling and their different approaches like C-rep and B-rep along with mass property calculations, mechanical tolerance.
- To know the principles of CAD database and its structure and learn the different neutral file formats, like IGES and PDES.
- To know the different types of numerical control machine tools its features and elements; the basic concept of part families, its layout along with CAD/CAM integration and rapid prototyping concepts.\

Course Outcomes:

- Explain the concepts and theory of modeling and design in engineering applications.
- Compare the different types of modeling techniques and explain the central role solid models play in the successful completion of CAD/CAM-based product development
- Recognize the design applications and perform 2D transformations about arbitrary point.
- Write part programs for simple components.
- Describe the current state-of-the-art CAD/CAM technologies

UNIT-I

Design Processes: Design criteria, Alternative solutions, Alternative design, Computer Aided Design and Review.

Drafting Techniques: Basic geometric elements and their creation

Geometric Modelling: Wireframe entities and their definition, Interpolation and Approximation curves. Concept of parametric and non parametric representation of a circle and helix curves, properties of splines.

Synthetic curves: Parametric representation of cubic spline, Bezier and B-spline curves, continuity, properties and characteristics. Concept of NURBS

UNIT-II

Surface Modeling: Analytic surfaces: Definitions of planar, surface of revolution, Tabulated cylinder, synthetic surfaces: Cubic and Bezier surfaces and coons surface

Solid Modeling: C - rep and B - rep approaches feature based and parametric modelling

Design Applications: Mass property calculations, Mechanical tolerance, Finite Element Analysis, Design Review.

2D Transformations: Translation, Scaling and Rotation about arbitrary point, Shearing and Reflection, Homogeneous representation, concatenation.

UNIT-III

CAD Database and Data Exchange: CAD Database and Structure, **CAD Exchange format:** IGES, STEP and STL format.

Numerical Control Machine Tools: Features and elements of NC, Positional, paraxial and contouring types. Definitions of axes. Definitions of interpolation, post - processor, preparatory and miscellaneous functions, canned cycles, Tool length and cutter radius compensation Manual and computer aided part programming (APT) for simple components. Programming with MACROS

UNIT-IV

Computer Numerical Control: CNC, DNC and Adaptive control systems. Typical configurations and relative features. Machining centers, Introduction to FANUC, SINUMERIC controllers.

Industrial Robots: Robot Anatomy, Configurations, Controls, Drivers, Programming methods and Applications.

UNIT-V

GT: Part families, layout, part classification and coding system. Opitz, MICLASSCODE system **CAPP:** Variant and Generative process planning.

FMS & CMS: Building blocks of Flexible Manufacturing systems and their control, Elements of CIMS.

Computer Aided Inspection and QC:

Coordinate Measuring Machine, Non contact inspection: Machine vision, Scanning Laser Beam Devices Quality control. CAD/CAM Integration, Turnkey CAD/CAM Systems, Introduction to Rapid Prototyping Technique, Reverse Engineering.

Suggested Reading:

1. Arvid R. Eide, Roland D. Jenison, Lane H. Mashaw, Larry L. Northup, *"Introduction to Engineering Design*" McGraw -Hill, 1998.
2. Ibrahim Zeid. CAD/CAM, "*Theory and Practice*", McGraw. Hill Inc. New York, 2011.
3. Grover, MP and Zimmers E.W. "*CAD/CAM*", Prentice Hall of India, 1989.
4. Rao, PN. "*CAD/CAM: Principles and Applications*", 2nd Edition, Tata McGraw Hill, New Delhi, 2004.
5. Yoram Koren, "*Computer Control of Manufacturing Systems*", McGraw Hill Int, New York, 1994.
6. Elanchezhian. C. Sunder Selwyn. T. Shanmuga Sunder, G, "*Computer Aided" Manufacturing"*, Laxmi Publications (P) Ltd., 2nd Edition, New Delhi, 2007.

Course Code	Course Title						Core/Elective
Mandatory Course	GENDER SENSITIZATION						Core
Prerequisite	Contact Hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	--	--	--	30	70	0

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT I
Understanding Gender
Gender: Why Should We Study It? Socialization: Making Women, Making Men
Introduction Preparing for Womanhood Growing up Male First lessons in Caste. Different Masculinities

Just Relationships: Being Together as Equals, Mary Kom and Onler Love and Acid just do not Mix. Love Letters Mothers and Fathers Rosa Parks-The Brave Heart

UNIT – II
Gender and Biology
MissingWomen: Sex Selection and Its Consequences Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary Two or Many? Struggles with Discrimination Our Bodies Our Health

UNIT – III
Gender and Labour
Housework: The Invisible Labour "My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics Fact and Fiction. Unrecognized and Unaccounted work.Wages and Conditions of Work

UNIT – IV
Issues of Violence
Sexual Harassment: Say No! Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment "Chupulu"
Domestic Violence
Speaking Out: Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives New Forums for Justice
Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life"The Caste Face of Violence

UNIT – V
Gender Studies
Knowledge through Lens of Gender: Point of View – Gender and the structure of knowledge – Unacknowledged women artists of Telangana; Whose History? **Questions for Historians and Others**: Reclaiming a past – Writing other histories – Missing Pages from modern Telangana History

Suggested Reading

1. A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu *" Towards a World of Equals*" A Bilingual Textbook on Gender by Telugu Akademi, Hyderabad, Telangana., 1ST Edition,2015**.**

Course Code	Course Title						Core / Elective
PC551MP	**METAL FORMING TECHNOLOGY LAB**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To familiarize with Stress strain characteristics of ferrous and non-ferrous metals.
- To know the principle and working of Erichsen cupping test, Fly press, Hydraulic press and compound, progressive and combination dies
- To understand the concept of spinning and computer simulation of typical forming operations

Course Outcomes

- To demonstrate the understanding of the theoretical concepts of different forming dies and presses.
- To conduct experiments and put hands-on experience on various processes in sheet metal forming operations.
- To use the hand tools and perform manual forging operations to forge a given work piece to the required shape.
- To perform Erichsen cupping test experiment to determine the ductility of various sheet metals.

List of Experiments:

1. Evaluation of True-Stress and True - Strain characteristics of ferrous and Non-ferrous metal in a tensile test.
2. Evaluation of formability of sheet metals in Erichsen Cupping test.
3. Exercise on blanking and piercing operations on Fly press and Hydraulic press.
4. Production of typical components using Compound die.
5. Production of typical components using Progressive die.
6. Production of cup on Combination die.
7. Exercise on drawing operation to produce cup on hydraulic press.
8. Exercise on wire drawing operations on different materials.
9. Exercise on forging practice.
10. Exercise on sheet metal operations.
11. Exercise on spinning / flow forming operations.
12. Computer simulation of typical forming operations.

Suggested Reading

1. Serope Kalpakjian, "*Manufacturing Engineering and Technology"* Addison-Wesley Publishing Company.
2. P. N. Rao, "*Manufacturing Technology"* Tata McGraw Hill Publ., 2nd edition, 1990.
3. Pakirappa, "*Production Technology*" Durga Publishing House, Hyderabad, 2015

Note: Minimum ten experiments should be conducted in the semester.

Course Code	Course Title						Core/Elective
PC552MP	**COMPUTER AIDED PRODUCTION DRAWING LAB**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**--**	**--**	**--**	**2**	**25**	**50**	**1**

Course Objectives:

- To learn design criteria of machine components, selection of materials and manufacturing Process.
- To learn application of principles to design helical coiled and leaf springs, gears, curved beams, sliding contact and rolling element bearings, chain drives, IC engine components and fly wheels.

Course Outcomes:

- Create the models of the components
- Demonstrate the documentation and presentation skills
- Prepare the production drawings of the parts from the given assembly drawing
- Generate the bill of materials and indicate details pertaining to manufacturing requirements.

List of Experiments

1. Part modeling from given assembly drawings using any solid modeling package.
2. Geometrical dimensioning and tolerance representation on part drawings.
3. Conventional practices indicating Dimensional, Form & Position tolerances.
4. Calculation of limits, suggestion of suitable fits for mating parts with Interference detection.
5. Surface finish, surface treatments- specification and indication methods on the drawings.
6. Generation of production drawings in 2D from part models representing Limits, fits, tolerances, Surface finish, geometrical and form tolerance etc.
7. Preparation of Process sheet incorporating Tool work orientation diagrams.

Suggested Reading*:*

1. K. L. Narayana, P. Kannaiah and K. Venkat Reddy, "*Production Drawing"*, New Age International (P) Ltd. Revised edition 1997.
2. P. Narasimha Reddy, T. A. Janardhan Reddy and C. Srinivas Rao, "*Production Drawing Practice"*, Hi-Tech Publishers, 2001.

Course Code	Course Title						Core/Elective
PC553ME	**DYNAMICS LAB**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**--**	**--**	**--**	**2**	**25**	**50**	**1**

Course Objectives:

- To understand the effects and importance of kinematic and dynamic analysis of mechanisms
- To understand effects and analysis of Single degree freedom vibration systems
- To study the gyroscope, governors and cams
- To carry out the static and dynamic analysis of four bar mechanisms and drives

Course Outcomes:

- To find out natural frequencies of various beams with different constraints
- Evaluate static and dynamic balancing of masses
- To find the gyroscopic effect on vehicles
- To find out kinematic and dynamic behavior of mechanisms

List of Experiments

Governors

1. Centrifugal Governors: Experiment on Performance Characteristic Curves

Gyroscope

2. Estimation of Gyroscopic Couple & Understanding of Gyroscopic Effects on a rotating disc.

Static And Dynamic Balancing Equipment

3. Static and Dynamic Balancing of Rotating Masses

Moment of Inertia

4. Determination of Moment of Inertia of Flywheel and Connecting Rod

Universal Vibration System

5. Damped and Undamped Torsional Vibrations of Single and Double Rotor System.
6. Single DOF (Degrees of Freedom) of Spring Mass Damper System. (Damped and Undamped Systems)
7. Free and Forced Vibration of Simply Supported Cantilever Beam
8. Dunkerley Method to Find Fundamental Frequencies.
9. Modal Analysis of Beam & Disc.

Cam And Follower Apparatus

10. Dynamic Forces In Cams

Gear Trains

11. Velocity Ratios of Simple, Compound, Epicyclic and Diffrential Gear Trains.
12. Critical Speed of Shaft.

Note: Minimum ten experiments should be conducted in the semester.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VI – Semester
(PRODUCTION ENGINEERING)

S.No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hr/Wk	CIE	SEE	Duration in Hours	
Theory Course										
1.	PC601MP	Metal Casting & Welding	3	-	-	3	30	70	3	3
2.	PE602ME	Modern Machining and Forming Methods	4	-	-	4	30	70	3	4
3.	PC602ME	Refrigeration and Air conditioning	4	-	-	4	30	70	3	4
4.	PC604ME	Metrology and Instrumentation	3	-	-	3	30	70	3	3
5.	PE – I	Professional Elective-I	3	-	-	3	30	70	3	3
6.	OE – I	Open Elective-I	3	-	-	3	30	70	3	3
Practical / Laboratory Course										
7.	PC651MP	Metal Casting & Welding Lab	-	-	2	2	25	50	3	1
8.	PC651ME	Metrology and Machine Tools Lab	-	-	2	2	25	50	3	1
9.	MC	Mandatory Course	-	-	3	3	50	-	3	0
10.	SI 671PE	Summer Internship*								
Total			**20**	**0**	**7**	**27**	**280**	**520**		**22**

PC: Professional Course **PE**: Professional Elective **OE**: Open Elective
MC: Mandatory Course **SI**: Summer Internship
L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note -1:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete his experiment

Note-2:

* The students have to undergo a Summer Internship of four weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

****** Subject is not offered to the students of Automobile, Mechanical and Production Engineering Department.

Open Elective-I:

S.No	Course Code	Course Title
1	OE601CE	Disaster Management
2	OE602CE	Geo Spatial Techniques
3	OE601CS	Operating Systems
4	OE602CS	OOP using Java
5	OE601IT	Database Systems
6	OE601EC	Principles of Embedded Systems
7	OE602EC	Digital System Design using HDL Verilog
8	OE601EE	Reliability Engineering
9	OE602EE	Basics of Power Electronics
10	OE601ME	Industrial Robotics**
11	OE602ME	Material Handling**
12	OE632AE	Automotive Safety & Ergonomics**

Professional Elective – I

S.No	Course Code	Course Title
1	PE611MP	Flexible Manufacturing System
2	PE612ME	Control Systems Theory

Mandatory Course

S.No	Course Code	Course Title
1	MC951SP	Yoga Practice
2	MC952SP	National Service Scheme
3	MC953SP	Sports

Course Code	Course Title						Core/Elective
PC601MP	**METAL CASTING & WELDING**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**--**	**--**	**--**	**30**	**70**	**3**

Course Objectives:

- To familiarize with the moulding sands and patterns.
- To study about the different types of casting processes.
- To understand the concept of different types of welding processes and their characteristics.
- To know about the plastics and their moulding processes.

Course Outcomes:

- Describe the concepts of Foundry Technologies consisting of pattern making, mould making, gating design and solidification.
- Discuss the importance of special casting processes, categorize various casting defects and describe the processing of plastics.
- Classify and differentiate various Arc welding, Gas welding and Advanced welding processes, discuss their advantages, applications and limitations.
- Differentiate various Solid State welding and Resistance welding processes, discuss their applications, and identify various welding defects.

UNIT-I

Moulding: Moulding sands, patterns and cores and moulding methods, moulding machines. Directional solidification, gating and risering design.

Moulding practices: Absorption of gases during melting, Sivert's Law.

Furnaces: Cupola, Induction and Arc furnace and charge calculation for cupola.

UNIT-II

Special Casting Process: Shell moulding, CO_2 process, continuous casting, Die casting, investment casting and centrifugal casting. Common defects in casting - causes and remedies Inspection and testing methods of casting

UNIT-III

Welding Processes: Solid state welding (Friction, forge, explosive and ultrasonic welding), Gas welding, Brazing, Soldering, Arc welding Processes - SMAW, SAW, GMAW, GTAW, Atomic hydrogen, plasma arc welding. LBW, EBW, Thermit welding Electro - slag welding.

UNIT-IV

Resistance Welding: Processes and its variation, welding aspects of low carbon steels, stainless steels, aluminium alloys and the welding metallurgy concerning weldability of those materials.

UNIT-V

Weld Defect: Cold cracks and hot cracks.

Weldability Tests: Simulation tests, carbon equivalent tests varestraintest, Cruciform test, ring weldability test.

Plastics: Thermoplastics, thermosetting plastics and their applications.

Plastic Moulding Processes: Extrusion, injection moulding, blow moulding and thermo forming, Introduction to Composites and MEMS.

Suggested Reading:

1. P. N. Rao, "*Manufacturing Technology"* Tata Me Graw Hill Publication, 2nd Ed., 1990.
2. Amitabh Ghosh & Mallick, "*Manufacturing Science"* Assoc. East. West Press Pvt. Ltd. 4th Ed, 1991.
3. Roy A. Lindbtrg*, "Materials & Process of Manufacturing"* Prentice Hall of India, 5th Edn, 1992.
4. Parmer, *RS,"Welding Engineering and Technology",* Khanna Publishers, 1997.
5. Pakirappa, "Production Technology" Durga Publishing House, Hyderabad, 2015

Course Code	Course Title						Core/Elective
PE602ME	**MODERN MACHINING AND FORMING METHODS**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**4**	**--**	**--**	**--**	**30**	**70**	**4**

Course Objectives:

- To understand the importance and have knowledge of Unconventional machining and forming processes.
- To have the knowledge of different micro machining methods.
- To understand the working principles of various Non-traditional methods in machining and forming

Course Outcomes:

- Gain the knowledge on various Non-Traditional machining methods which are applicable for difficult-to-cut materials, defence and aerospace sectors
- Decide on the process parameters to be adopted and applicability of various materials that are suitable for mechanical energy based machining processes
- Decide on the process parameters to be adopted and applicability of various materials that are suitable for electrical and thermal based machining processes
- Decide on the process parameters to be adopted and applicability of various materials that are suitable for chemical and electro-chemical energy based machining processes

UNIT-I

Ultrasonic Machining (USM): Introduction, process description, abrasive slurry, Abrasive materials and their characteristics. Functions of liquid medium in slurry, Types of Transducers, effect of process parameters, applications and limitations. Abrasive Jet Machining (AJM): Principle of operation, process details, process variables and their effect on MRR and accuracy Equation for MRR. Advantages, disadvantages and applications Water Jet Machining (WJM): Schematic diagram, equipment used, advantages and applications.

UNIT-II

Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters, functions and characteristics of dielectric medium, dielectric fluids, over cut and side taper' Flushing, Mechanism of metal removal, crater volume, types of power supply circuits, mathematical analysis of metal removal rate (MRR), characteristics of spark eroded surfaces, advantages, disadvantages and applications. Wire EDM: Process description and applications. Electro-Chemical Machining (ECM): Schematic of the process parameters, function and characteristics of electrolyte, chemistry of the process, Equation for specific MRR and electrode feed rate, advantages, limitations and applications., Rotary Machining, Hot machining, high speed machining, description of each process, process parameters, advantages and applications.

UNIT-III

LASER Beam Machining (LBM): Principle of LASER Beam production, materials used, thermal analysis of the process, process parameters, equations for power density and machining rate, advantages, limitations and applications. Plasma Arc Machining (PAM): Introduction equipment used, process description and parameters, types of plasma arc; Transferred arc and non transferred arc and process applications. Electron Beam Machining (EBM): Schematic of the process, process parameters, principle of production of Electron beam, equipment used, Advantages, disadvantages and applications. ION Etching: Process description and applications.

UNIT-IV

Rubber Pad Forming: Principle of the process, process details and its types; Guerin, wheelon, Marfoming and Hydro forming processes and applications. Electro-Hydraulic forming (EHF): Schematic of the process description and its applications. High Energy Rate Forming (HERF): HERF hammers, principle of explosive forming, Explosive materials, types of explosive forming, stand off operation and contact operation, the pressure pulse, Gas bubble and the process applications.

UNIT-V

Stretch Forming: Introduction, types of stretch forming: stretch draw forming, rotary stretch forming or stretch wrapping, compression forming, radial draw forming. Stretch forming equipment and accessories, accuracy and surface finish, process variables and limitations Tube spinning: Introduction, methods of tube spinning, backward spinning, Forward spinning, machines and tools used. Machine variables, speeds and feeds, effect of tube spinning on work metal properties and applications. Hydrostatic Forming: Process principle, description and applications. Water Hammer Forming (WHF): Schematic diagram of the process, principle of operation, process variables, work materials, process limitations and applications.

Suggested Reading:

1. P.C. Pandey and H.S. Shah, *Modern Machining Process,* Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1980.
2. Bhatacharya, *New Technology,* The Institution of Engineers (India), 1984.
3. Davies and Austin, *Developments in High Speed Metal Forming,* The Machinery Publishing Co. Ltd., 1985.
4. *Production Technology,* HMT.

Course Code	Course Title						Core/Elective
PC602ME	**REFRIGERATION & AIR CONDITIONING**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Heat Transfer	**4**	**--**	**--**	**--**	**30**	**70**	**4**

Course Objectives:

- To understand the basic concepts of refrigeration and air conditioning systems.
- To study the methods of refrigeration for commercial and industrial applications.
- To study the lower temperature applications: cryogenics by using cascade systems.
- Solving the problems related to cooling and heating system (HVAC).

Course Outcomes:

- Identify various natural and artificial methods of refrigeration. State the importance of refrigerant selection and the environmental issues related to the use of CFCs
- Formulate equations for different types of refrigerants used in vapour compression refrigeration system. Justify the selection of single or multi stage system based on operating temperature range
- Explain the working principles of vapour absorption, thermoelectric and steam-jet refrigeration systems. Select a suitable refrigerant absorbent mixture for Vapour absorption refrigeration system
- Define Psychometric and its properties. Analyze various problems on psychrometric processes, know the construction and application of Psychrometric chart
- Able to design an air condoning system based on given inside and outside conditions. Evaluate cooling and heating loads in an air-conditioning system
- List typical conditions required for various food product processes and List applications of refrigeration and air conditioning

UNIT-I

Introduction to Refrigeration: Definition of Refrigeration and Air-conditioning, Necessity of Refrigeration and its applications, Methods of Refrigeration, Unit of Refrigeration and C.O.P. Reversed Carnot cycle, Limitations, Effect of operating temperatures,

Properties of Refrigerants: Survey, Designation, Desirable properties of refrigerants, Thermodynamic, Chemical and Physical properties, Classification of Refrigerants, Alternative refrigerants, Substitute for CFC Refrigerants, Global warming, Green House Effect and Future of Refrigerants.

Air Refrigeration Systems: Analysis of Bell-Coleman Cycle or Reversed Brayton cycle, Open and Dense air system, Application to aircraft refrigeration, Simple cooling system, Bootstrap refrigeration system, Regenerative cooling system and Reduced ambient cooling system.

UNIT-II

Vapour compression system: Working principle and essential components of Simple vapor compression Refrigeration cycle, Compressor, condenser, evaporator, and expansion devices, Analysis of cycle, C.O.P, Representation of the cycle on T-S, P-H and H-S charts. Performance improvement of simple vapour compression refrigeration cycle by means of flash chamber and accumulator

Dry and wet compression, Effect of operating conditions like evaporating pressure, condenser pressure, Liquid sub-cooling and Vapor super heating, Performance of the system.

Low temperature refrigeration system (with single load system), Compound compression with water inter cooler and Flash intercooler, Cascade refrigeration system-Analysis and advantages

UNIT-III

Vapour Absorption Refrigeration System: Simple absorption systems, COP, Practical ammonia absorption refrigeration system, Lithium bromide absorption system, Electrolux refrigerator, Common refrigerants and absorbents properties, Comparison with vapor compression refrigeration system

Steam Jet Refrigeration: Principle of working**, A**nalysis of the system, Advantages, limitations and applications.

Non-Conventional Refrigeration Systems: Principle and operation of Thermoelectric Refrigeration Systems, Seebeck effect - Peltier effect - Thomson effect, Analysis, Pulse tube refrigeration system.

Introduction to Cryogenics- Advantages, Limitations and applications

UNIT-IV

Psychometric: Psychometric properties, Psychrometric chart, construction, Representation of Psychrometric processes on the chart, Heating and Cooling with Humidification and Dehumidification, Adiabatic dehumidification, adiabatic chemical dehumidification and mixing processes

Introduction to Air Conditioning: Requirements of comfort air conditioning, Thermodynamics of human body, Body temperature, Metabolism, Body defense and Human tolerance, Effect of heat on performance, ASHRE comfort chart, Effective temperature

UNIT-V

Cooling Load Calculations in Air Conditioning: Concept of bypass factor, Sensible heat factor, Apparatus Dew Point, Room Sensible Heat Factor (RSHF), Gross Sensible Heat Factor (GSHF), Different heating and cooling loads, Problems.

Design of air conditioning systems: All fresh air, Re-circulated air with bypassed air, Design of Summer, winter and Year round air conditioning systems, Energy conservation in air conditioned building, Case study of one building with all load calculations

Air Conditioning Systems: Types, Components of air conditioner equipments, Humidifier, Dehumidifier, Filter, Grills, Fans and Blowers, Duct layout**.**

Applications of Refrigeration and Air conditioning Food Preservation, Transport air conditioning, and Industrial applications

Suggested Reading:

1. Arora C.P., "*Refrigeration and Air conditioning",* Tata McGraw Hill, New Delhi, 2009.
2. Arora, S.C. and Domkundwar, S., *"A Course in Refrigeration and Air conditioning",* Dhanpat Rai & Sons, New Delhi, 2010.
3. Jain, V.K., *"Refrigeration and Air Conditioning",* S Chand & Company, New Delhi, 2010.
4. Stocker, W.S.,*"Refrigeration and Air conditioning ",* McGraw Hill, New Delhi, 2009.

Course Code	Course Title						Core/Elective
PC604ME	**METROLOGY & INSTRUMENTATION**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**4**	**--**	**--**	**--**	**30**	**70**	**4**

Course Objectives:

- To familiarize with Limits & fits, I.S.O. system and the instruments used to measure these limits.
- To have knowledge of various precision linear and angular measuring instruments.
- To learn the importance of form and how to measure form errors.
- To understand the working principles of various instruments used for the measurement of strain, forces, pressure, temperature and vibrations.

Course Outcomes:

- To understand limits, fits and tolerances and their applications. Linear and angular measurements and measuring instruments.
- To understand the design of limit gauges, evaluate roughness and its measurement.
- To understand basic measuring system, static and dynamic characteristics of instruments
- To understand various principles to measure pressure, temperature, displacement, force, torque and vibrations.

UNIT-I:

Limits and Fits, ISO system: Types of interchangeability Taylor's Principle or plain limit gauges, Use of Plug, Ring and Snap gauges. Indicating type limit gauges. Introduction_ Linear and Angular measurements – Slip gauges and End bars – Gauge material and manufacturing methods, Different types of Micrometers, Height gauges Tomlinson gauges. Precision polygon, Sine bar, Auto collimator

UNIT-II:

Comparators: Dial indicator, Sigma and Mechanical comparator, free flow and Back pressure type Pneumatic comparator. Application of set jet gauge heads. Optical projector, Chart, screen gauges and measuring methods, Micro Gauge Bridge lines Tool maker's Microscope applications Measurement of Straightness and Flatness. Roundness measurement with bench centers and talyrond, Coordinate Measuring Machine in complex geometries

UNIT-III :

Surface Roughness Measurements – parameters as per ISO indices. Profilometer, Taylor Hobson Talysurf. Application of Thread metrology - 2 wire and 3 wire methods, Gear measurement - Gear tooth thickness, Parkinson gear tester, General geometric tests for testing machine tools – Lathe, drill and Mill.

UNIT-IV:

Elements of Instrumentation System: Static and Dynamic characteristics Types of errors. Displacement transducers LVD.Strain measurement -Wire and foil type resistance strain gauges. Rosette Gauges. Bonding procedure Lead resistance compensation. Adjacent arm and self-compensating gauges Proving rin Strain gauge load cells, measurement of axial load and torsion by strain gauges Piezo-electric load cell

UNIT-V:

Introduction to Seismic Transducers -displacement and acceleration measurement, Pressure measurement -Bourdon pressure gauge, bulk modulus gauge, pirani gauge, Temperature measurement by thermo couples. Laws of thermo electricity Types of materials used in thermocouples. Protection tubes Extension wire. Series and parallel circuits Ambient temperature compensation

Suggested Reading:

1. I.C. Gupta – "*Engineering Metrology*", Dhanpat Rai Publications, New Delhi.
2. Rega Rajendra, "*Principles of Engineering Metrology",* Jaico Publishing House, Mumbai.
3. VSR Murti, "*Metrology and Surface Engineering*", Frontline publications, 2011
4. RK Jain, "*Engineering Metrology*", Khanna Publications, 1996.
5. Doeblin,"*Measurement Systems Application and Design*", Tata Mc¬Graw Hill,5th ed., 2004.
6. Beckwith, Buck, Lienhard, "*Mechanical Measurements*", Paerson education india
7. P. Donald Echman, "*Industrial Instrumentation*", John Wiley and Sons, 1996.
8. Hume, "*Engineering Metrology*", Kalyani Publications, 1985.

Course Code	Course Title						Core/Elective
PC651MP	**METAL CASTING & WELDING LAB**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**--**	**--**	**--**	**2**	**25**	**50**	**1**

Course Objectives:

- To familiarize with the foundry equipment and moulding sands.
- To detect the general defects in casting etc.
- To know the principle of various welding processes and various equipment used.
- To determine the weld characteristics using DC & AC power sources.
- To understand strength evaluation of Butt joint and Lap joint

Course Outcomes:

- Conduct experiments and put hands-on experience on various practices in foundry, welding technologies.
- Demonstrate the understanding of the theoretical concepts of above technologies while working in small groups.
- Identity the defects / imperfections and discuss their causes and suggest remedies to eliminate them.

Foundry:

1. Study of foundry equipment and sand reclamation.
2. Testing of greensand properties.
3. Greensand mould making process with complete sprues, gates risers designs.
4. Melting and casting aluminium metal.
5. Making of a shell using shell moulding machine.
6. Study of defects in castings.

Welding:

1. Making of lap joint by resistance welding process and its strength evaluation
2. Study of different types flames in gas welding process.
3. Study of bead geometry in arc welding process.
4. Determination of weld characteristics using DC and AC power sources.
5. Study of butt joint strength evaluation by GMAW process.
6. Welding of Aluminium with GTAW process.

Suggested Reading:

1. Amitabh Ghosh & Mallick, "*Manufacturing Science"* Assoc. East. West Press Pvt. Ltd. 4th Ed, 1991.
2. Parmer, *RS,"Welding Engineering and Technology",* Khanna Publishers, 1997.

Note: Minimum ten experiments should be conducted in the semester

Course Code	Course Title						Core/Elective
PC651ME	**METROLOGY & MACHINE TOOLS LAB**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**--**	**--**	**--**	**2**	**25**	**50**	**1**

Course Objectives:

- To have knowledge of various precision measuring instruments.
- To familiarise machining and metal cutting operations.

Course Outcomes:

- Select and apply the knowledge of measuring tools for external, internal and angular measurements for promoting the qualitative production management.
- Adapt the principles of optical measurements in measurement of screw and gear profiles.
- Choose and practice the appropriate methods of force measuring devices principles for required situation.
- Demonstrate the need of machine alignment test for qualitative production.
- Practice calibration principles for maintaining the required precision of instruments / tools.
- Select and practice the methods of temperature measurement.
- Select cutting tool materials and tool geometries along with appropriate cutting conditions for different work materials and grind the cutting tools to the required geometry.
- Recognize and summarize the features and applications of various machine tools like Lathe, Milling, Drilling, Grinding, Shaping, Slotting etc.
- Conduct tests to determine temperatures and tool life in metal cutting

Metrology and Instrumentation:

1. a) Measurement with inside, outside and depth micrometers, Vernier calipers and Height gauges.
   b) Measurement of roundness errors with Bench Centres, V-block and dial guage.
2. a) Measurement of Linear and Angular dimensions with Tool Maker's Microscope: Flat specimens. Plain cylindrical specimens with centers and threaded components
   b) Measurement of angles with Sinebar, Bevel protractor and Precision level.
3. Measurement with Dial Indicator / Electrical Comparator / Mechanical Comparator / Dial Bore Gauge / Snap Gauge.
4. Calibration of Outside micrometer / Dial gauge.
5. Calibration and Force measurement with Strain gauge type load cell/Proving Ring/spring type sensor
6. Speed measurement with contact & non-contact type sensors / Temperature measurement with Thermocouple

Machining Operations:

7. Thread Cutting on Lathe: single start and multi start threads.
8. Typical exercises on Shaper, Drilling machine, Milling machine and cylindrical grinding machine.
9. Gear milling.
10. Production of threads with taps and threading dies and milling cutters.

Metal Cutting:

11. Estimation of shear angle by measuring thickness and length of chips.
12. Measurement of Cutting forces with Lathe tool dynamometer and determination of friction angle and stresses on shear plane and rake plane.
13. a) Test for tool life. b) Measurement of Chip-tool interface temperature by thermocouple.
14. Study of reaming, boring and burnishing operations.
15. Experiments on CNC Lathe, CNC Milling and CNC EDM.

Note: Minimum ten experiments should be conducted in the semester

Course Code	Course Title						Core/Elective
PE611MP	**FLEXIBLE MANUFACTURING SYSTEM**						**Elective**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**--**	**--**	**--**	**30**	**70**	**3**

Course Objectives:

- Modern manufacturing systems
- To understand the concepts and applications of flexible manufacturing systems

Course Outcomes:

- Ability to perform Planning, Scheduling and control of Flexible Manufacturing systems
- Perform simulation on software's use of group technology to product classification

UNIT-I

Introduction to FMS– development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility –single product, single batch, n – batch scheduling problem – knowledge based scheduling system.

UNIT-II

Composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends

UNIT-III

Application of Simulation – model of FMS– simulation software – limitation – manufacturing data systems – data flow – FMS database systems – planning for FMS database.

UNIT-IV

Matrix Formulation – mathematical programming formulation –graph formulation – knowledge based system for group technology – economic justification of FMS- application of possibility distributions in FMS systems justification.

UNIT-V

FMS Applications in Machining- sheet metal fabrication, prismatic component production – aerospace application – FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future.

Suggested Reading:

1. Jha, N.K. "*Handbook of flexible manufacturing systems"*, Academic Press Inc., 1991.
2. Radhakrishnan P. and Subramanyan S., *"CAD/CAM/CIM"*, Wiley Eastern Ltd., New Age International Ltd., 1994.
3. Ranky, P.G., *"Design and Operation of FMS",* - IFS Publishers, UK, 1988
4. Kusiak, A., *"Intelligent Manufacturing Systems"*, - Prentice Hall, 1990.

Course Code	Course Title						Core/Elective
PE612ME	**CONTROL SYSTEMS THEORY**						**Elective**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**--**	**--**	**--**	**30**	**70**	**3**

Course Objectives:

- To know the development of input-output relations using block diagrams, signal flow graphs of mechanical, electromechanical systems etc and methods of obtaining time and frequency response.
- To understand the stability and margins for stability from characteristics equation, root-locus method or frequency methods.
- To know the development of the alternative state space models of dynamic systems, and their importance in predicting time response of multiple variables of the system.

Course Outcomes:

- Derive the transfer function of mechanical, electrical, hydraulic and thermal systems.
- Evaluate the time response of I and II order systems for various input signals.
- Sketch the Bode, Polar and Root locus plots to check the stability of the system.
- Sketch the Nyquist plot and design the Lead & Lag compensators to meet the requirements.
- Develop the State space model of a system, check for its Controllability & Observability.

UNIT I:

Control Systems Classification: Open Loop & Closed Loop Systems. Mathematical models and Transfer functions from governing equations of mechanical, electrical, hydraulic, pneumatic, thermal systems AC, DC servomotors & Electromechanical servo systems

UNIT II:

Block Diagrams-Block diagram reduction. Signal flow graphs, Mason's gain formula. Transient response Time domain specifications of 151 and 2nd order systems Steady state error, Error coefficients, and sensitivity Performance indices Routh criteria

UNIT III:

Routh criteria- Root Locus method Frequency Response: Bode, Polar plots. Correlation between transient and frequency response, Bandwidth, Experimental determination of transfer functions.

UNIT IV:

Nyquist criteria - Gain and phase margins, Lead. Lag and Lead-lag compensator design, PID controller, linearization of Non linear systems.

UNIT V:

State - Space Representation of Linear Control Systems: State transition matrix. Solution of state equations: Zero input response and Zero state response. Concept of controllability and observability

Suggested Reading:

1. Dorf, R.C., *Modern Control Systems, Addison*-Wesley 1989.
2. M. Gopal, *Con tori Systems,* Tata McGraw Hill, 2004.
3. Ogata, K., *Modern Control Engineering,* Prentice Hall, 2004.
4. Norman S. Nise, *Control Systems Engineering,* John Wiley & Sons, Inc., 2001.

Course Code	Course Title						Core / Elective
OE 601 CE	**DISASTER MANAGEMENT**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Course Outcomes

- The students will be able to understand impact on Natural and manmade disasters.
- Able to classify disasters and destructions due to cyclones
- Able to understand disaster management applied in India

UNIT-I

Introduction to Disasters: Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Natural and Manmade disasters, impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT-II

Disaster: Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc. Differential Impacts, in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change. Cyclones and Floods: Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

UNIT-III

Approaches to Disaster Risk Reduction: Disaster cycle, its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural sources, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRis/ULBs), states, Centre, and other stake-holders.

UNIT-IV

Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change, Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V

Disaster Risk Management in India: Hazard and Vulnerability profile of India

Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation)

Field Work and Case Studies: The field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.

Suggested readings:

1) Sharma V. K., "**Disaster Management, National Centre for Disaster Management**", IIPE, Delhi, 1999.
2) Gupta Anil K, and Sreeja S. Nair., "**Environmental Knowledge for Disaster Risk Management"**, NIDM, New Delhi, 2011.
3) Nick., **"Disaster Management: A Disaster Manager's Handbook"** Asian Development Bank, Manila Philippines, 1991.
4) Kapur, et al. , "**Disasters in India Studies of Grim Reality"**, Rawat Publishers, Jaipur, 2005.
5) Pelling Mark, "**The Vulnerability of Cities**: **Natural Disaster and Social Resilience**", Earth scan publishers, London, 2003.

Course Code	Course Title						Core / Elective
OE 602 CE	**GEO-SPATIAL TECHNIQUES**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- Description about various spatial and non-spatial data types, and data base management techniques
- Development of the concepts and professional skills in utility of geospatial techniques Enhancement of knowledge of geospatial techniques to field problems

Course Outcomes

- The students will be able to understand and apply GIS tools
- Will be able to analyse and process data to apply to the GIS tools.
- Will be able assimilate knowledge on field problems using remote sensing

UNIT I

Introduction: Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems. Projections and Coordinate Systems: Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations map analysis.

UNIT II

Data Acquisition and Data Management: data types, spatial, non-spatial (attribute) data, data structure and database management, data format, vector and raster data representation, object structural model filters and files data in computer, key board entry, manual digitizing, scanner, aerial photographic data, remotely sensed data, digital data, cartographic database, digital elevation data, data compression, data storage and maintenance, data quality and standards, precision, accuracy, error and data uncertainty. Data Processing: Geometric errors and corrections, types of systematic and non-systematic errors, radiometric errors and corrections, internal and external errors.

UNIT III

Data Modeling: Spatial data analysis, data retrieval query, simple analysis, recode overlay, vector data model, raster data model, digital elevation model, cost and path analysis, knowledge based system. GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data

UNIT IV

Applications of GIS: Environmental and natural resource management, soil and water resources, agriculture, land use planning, geology and municipal applications, urban planning and project management, GIS for decision making under uncertainty, software scenario functions, standard GIS packages, introduction to Global Positioning Systems (GPS) and its applications.

UNIT V

Introduction to Remote Sensing: General background of remote sensing technology, objectives and limitations of remote sensing, electro-magnetic radiation, characteristics, interaction with earth surface and atmosphere, remote sensing platforms and sensors, satellite characteristics, digital image processing, IRS

series and high resolution satellites, software scenario functions, remote sensing applications to watershed modeling, environmental modeling, urban planning and management.

Suggested readings:

1) Burrough, P. A., and McDonnell R. A., '**Principles of Geographical Information Systems'**, Oxford University Press, New York, 1998.
2) Choudhury S., Chakrabarti, D., and Choudhury S. **'An Introduction to Geographic Information Technology**', I.K. International Publishing House (P) Ltd, New Delhi, 2009.
3) Kang-tsung Chang , "**Introduction to Geographical information Systems'**, Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi, 2006.
4) Lilysand T.M., and Kiefer R.W. '**Remote Sensing and Image Interpretation'**, John Wiley and Sons, Fourth Edition, New York, 2002.
5) Tor Bernhardsen, **'Geographical Information System'**, Wiley India (P) Ltd., Third Edition, New Delhi, 2002.
6) Hoffman-Wellenhof, B, et al. '**GPS Theory and Practice'**, Fourth Edition, Springer Wein, New York, 1997.

Course Code	Course Title						Core / Elective
OE 601 CS	**OPERATING SYSTEMS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To understand CPU, Memory, File and Device management
- To learn about concurrency control, protection and security
- To gain knowledge of Linux and Windows NT internals

Course Outcomes

- Explain the components and functions of operating systems.
- Analyze various Scheduling algorithms.
- Apply the principles of concurrency
- Compare and contrast various memory management schemes
- Perform administrative tasks on Linux Windows Systems

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory Management: Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring, Encryption. UNIT-IV Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU- Device interactions, I/O optimization.

UNIT-V

Case Studies: The Linux System, Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication Windows NT, General Architecture, The NT kernel, The NT executive

Suggested Readings:

1. Abraham Silberschatz, Peter B Galvin, ***"Operating System Concepts",*** Addison Wesley, 2006
2. William Stallings, "***Operating Systems-Internals and Design Principles"***, 8th edition, Pearson, 2014
3. Andrew S Tanenbaum, "***Modern Operating Systems"***, 4th edition, Pearson, 2016.

Course Code	Course Title						Core / Elective
OE 602 CS	**OOPS USING JAVA**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To introduce fundamental object oriented concepts of Java programming Language, such as classes, inheritance packages and interfaces.
- To introduce concepts of exception handling and multi-threading.
- To use various classes and interfaces in java collection framework and utility classes.
- To understand the concepts of GUI programming using AWT controls.
- To introduce Java I/O streams and serialization

Course Outcomes

- Able to develop java applications using OO concepts and packages.
- Able to write multi-threaded programs with synchronization
- Able to implement real world applications using java collection frame work and I/O classes Able to write Event driven GUI programs using AWT/Swing

UNIT – I

Object Oriented System Development: understanding object oriented development, understanding object oriented concepts, benefits of object oriented development. Java Programming Fundamentals: Introduction, overview of Java, data types, variables and arrays, operators, control statements

UNIT – II

Java Programming Object Oriented Concepts: classes, methods, inheritance, packages and interfaces. Exceptional Handling, Multithreaded Programming

UNIT – III

I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling Exploring Java. Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer

UNIT – IV

Introducing AWT Working with Graphics: AWT Classes, Working with Graphics Event Handling: Two Event Handling Mechanisms, the Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, Check box Group, Choice Controls, Using Lists, Managing Scroll Bars, Using Text Field, Using Text Area, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, File Dialog, Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers.

UNIT – V

Java I/O Classes and Interfaces: Files, Stream and Byte Classes, Character Streams, Serialization.

Suggested Readings:

1. Herbert Schildt, "**The Complete Reference JAVA"**, Tata McGraw Hill, 7thEdition, 2005
2. James M Slack, **"Programming and Problem Solving with JAVA"**, Thomson learning, 2002
3. C.Thomas Wu,**"An Introduction to Object-Oriented Programming with Java"**, Tata McGraw Hill, 5thEdition, 2005.

Course Code	Course Title						Core/Elective
OE601IT	**DATABASE SYSTEMS**						**Elective**
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce E-R Model and Normalization
- To learn formal and commercial query languages of RDBMS
- To understand the process of database application development
- To study different database architectures
- To introduce security issues in databases

Course Outcomes:

Student will be able to:

- Understand the mathematical foundations of Database design
- Model a set of requirements using the Entity Relationship (E-R)Model , transform an E-R model into a relational model ,and refine the relational model using theory of Normalization
- Understand the process of developing database application using SQL
- Understand the security mechanisms in RDBMS

UNIT 1

Design: Conceptual design (E-R modeling), the relational model, normalization

UNIT II

Queries: algebra and logic (relational algebra and calculus), relational query languages and queries (namely SQL),select, project, join, union, intersection, except, recursion, aggregation, data manipulation

UNIT III

Applications: application development, database application interfaces (e.g., JDBC), internet applications,proper database application paradigms, transactions, transaction management, concurrency control, crash recovery

UNIT IV

Distributed DB, Architecture, Query processing and Optimization in Distributed DB, Introduction to NoSQL Databases, Graph databases, Columnar Databases

UNIT V

Introduction to Database Security Issues, Security mechanism, Database Users and Schemas, Privileges

Suggested Readings:

1. Jim Melton and Alan R. Simon.SQL 1999: Understanding Relational Language Components.First Edition, 1999.Morgan Kaufmann Publishers.
2. Don Chamberlin.Using the New DB2: IBM's Object-Relational Database System.First Edition, 1996.Morgan Kaufmann Publishers.
3. Database System Concepts Sixth Edition, by Abraham Silberschatz , Henry F Korth, S Sudarshan,Mc Graw-Hill Education
4. Fundamentals of Database Systems , Elmasri, Navathe, Sixth Edition , Addison- Wesley

Course Code	Course Title						Core / Elective
OE 601 EC	**PRINCIPLES OF EMBEDDED SYSTEMS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- To understand the fundamentals of embedded systems
- To study the block diagram and advanced hardware fundamentals
- To study the software architecture of embedded systems
- To learn the tool chain of embedded systems
- To understand the tools and debugging process of embedded systems.

Course Outcomes

Student will be able:

- To acquire an overview of what an embedded system implies
- To understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.
- To apply theoretical learning to practical real time problems for automation.
- To understand how to build and debug an embedded system application.
- To analyze and design real world applications and interface peripheral devices to the microprocessor.

UNIT – I

Fundamentals of Embedded Systems: Definition of Embedded system, Examples of Embedded Systems, Typical Hardware, Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory

UNIT – II

Advanced Hardware Fundamentals: Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor, Conventions used in Schematics, Microprocessor Architecture, Interrupts Basics, Shared Data Problem, Interrupt Latency.

UNIT – III

Software Architecture of Embedded Systems: Round- Robin, Round-Robin with Interrupts, Function-Queue- Scheduling Architecture, Real- Time Operating System Architecture, Selecting Architecture

UNIT – IV

Embedded Software Development Tools: Host and Target Machines, Cross compilers, Cross Assemblers and Tool Chains, Linkers /Locaters for Embedded Software, Getting Embedded Software into Target System: PROM programmers, ROM Emulators, In-Circuit Emulators.

UNIT – V

Debugging Techniques: Testing on your host machine, Instruction Set Simulators, The assert Macro, Using Laboratory Tools

Suggested Readings:

1. David. E. Simon, "**An Embedded Software Primer**", Low price edition, Pearson Education, New Delhi, 2006.
2. Frank Vahid and Tony Givargis "**Embedded System Design: A Unified Hardware/Software. Approach"**. John Wiley & Sons, October 2001.
3. Rajkamal, "**Embedded systems: Programming, architecture and Design",** second edition, McGraw-Hill Education (India), March 2009.

Course Code	Course Title						Core / Elective
OE 602 EC	**DIGITAL SYSTEM DESIGN USING VERILOG HDL**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- Describe Verilog hardware description languages (HDL).
- Develop Verilog HDL code for combinational digital circuits.
- Develop Verilog HDL code for sequential digital circuits.
- Develop Verilog HDL code for digital circuits using switch level modeling and describes system tasks, functions and compiler directives
- Describes designing with FPGA and CPLD.

Course Outcomes

After completion of this course, students should be able:

- To understand syntax of various commands, data types and operators available with verilog HDL
- To design and simulate combinational circuits in verilog
- To design and simulate sequential and concurrent techniques in verilog
- To write Switch level models of digital circuits
- To implement models on FPGAs and CPLDs

UNIT I

Introduction to Verilog HDL: Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools

Verilog Data Types and Operators: Binary data manipulation, Combinational and Sequential logic design, Structural Models of Combinational Logic, Logic Simulation, Design Verification and Test Methodology, Propagation Delay, Truth Table models using Verilog.

UNIT II

Combinational Logic Circuit Design using Verilog: Combinational circuits building blocks: Multiplexers, Decoders , Encoders , Code converters, Arithmetic comparison circuits, Verilog for combinational circuits , Adders-Half Adder, Full Adder, Ripple-Carry Adder, Carry Lookahead Adder, Subtraction, Multiplication.

UNIT III

Sequential Logic Circuit Design using Verilog: Flip-flops, registers & counters, synchronous sequential circuits: Basic design steps, Mealy State model, Design of FSM using CAD tools, Serial Adder Example, State Minimization, Design of Counter using sequential Circuit approach.

UNIT IV

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with Strengths and Delays, Strength Contention with Trireg Nets.

System Tasks Functions and Compiler Directives: Parameters, Path Delays, Module Parameters. System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

UNIT V

Designing with FPGAs and CPLDs: Simple PLDs,ComplexPLDs,Xilinx 3000 Series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices (CPLDs), Altera FLEX 10K Series CPLDs.

Suggested Readings:

1. T.R. Padmanabhan, B Bala Tripura Sundari, "**Design Through Verilog HDL**", Wiley 2009.
2. Samir Palnitkar, "**Verilog HDL**", 2nd Edition, Pearson Education, 2009.
3. Stephen Brown, Zvonko Vranesic , "**Fundamentals of Digital Logic with Verilog Design**, TMH, 2nd Edition 2003.

Course Code	Course Title						Core / Elective
OE 601 EE	**RELIABILITY ENGINEERING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- To understand the concepts of different types of probability distributions importance of reliability evaluation of networks.
- To make the students understand about Reliability, availability model of Power Systems and markov modeling of Power Plants. With identical and no identical units.

Course Outcomes

- Able to understand the meaning of discrete and continuous random variables and their significance, causes of failures of a system.
- Able to acquire the knowledge of different distribution functions and their applications.
- Able to develop reliability block diagrams and evaluation of reliability of different systems.

UNIT- I

Discrete and Continuous Random Variables: probability density function and cumulative distribution function, Mean and Variance, Binomial, Poisson, Exponential and Weibull distributions.

UNIT, II

Failure and Causes of Failure: Failure rate and failure density, Reliability function and MTTF, Bath tub curve for different systems, parametric methods for above distributions, Non- Parametric methods from field data.

UNIT- III

Reliability Block Diagram: Series and parallel systems, Network reduction technique, Examples, Evaluation of failure rate, MTTF and reliability, Active and Standby Redundancy, r out of n configuration. Non-series, parallel systems. Path based and cut set methods.

UNIT- IV

Availability, MTTR and MTBF: Markov models and State transition matrices, Reliability models for single component, two components, Load sharing and standby systems, Reliability and availability models of two unit parallel system with repair and standby systems with repair.

UNIT- V

Repairable Systems: Maintainability, Preventive maintenance, Evaluation of reliability and J1TTF, Overhauling and replacement, Optimum maintenance policy, Markov model of a power plant with identical units and non-identical unit, Capacity outage probability table. Frequency of failures and Cumulative frequency

Suggested Readings:

1. Charles E.Ebeling, "**Reliability and Maintainabelity Engineering**", Mc Graw Hill International Edition, 1997.
2. Balaguruswamy, "**Reliability Engineering,**"Tata McGraw Hill Publishing company Ltd,1984.
3. R.N.Allan. "**Reliability Evaluation of Engineering Systems**", Pitman Publishing, 1996.
4. Endrenyi. "Reliability Modelling in Electric Power Systems". JohnWiley & Sons, 1978.

Course Code	Course Title						Core / Elective
OE602EE	BASICS OF POWER ELECTRONICS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	30	70	3

Course Objectives

- To be able to understand various power switching devices, characteristics and applications.
- To learn and understand the various converters like rectifiers, choppers and inverters principle operation, characteristics and applications.

UNIT I: Power Switching Devices

Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, methods of SCR commutation, UJT as a trigger source, gate drive circuits for BJT and MOSFETs

UNIT II: AC-DC Converters (Phase Controlled Rectifiers)

Principles of single-phase fully-controlled converter with R, RL, and RLE load, Principles of single-phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits, Single phase and Three phase dual converters

UNIT III: DC-DC Converters (Chopper/SMPS)

Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current Buck converter - Power circuit, analysis and waveforms at steady state, duty ratio control of output voltage. Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage. Buck-Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage

UNIT IV: DC-AC Converters (Inverters)

Introduction, principle of operation, performance parameters, single phase bridge inverters with R, RL loads, 3-phase bridge inverters - 120 and 180 degrees mode of operation, Voltage control of single phase inverters –single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

UNIT V: AC-AC Converters

Phase Controller (AC Voltage Regulator)-Introduction, principle of operation of single phase voltage controllers for R, R-L loads and its applications. Cycloconverter-Principle of operation of single phase cycloconverters, relevant waveforms, circulating current mode of operation, Advantages and disadvantages

Suggested Reading:

1. Singh.M.D and Khanchandani.K.B, Power Electronics, Tata McGraw Hill, 2nd Edition, 2006.
2. Rashid.M.H, Power Electronics Circuits Devices and Applications. Prentice Hall of India, 2003
3. M.S.Jamil Asghar, Power Electronics, Prentice Hall of India, 2004 With effect from Academic Year 2016-2017
4. Bimbra.P.S, Power Electronics, Third Edition, Khanna Publishers, 1999
5. Mohan, Undeland, Robbins, Power Electronics, John Wiley, 1996

Course Code	Course Title						Core / Elective
OE 601 ME	**INDUSTRIAL ROBOTICS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To familiarize the student with the anatomy of robot and their applications.
- To provide knowledge about various kinds of end effectors usage.
- To equip the students with information about various sensors used in industrial robots.
- To make the student understand the importance of spatial transformation of robots using forward and inverse kinematics.
- To specify and provide the knowledge of techniques involved in robot vision in industry.
- To equip students with latest robot languages implemented in industrial manipulators.

Course Outcomes

- Able to demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and have an understanding of the functionality and limitations of robot actuators and sensors.
- Able to demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulation tools.
- Able to apply knowledge and choose the best & economically suitable sensors/end effectors required for specific applications.
- Able to understand the importance of robot vision and apply the learnt techniques to get the required information from input images.
- Able to design and develop a industrial robot for a given purpose economically.
- Appreciate the current state and potential for robotics in new application areas.

UNIT – I

Introduction to Robotics: Basic structure of Robots. Degree of freedom of Robots, Work envelope, Classification of Robots based on Drive Technology, Work-Envelope and motion control methods. Application of Robots in Industry, Repeatability, Precision and Accuracy as applied to Robots, Specifications of robots used for various applications. End effectors, Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers, Two fingered and three fingered grippers, internal grippers and external grippers, Selection and design considerations.

UNIT – II

Requirements of a Sensor: Principles and Applications of the following types of sensors- Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors), Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters), Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors), Touch sensors (Binary sensors, Analog sensors), Wrist Sensors, Compliance Sensors, Slip Sensors.

UNIT – III

Kinematic Analysis of Robots: Rotation matrix. Homogeneous transformation matrix, Denavit & Hartenberg representation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots, Static force analysis

UNIT – IV

Introduction to Techniques used in Robot Vision: Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, segmentation & description of 3- dimensional structures, their recognition and interpretation. Types of Camera, frame grabbing, sensing and digitizing image data, Signal conversion, Image Storage, Lighting techniques, Image processing and analysis, Data reduction, Segmentation, Feature extraction, Object recognition, and various algorithms, Applications, Inspection, identification, visual serving and navigation.

UNIT – V

Robot Programming Languages: Characteristics of robot level languages, task level languages. Teach pendant programming, Lead through programming, Robot programming languages, VAL programming, Motion commands, Sensor commands. End effecter commands, Simple programs. RGV, AGV, Implementation of robots in industries, various steps, Safety considerations for robot operations. Economic analysis of robots, Pay back method, EUAC method and Rate of return method

Suggested Readings:

1. Groover M P, "**Industrial Robotics**", McGraw Hill Publications, 1999.
2. Fu. K.S., Gon Zalez R.C., Lee C.S.G. "**Robotics, Control-sensing vision and Intelligence**", McGraw Hill, Int. Ed., 1987.
3. Spong and Vidyasagar, "**Robot Dynamics & Control**", John Wiley and Sons, Ed.,1990.
4. Mittal and Nagrath, "**Industrial Robotics**", Tata McGraw Hill Publications, 2004.
5. Saha & Subir kumar saha, '**Robotics'**, TMH, India.

Course Code	Course Title						Core / Elective
OE 602 ME	**MATERIAL HANDLING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To know about the working principle of various material handling equipments.
- To understand the Material handling relates to the loading, unloading and movement of all types of materials.
- To understand the estimation of storage space and maintenance of material handling equipments.

Course Outcomes

- Able to understand various conveying systems that available in industry.
- Able to understand various bulk solids handling systems and their design features.
- Able to understand and various modern material handling systems and their integration.
- Able to calculate number of MH systems required, storage space, cost and maintenance.

UNIT – I

Mechanical Handling Systems: Belt Conveyors and Desing, Bucket Elevators, Package conveyors, Chain and Flight Conveyors, Screw Conveyors, Vibratory Conveyors, Cranes and Hoists.

UNIT – II

Pneumatic and Hydraulic Conveying Systems: Modes of Conveying and High pressure conveying systems, Low Velocity Conveying System. Components of Pneumatic Conveying Systems: General Requirements, Fans and Blowers, Boots-Type Blowers, Sliding-Vane Rotary Compressors, Screw Compressors, Reciprocating Compressors, Vacuum Pumps.

UNIT – III

Solids Handling: Particle and Bulk Properties- Adhesion, Cohesion and Moisture Content. Gravity Flowof Bulk Solids: Static and Dynamic Pressure Distribution in Bulk Solids. Modes of Flow: Mass Flow, Funnel Flow and Expanded Flow from Hoppers, Bins and Silos.

Unit IV

Modern Material Handling Systems: Constructional features of (i) AGV (ii) automated storage and retrieval systems. Sensors used in AGVs and ASRS.Bar code systems and RFID systems: Fundamentals and their integration with computer-based information systems.

UNIT – V

Total MH Throughput: Calculation for no. of MH systems; storage space estimation based on number of aisles. Maintenance of MH equipment, spare parts management, cost of materials handling, cost per unit load computations

Suggested Readings:

1. Dr. Mahesh Varma, "**Construction Equipment and its Planning & Application**", Metropolitan Book Co. (P) Ltd., New Delhi, India, 1997.
2. James M. Apple, **"Material Handling Systems Design",** the Ronald Press Company, New York, USA, 1972.
3. Woodcock CR. and Mason J.S., **"Bulk Solids Handling: An Introduction to Practice Technology**", Leonard Hill USA, Chapman and Hall, New York.
4. M P Groover etal, **"Industrial Robotics**", Me Graw Hill, 1999.

Course Code	Course Title						Core / Elective
OE 632 AE	**AUTOMOTIVE SAFETY AND ERGONOMICS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

It is intended to make the students to

- Understand the basics of vehicle collision and its effects
- Understand the various safety concepts used in passenger cars.
- Gain knowledge about various safeties and its equipment.
- Understand the concepts of vehicle ergonomics.
- Gain knowledge about various automotive comforts features.

Course Outcomes:

After the completion of this unit, the student is able to

- Break down the importance of safety in Automobiles
- Describe the various safeties equipment used in Automobiles
- Explain about Vehicle ergonomics and Comforts in Automobiles

UNIT-I

Introduction: Design of the Body for safety, Energy equations, Engine location, Effects of Deceleration inside passenger compartment, Deceleration on impact with stationary and movable obstacle, Concept of Crumble zone and Safety sandwich construction, Active and passive safety, Characteristics of vehicle structures, Optimization of vehicle structures for crash worthiness, Types of crash / roll over tests, Regulatory requirements for crash testing, instrumentation, High speed photography, image analysis.

UNIT-II

Safety Concepts: Active safety- driving safety, Conditional safety, Perceptibility safety and Operating safety, Passive safety: Exterior safety, Interior safety, Deformation behaviour of vehicle body, Speed and acceleration characteristics of passenger compartment on impact, pedestrian safety, human impact tolerance, determination of injury thresholds, severity index, study of comparative tolerance, Study of crash dummies.

UNIT-III

Safety equipments: Seat belt, automatic seat belt fastening system, Collapsible steering column, tilt-able steering wheel, Air bags, electronic systems for activating air bags, Frontal design for safety, collision warning system, Causes of rear end collision, frontal object detection, rear vehicle object detection system, Object detection system with braking system interactions. Anti-lock braking system ESP and EBD systems

UNIT- IV

Vehicle Ergonomics: Introduction to human body - anthropometrics and its application to vehicle ergonomics, Cockpit design, Driver comfort – seating, visibility, Man-machine system- psychological factors – stress, attention, Passenger comfort - ingress and egress, spaciousness, Ventilation, temperature control, Dust and fume prevention and vibration, Interior features and conveniences, Use of modern technology for the same

UNIT-V

Comfort and Convenience System: Cabin comfort - in-car air conditioning – overall energy efficiency, Air management, central and Unitary systems, air flow circuits, air cleaning, ventilation, air space diffusion, Compact heat exchanger design, controls and instrumentation, Steering and mirror adjustment, central locking system, Garage door opening system, tire pressure control system, rain sensor system, environment information system, Automotive lamps, types, design, construction, performance, Light signalling devices- stop lamp, Rear position lamp, Direction indicator, Reverse lamp, reflex reflector, position lamp, gas discharge lamp, LED, Adoptive front lighting system (AFLS) and Daylight running lamps (DRL).

Suggested Reading

1. Prasad, Priya and BelwafaJamel, "Vehicles Crashworthiness and Occupant Protection", American Iron and Steel Institute, USA.
2. JullianHappian-Smith "An Introduction to Modern Vehicle Design" SAE, 2002
3. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
4. "Recent development in Automotive Safety Technology", SAE International Publication. Editor: Daniel J Helt, 2013.
5. Keitz H.A.E. "Light Calculations and Measurements", Macmillan 1971.

Course Code	Course Title						Core/Elective
MC 951 SP	**YOGA PRACTICE**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**20**	**30**	**3U**

Course Objectives:

- Enhances body flexibility
- Achieves mental balance
- Elevates Mind and Body co-ordination
- Precise time management
- Improves positive thinking at the expense of negative thinking

Course Outcomes:

Student will be able to:

- Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
- An all-round development-physical, mental and spiritual health-takes place.
- Self-discipline and discipline with respect society enormously increases.
- University environment becomes more peaceful and harmonious.

UNIT-I

Introduction: Yoga definition – Health definition from WHO-Yoga versus Health-Basis of Yoga-yoga is beyond science-Zist of 18 chapters of Bhagavadgita- 4 types of yoga: Karma, Bhakti, Gnyana and Raja yoga–Internal and External yoga-Elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi)-Panchakoshas and their purification through Asana, Pranayama and Dhyana.

UNIT-II

Surya Namaskaras (Sun Salutations): Definition of sun salutations-7 chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar)- Various manthras (Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya and Om Bhaskaraya) and their meaning while performing sun salutations-Physiology-7systems of human anatomy-Significance of performing sun salutations.

UNIT-III

Asan as (Postures): Pathanjali's definition of asana-Sthiram Sukham Asanam-3rdlimbofAshtangayoga-Looseningorwarmingupexercises- Sequence of perform in as an as (Standing, Sitting, Prone, Supine and Inverted)-Nomenclature of as an as (animals, trees, rishis etc)-As an as versus Chakras-As an as versus systems-As an as versus physical health-Activation of Annamaya kosha

UNIT-IV

Pranayama (Breathing Techniques): Definition of Pranayama as per Shankaracharya-4th limb of Ashtanga yoga-Various techniques of breathing-Pranayama techniques versus seasons-Band has and their significance in Pranayama-Mudras and their significance in Pranayama-Restrictions of applying band has with reference to health disorders-Pranayama versus concentration-Pranayama is the bridge between mind and body-Pranayam versus mental health-Activation of Pranamaya kosha through Pranayama.

UNIT-V

Dhyana (Meditation): Definition of meditation-7th limb of Ashtanga yoga- Types of mind (Conscious and Sub-Conscious)-various types of dhyana. Meditation versus spiritual health-Dharana and Dhyana-Extention of Dhyana to Samadhi-Dhyana and mental stress-Activation of Mano mayakosha through dhyana- Silencing the mind

Suggested Reading:

1. Light on Yoga by BKS lyengar
2. Yoga education for children Vol-1 by Swami Satyananda Saraswati
3. Light on Pranayama by BKS lyengar
4. Asana Pranayama Mudra and Bandha by Swami Satyananda Saraswati
5. Hatha Yoga Pradipika by Swami Mukhtibodhananda
6. Yoga education for children Vol-11 by Swami Niranjan an and a Saraswati
7. Dynamics of yoga by Swami Satyananda Saraswati

Course Code	Course Title						Core/Elective
MC 952 SP	**NATIONAL SERVICE SCHEME (NSS)**						**Elective**
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**3U**

Course Objectives:

- To help in Character Molding of students for the benefit of society
- To create awareness among students on various career options in different fields
- To remold the students behavior with assertive skills and positive attitudes
- To aid students in developing skills like communication, personality, writing and soft skills
- To educate students towards importance of national integration, participating in electoral process etc. by making them to participate in observing important days.

Course Outcomes:

Student will be able to:

- Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
- An all-round development-physical, mental and spiritual health-takes place.
- Self-discipline and discipline with respect society enormously increases.
- University environment becomes more peaceful and harmonious.

List of Activities:

1. Orientation programme about the role of NSS in societal development
2. Swachh Bharath Programme
3. Guest lecture's from eminent personalities on personality development
4. Plantation of saplings/Haritha Haram Programme 5.BloodDonation / Blood Grouping Camp
5. Imparting computer education to schoolchildren
6. Creating Awareness among students on the importance of Digital transactions
7. Stress management techniques
8. Health Checkup Activities
9. Observation of Important days like voters day, World Water Day etc.
10. Road Safety Awareness Programs
11. Energy Conservation Activities
12. Conducting Programme' son effective communication skills
13. Awareness programme's on national integration
14. Orientation on Improving Entrepreneurial Skills
15. Developing Effective Leadership skills
16. Job opportunity awareness programs in various defence, public sector undertakings
17. Skill Development Programmes
18. Creating awareness among students on the Importance of Yoga and other physical activities
19. Creatingawarenessamongstudentsonvariousgovernmentsponsoredsocialwelfare schemes for the people

Note: At least Ten Activities should be conducted in the Semester**.** Each event conducted under Swachh Barath, Plantation and important days like voters day, world water day may be treated as a separate activity.

Course Code	Course Title						Core/Elective
MC 953 SP	**SPORTS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**20**	**30**	**3U**

Course Objectives:

- To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
- To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
- To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
- To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
- To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

Course Outcomes:

Student will be able to:

- Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.
- Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.
- Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.
- Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.
- Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive.

I. Requirements:

i) Track Pant (students should bring)
ii)Shoes
iii) Volley Ball, Foot Ball and Badminton (Shuttle)
iv) Ground, Court, indoor stadium and swimming pool

II. Evaluation Process:

Total Marks 50
i) 20marks for internal exam (continuous evaluation) a) 8 marks for viva
b) 12marks for sports & fitness

ii) 30marksforendexam a) 10marks for viva
b) 20marks for sports & fitness

Course Code	Course Title						Core/Elective
SI 671 ME	**SUMMER INTERNSHIP**						**Core**
Prerequisite	**L**	**T**	**D**	**P**	**CIE**	**SEE**	**Credits**
-	**0**	**0**	**0**	**2**	**50**	**0**	**2***

Course Objectives: To prepare the students

- To give an experience to the students in solving real life practical problems with all its constraints.
- To give an opportunity to integrate different aspects of learning with reference to real life problems.
- To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes: On successful completion of this course student will be

- Able to design/develop a small and simple product in hardware or software.
- Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
- Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
- Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Industry / R & D Organization / National Laboratory for a period of 4 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional marks are based on the performance of the student at the work place and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

Note: * Students have to undergo summer internship of 4 weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.