SCHEME OF EXAMINATION									
B.TECH (FOUR YEAR) DEGREE COURSE									
FIRST YEAR , INDUSTRIAL PRODUCTION ENGINEERING									
SEMESTER I (COURSE-B)									
EFFECTIVE FROM SESSION 2018-19									
SL. NO.	SUBJECT CODE	SUBJECTS	PERIODS/WEEK			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
THEORY									
1	IP01TBS01	MATHEMATICS-II	3	1	0	30	70	100	4
2	IP01TBS02	CHEMISTRY	3	1	0	30	70	100	4
3	IP01TES01	PROGRAMMING FOR PROBLEM SOLVING	3	0	0	30	70	100	3
4	IP01TES02	ENGINEERING MECHANICS	3	0	0	30	70	100	3
PRACTICAL									
1	IP01PBS01	CHEMISTRY LAB	0	0	3	30	20	50	1.5
2	IP01PES01	PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	3	30	20	50	1.5
3	IP01PES02	WORKSHOP & MANUFACTURING PRACTICES	1	0	3	30	20	50	2.5
4	IP01PES03	ENGINEERING MECHANICS LAB	0	0	2	30	20	50	1
5	IP01PMC01	INDUCTION TRAINING PROGRAMME	-	-	2	-	-	-	-
								TOTAL	20.5
IA – INTERNAL ASSESSMENT ESE – END SEMESTER EXAM. L- LECTURE T-TUTORIAL P-PRACTICAL									

SCHEME OF EXAMINATION									
B.TECH (FOUR YEAR) DEGREE COURSE									
FIRST YEAR , INDUSTRIAL PRODUCTION ENGINEERING									
SEMESTER II (COURSE-A)									
EFFECTIVE FROM SESSION 2018-19									
SL. NO.	**SUBJECT CODE**	**SUBJECTS**	**PERIODS/WEEK**			**EVALUATION SCHEME**			**CREDITS**
			L	**T**	**P**	**IA**	**ESE**	**TOTAL**	
THEORY									
1	IP02TBS03	PHYSICS	3	1	0	30	70	100	4
2	IP02TES03	BASIC ELECTRICAL ENGINEERING	3	1	0	30	70	100	4
3	IP02TBS04	MATHEMATICS-I	3	1	0	30	70	100	4
4	IP02THS01	ENGLISH	3	0	0	30	70	100	3
5	IP02THS02	ENVIRONMENTAL SCIENCES	3	0	0	...	...	..	0
PRACTICAL									
1	IP02PBS02	PHYSICS LAB	0	0	3	30	20	50	1.5
2	IP02PES04	BASIC ELECTRICAL ENGINEERING LAB	0	0	2	30	20	50	1
3	IP02PES05	ENGINEERING GRAPHICS & DESIGN	1	0	3	30	20	50	2.5
								TOTAL	20

IA – INTERNAL ASSESSMENT ESE – END SEMESTER EXAM. L- LECTURE
T-TUTORIAL P-PRACTICAL

Subject code/SUBJECT	L	T	P	Credit
IP01TBS01/MATHEMATICS-II	3	1	0	4

Module 5a: First order ordinary differential equations(6 hours)
Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.
Module 5b: Ordinary differential equations of higher orders (Prerequisite 2c, 4a) (8 hours)
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.
Module 5c: Partial Differential Equations–First order(Prerequisite 5a-b) (6 hours)
First order partial differential equations, solutions of first order linear and non-linear PDEs.
Module 5d: Partial Differential Equations- Higher order(Prerequisite 5b-c) (10 hours)
Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.
Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
7. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
8. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
9. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
10. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010
11.Denian murry,defferential equations ,oxford publications

31/10/18 31/7/18 31/7/18

SUBJECT CODE/NAME	L	T	P	Credit
IP01TBS02/CHEMISTRY	3	1	0	4

Unit-I **Concept of Quantum Energy and Spectroscopy:** Quantization of Energy, Regions of spectrum. Electronic Spectroscopy: Electronic Transition, Woodward Fiesher rules for calculating λ_{max} of conjugated dienes & α,β-unsaturated carbonyl compound, various shifts in λ_{max} and intensities. Infra Red Spectroscopy: Conditions for Infra Red Spectroscopy, Molecular vibrations & factors affecting Infra Red frequencies. **[8 L]**

Unit-II **Chemical Bonding in Molecules:** Introduction of chemical bonding, VSEPER Theory, V.B.Theory and Molecular Orbital Theory. Energy level diagrams of diatomic molecules and ions. **[16 L]**

Unit-III Concept of Chirality, Enentiomers, Diastereomers,Meso-compounds and Recimic mixtures. Conformation of Acyclic hydrocarbons (Ethane, Propane & n-Butane) and Cyclic hydrocarbon (Cyclohexane), Plane of symmetry, Center of symmetry, Absolute and Relative Configuration (R &S, D & L and E & Z). **[8 L]**

Unit-IV Reactivity of Organic Molecules, Factors influencing acidity, basicity and nucleophilicity of molecules, kinetic vs thermodynamic control of reactions. **[12 L]**

Unit-V Strategy for Synthesis of Organic Compounds: Reaction intermediates: Stability of Free Radicle, Carbocation and Carbanion. Introduction to reaction involving Addition, Elimination, Substitution and Ring opening and Cyclization. **[16 L]**

31/7/18 31/7/18

Subject code/NAME	L	T	P	Credit
IP01TES01/PROGRAMMING FOR PROBLEM SOLVING	3	0	0	3

Unit 1

Introduction to Programming (3 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) -

Idea of Algorithm (3 lectures): steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Unit 2

Arithmetic expressions and precedence (12 lectures)

Conditional Branching and Loops

Writing and evaluation of conditionals and consequent branching

Iteration and loops

Arrays (6 lectures) Arrays (1-D, 2-D), Character arrays and strings

Unit 3

Basic Algorithms (6 lectures)

Searching ,concept of binary search etc , Basic Sorting Algorithms Bubble sort etc,Finding roots of equations, introduction of Algorithm complexity

Unit *4*

Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference binary search etc

Recursion functions (5 lectures) Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, etc.

Unit 5

Structure (4 lectures)

Structures, Defining structures and Array of Structures

Pointers (3 lectures) Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

31/7/18 31/7/18

31/7/18

SUBJECT CODE/SUBJECT	L	T	P	Credit
IP01TES02/ENGINEERING MECHANICS	3	0	0	3

ENGINEERING MECHANICS

UNIT-I

Introduction to Engineering Mechanics covering, Force SystemsBasic concepts,Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar,Concurrent Forces, Components in Space–Resultant- Moment of Forces and its Application;Couples and Resultant of Force System, Equilibrium of System of Forces, Free bodydiagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II

Friction covering, Types of friction, Limiting friction, Laws of Friction, Staticand Dynamic Friction; Motion of Bodies.

Basic Structural Analysis covering, Equilibrium in three dimensions; Method ofSections; Method of Joints; Simple Trusses; Zero force members.

UNIT-III

Centroid and Centre of Gravity covering, Centroid of simple figures from firstprinciple, centroid of composite sections; Centre of Gravity and its implications; Areamoment of inertia- Definition, Moment of inertia of plane sections from first principles,Theorems of moment of inertia, Moment of inertia of standard sections and compositesections.

UNIT-IV

Virtual Work and Energy Method- Virtual displacements, principle of virtualwork for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, mechanical efficiency.

Review of particle dynamics- Rectilinear motion; Newton's 2nd law (rectangular and path). Work-kinetic energy,power, potential energy.Impulse-momentum; Impact (Direct and oblique).

UNIT-V

Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principlesin dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simpleproblems; D'Alembert's principle and its applications in plane motion and connected bodies;Work energy principle and its application in plane motion of connected bodies; Kinetics ofrigid body rotation;

Text/Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II,–Dynamics, 9th Ed, Tata McGraw Hill
3. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
4. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
5. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
6. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
7. Tayal A.K. (2010), Engineering Mechanics, Umesh Publication

31/07/18 31/7/18 31/7/18 31/7/18

SUBJECT CODE/SUBJECT	L	T	P	Credit
IP01PBS01/CHEMISTRY LAB	0	0	3	1.5

List of Experiments:

Group – A:

1. Standardization of sodium thiosulphate solution by standard potassium dichromate solution.
2. To determine the Normality and Strength (g/L) of given Ferrous Ammonium Sulphate solution 'A' using standard Ferrous Ammonium Sulphate (N/30) solution 'B' taking KMnO4 solution as an intermediate.
3. To determine the concentration of hypo solution ($Na_2S_2O_3.5H_2O$) iodimetrically with given Iodine (N/50) solution.
4. Find out the Temporary hardness of given water sample using 0.01M EDTA solution, buffer solution (pH-10) and EBT as an indicator.
5. To determine chloride ion in a given water sample by Argentometric method (Mohr's method)

Group – B:

6. Preparation of Urea Formaldehyde resin.
7. Acetylation of Primary Amine: Preparation of Acetanilide.
8. Base Catalyzed Aldol Condensation: Synthesis of Dibenzalpropanone.
9. [4+2] Cycloaddition Reaction: Diels-Alder reaction.
10. Preparation of Asprin and calculate its yield.

Group – C:

11. To calculate the λ_{max} of a given compound using UV-visible spectrophotometer.
12. To separate the metallic ions by paper chromatography.
13. To determine the surface tension of a liquid by stalagmometer.
14. To determine the percentage composition of the given mixture consisting of two liquids A and B (non interacting system) by viscosity method.
15. To determine the relative viscosity of given liquids by Ostwald's viscometer.

Note: At least two Experiments from each group must be performed.

31/7/18 31/7/18

SUBJECT CODE/NAME	L	T	P	Credit
IP01PES01/PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	3	1.5

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

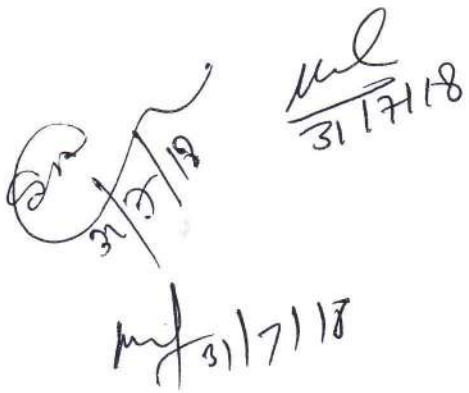
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures



SUBJECT CODE/NAME	L	T	P	Credit
IP01PES02/ WORKSHOP & MANUFACTURING PRACTICES	1	0	3	2.5

Lectures & videos 10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Suggested Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
(ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4Th edition, Pearson Education India Edition, 2002.
(iii) Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology–I" Pearson Education, 2008.
(iv) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
(v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

31/7/18

SUBJECT CODE/SUBJECT	L	T	P	Credit
IP01PES03/ENGINEERING MECHANICS LAB	0	0	2	1

Engineering Mechanics - Lab

List of Experiments

1. Verification of law of parallelogram of forces.
2. Verification of law of triangle of forces.
3. Verification of law of polygon of forces by universal force table.
4. Verification of law of moment by parallel forces apparatus.
5. Practical verification of forces in the member of jib crane.
6. Practical verification of forces in the member of the truss.
7. Determination of coefficient of friction between two given surfaces by inclined plane method.
8. Determination of efficiency of simple screw jack.
9. Determination of efficiency of single purchase winch crab.
10. Determination of efficiency of double purchase winch crab.
11. Determination of efficiency of simple wheel and axle.

31/07/18 31/7/18 31/7/18

SUBJECT CODE/SUBJECT	L	T	P	Credit
IP02TBS03/PHYSICS	3	1	0	4

Unit - 1: Optics: Interference and Diffraction

Introduction, Young's experiment, theory of interference, Coherent and non-coherent sources, Fresnel's Bi-prism and Newton's ring experiment.

Diffraction of light, Fresnel and Fraunhofer's diffraction, diffraction due to plane diffraction grating.

Unit - 2: Electromagnetic Theory

Coulomb's law, electrostatics field and potential, electric flux, Gauss' law, Poisson's and Laplace's equation, Equation of continuity for charge conservation, Ampere's and Faraday's laws, Maxwell's Electromagnetic equations.

Unit - 3: Laser and Fiber optics

Introduction, elementary idea of spontaneous and stimulated emission, active medium, population inversion, Einstein's coefficients, Types of lasers and important applications of lasers.

Introduction to optical fibers, basic principles of optical fiber, critical angle, numerical aperture, maximum acceptance angle, classification of optical fiber.

Unit -4: Semiconductor Physics and Devices

Formation of energy in solids, Energy band gap of metals, insulators and semiconductors, classification of semiconductor: Intrinsic and Extrinsic semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Electrical conductivity in conductors and semiconductors, working of P-N Junction diodes and Bipolar Junction transistor.

Unit - 5: Introduction to Quantum Mechanics

Introduction to QuantumMechanics, Photoelectric effect, Compton effect, wave-particle duality, uncertainty principle, wave function, De-Broglie waves, Phase and Group velocity, Davisson and Germer experiment, Schrodinger wave equation, particle in a box (1-Dimentional).

Text Books and References

1) Applied Physics – I and II by Navneet Gupta, Dhanpat Rai & Co.
2) Engg. Physics by S. K. Srivastava and R. A. Yadav, New Age Pub. New Delhi
3) Engg. Physics by Uma Mukherjee, Narosa Publication
4) Engg. Physics by M. N. Avadhanulu, S. Chand Pub.
5) Electricity and Magnetism by Rangwala and Mahajan, Tata McGraw Hill, 1998
6) Concepts of Physics Part -II by H. C. Verma, BharatiBhawan (P&D), 1998
7) Modern Physics by Beiser, McGraw Hill Inc. New York, Publication 1995
8) Modern Physics by Mani and Mehta, East-West Press Pvt. Ltd. 1998
9) Introduction to Electrodynamics, David Griffith
10) J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
11) B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., 2007).
12) S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
13) Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
14) P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
15) Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
16) Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

31/7/18

SUBJECT CODE/NAME	L	T	P	Credit
IP02TES03/ BASIC ELECTRICAL ENGINEERING	3	1	0	4

Module 1 : DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase
Balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and
working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC bucks and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthling. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

(i)D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(ii)D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
(iii)L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
(iv)E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
(v)V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

31/07/18 31/7/18

Subject code	L	T	P	Credit
IP01TBS01/ **MATHEMATICS-I**	3	1	0	4

Calculus (Single Variable)

Module 2a: ***Calculus:*** (6 hours)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Asymptotes: definition, properties and problems.

Module 2b: ***Calculus:*** (6 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 2c:*Sequences and series:* (Prerequisite 2b) (10 hours)

Convergence of sequence and series, tests for convergence, power series, Taylor's series.Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Textbooks/References:

1.G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11 Reprint, 2010.

4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Multivariable Calculus

Module 3a:*Multivariable Calculus (Differentiation)* (Prerequisite 2b) (10 hours) Limit, continuity and partial derivatives, direct ional derivat ives, total derivat ive; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 3b: ***Multivariable Calculus (Integration)*** (Prerequisite 3a) (10 hours)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple
applications involving cubes, sphere and rectangular parallelepipeds.

Textbooks/References:

1.G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002.

2.Veerarajan T., Engineering Mathemat ics for first year, Tata McGraw-Hill, New Delhi, 2008.

3.Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11 Reprint, 2010.

4.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

5.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,2000.

Matrices and Linear Algebra

Module 4a: ***Matrices (in case vector spaces is not to be taught)*** (14 hours)

31/3/18 31/3/18

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Module 4b:*Matrices (in case vector spaces is to be taught)* (8 hours)
Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Module 4c:*Vector spaces* (Prerequisite 4b) (10 hours)
Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation,ranknullity theorem, composition of linear maps, Matrix associated with a linear map.

Module 4d:*Vector spaces* (Prerequisite 4b-c) (10 hours)

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Textbooks/References:

1.D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
2.V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East-West press, Reprint 2005.
3.Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4.Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

31/7/18

31/7/18

Subject code	L	T	P	Credit
IP02THS01/ ENGLISH	3	0	0	3

1. Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

Sentence Structures , Use of phrases and clauses in sentences , Importance of proper punctuation , Creating coherence , Organizing principles of paragraphs in documents , Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

4. Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

5. Writing Practices

Comprehension, Précis Writing, Essay Writing.

6. Oral Communication (This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii)On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

31/7/18

CODE/SUBJECT	L	T	P	CREDIT
IP02TMC01/ENVIRONMENTAL SCIENCES	3	0	0	0

ENVIRONMENTAL STUDIES

~~CR-4~~ NC 04 Classes Bhiwadi

Introduction to environmental studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. Ecosystems: Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Natural Resources Renewable and Non---renewable Resources: Land resources and land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over---exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter---state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies. Biodiversity and Conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega---biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex--situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value. Environmental Pollution: Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case studies. Environmental Policies & Practices. Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, human wildlife conflicts in Indian context. Human Communities and the Environment. Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements Chipko, silent valley, Bishnois of Rajasthan. Environmental ethics: role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Field work: Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river etc.

Suggested Readings:

1. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
2. Grumbine,R. Edward, and Pandit, M.K.2013. Threats from India's Himalaya dams. Science, 339: 36---37.
3. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
4. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.

31/7/18

SUBJECT CODE/SUBJECT	L	T	P	Credit
IP02PBS02/PHYSICS LAB	0	0	3	1.5

List of Experiments:

1. To determine the wavelength of sodium light with help of Fresnel's Bi-prism.
2. To determine the refractive index and dispersive power of the material of prism with the help of spectrometer.
3. To determine the sodium light by Newton's ring method.
4. To determine the wavelength of sodium light by plane diffraction grating using spectrometer.
5. To demonstrate the diffraction pattern and determine the wavelength of different colors of mercury (white) light using plane diffraction grating and spectrometer.
6. To determine the wavelength and number of lines per cm on a diffraction grating using semiconductor laser diode.
7. To determine the specific rotation of sugar solution with the help of polarimeter.
8. Determine the width of the single slit and diameter of circular aperture using Fraunhofer diffraction pattern produced by semiconductor laser diode.
9. To determine the Energy band gap (E_g) of a semiconductor material using P-N junction diode.
10. To determine the e/m ratio by Thomson's method
11. To study the P-N junction diode characteristics, in forwarded and reverse bias conditions.
12. To study the Zener diode characteristics.
13. To study the characteristics and gain of Transistor in C-B and C-E mode.
14. Determine the Planck's constant.

31/7/18

SUBJECT CODE/NAME	L	T	P	Credit
IP02PES04/ BASIC ELECTRICAL ENGINEERING LAB	0	0	2	1

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments–voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
- Sinusoidal steady state response of R-L, and R-C circuits–impedance calculation and verification. Observation of phase differences between current and voltage. Resonancein R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidalwave-shapeduetoB-Hcurvenonlinearityshouldbeshownalongwitha discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
- Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronousspeed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters–PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

SUBJECT CODE/SUBJECT	L	T	P	Credit
IP02PES05/ENGINEERING GRAPHICS & DESIGN LAB	1	0	3	2.5

ENGINEERING GRAPHICS & DESIGN

UNIT-I

Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments,lettering, Conic sections including the Rectangular Hyperbola (General method only);Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

UNIT-II

Orthographic Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes.

Projections of Regular Solids

Inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioningand scale.

UNIT-III

Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid, Cone–Auxiliary Views; Development of surfaces of RightRegular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic viewsof geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT-IV

Isometric Projections covering,

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions;Isometric Views of lines, Planes, Simple and compound Solids; Conversion of IsometricViews to Orthographic Views and Vice-versa, Conventions;

UNIT-V

Overview of Computer Graphics

listing the computer technologies that impact on graphical communication, Demonstratingknowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard,Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs,Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), TheCommand Line (where applicable), The Status Bar, Different methods of zoom as used inCAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compoundSolids].

Suggested Text/Reference Books:

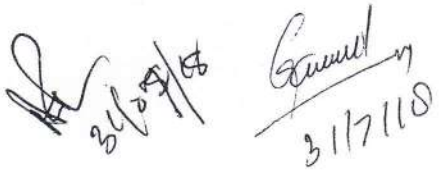
(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

(iii)Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

(v) (Corresponding set of) CAD Software Theory and User Manuals



GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
CBCS–New, Study & Evaluation Scheme W.E.F. Session: 2020–21
B.TECH SECOND YEAR, III SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
1.	IP03TBS05	Numerical Methods	3	–	–	30	70	100	3
2.	IP03TES05	Engineering Thermodynamic	3	1	–	30	70	100	4
3.	IP03TPC01	Strength of Material	3	1	–	30	70	100	4
4.	IP03TPC02	Theory of Machines	3	1	–	30	70	100	4
5.	IP03TPC03	Manufacturing Processes– I	3	–	–	30	70	100	3
Total			**15**	**3**	**–**	**150**	**350**	**500**	**18**
PRACTICALS									
1.	IP03PPC01	Theory of Machines Lab	–	–	2	30	20	50	1
2.	IP03PPC02	Material Testing Lab	–	–	2	30	20	50	1
3.	IP03PBS03	Programing in C & MATLAB	–	–	2	30	20	50	1
Total			**–**	**–**	**6**	**90**	**60**	**150**	**3**

Total Credits: **21**
Total Contact Hour: **24**
Total Marks: **650**
INTERNAL ASSESSMENT:–two class tests of 15 marks each will be conducted.
L–LECTURE, T–TUTORIAL, P–PRACTICAL, ESE –END SEMESTER EXAMINATION

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP03TBS05	Numerical Methods	3	0	0	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the information related to existence and uniqueness criteria applied to numerical methods.
2. To provide the knowledge of convergences criteria and awareness of reasons behind the failure of numerical methods.
3. To find numerical approximations to the roots of equation by Newton method, Bisection method, Secant method, etc.
4. To find numerical solution to a system of linear equations by Gaussian elimination and Gauss–Siedel iterative etc.
5. To find numerical solution for ordinary and partial differential equation.

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1: Apply knowledge of numerical analysis for understanding, formulating and solving engineering problems.

CO2: Acquire knowledge and hands–on competence in applying the concepts of Numerical Analysis and computer.

CO3: Programming in the analysis of mechanical systems.

CO4: Identify, analysis, and solve mechanical engineering problems useful to the society.

CO5: Work effectively with engineering and science teams as well as with multidisciplinary analysis.

COURSE CONTENT:

Module – I

Introduction of errors and their analysis, types of errors, numerical problems on error analysis. Curve fitting: method of least squares, fittings of straight line and parabola and by method of moments, fitting of exponential curves, fitting of the curve.

Module – II

Numerical solution of algebraic and transcendental equations: Graphical method, bisection method, Secant method, Regula–falsi method, Newton Raphson method. Solution of a system of simultaneous linear algebraic equations direct method: Gauss elimination method, Gauss Jordan method, Iterative methods, Jacobi iterative method, Gauss Seidel iterative method.

Module – III

The Calculus of finite differences: Finite differences, difference formula, operators and relation between operators, inverse operator. Interpolation with equal intervals: Newton's forward and backward interpolation formula. Interpolation with unequal intervals: Lagrange's interpolation, Newton's difference formula, inverse interpolation.

Module – IV

Numerical differentiation and integration: Numerical differentiation, maxima and minima of a tabulated function. Numerical Integration: Trapezoidol rule, Simpson's (1/3)rd and (3/8)th rule, Boole's rule, Weddle rule. Difference Equations: definition, order and degree of a difference equation, linear difference equations, difference equations reducible to linear form simultaneous difference equations with constant coefficients.

Module – V

Numerical solution of ordinary differential equation: Taylor series method, Euler's method, modified Euler method, Runge's method, Runge Kutta method, numerical method for solution of partial differential equations. General linear partial differential equation, Laplace equation and Poisson equation.

TEXT & REFERENCE BOOKS:

1. Numerical Methods for Scientific and Engineering Computations – Jain & Iyngar, New Age International Publications.
2. Numerical Analysis – G.S. RAO, New Age International Publications.
3. Numerical Methods in Engineering and Science – B.S. Grewal, Khanna Publishers.
4. Advance Engineering Methods – H. K. Das, S. Chand Publications.
5. Computer Oriented Numerical Methods– V. Rajaraman, PHI Learning Publications.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP03TES05	Engineering Thermodynamic	3	1	–	15	15	70	100	4

COURSE OBJECTIVES:

1. This course deals with the fundamentals of thermodynamics including thermodynamic systems, properties, and relationships among the thermos-physical properties, the laws of thermodynamics and applications of these basic laws in thermodynamic systems.
2. To enable the students to understand second law of thermodynamics and apply it to various systems, note the significance of the results and to know about entropy and second law aspects of daily life.
3. To enable the students about properties of pure substances and to analyse vapour power cycle.

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1: Apply principles of engineering, basic science, and mathematics (including multi variant calculus and differential equations) and thermodynamics to model, analyse, design, and realize physical systems, components, or processes.

CO2: Identify, formulate, and solve engineering problems.

CO3: Apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.

CO4: omprehend the thermodynamics and their corresponding processes that influence the behaviour and response of structural components.

COURSE CONTENT:

Module – I

Basic concepts: Concept of continuum, macroscopic and microscopic approach.

Thermodynamic systems: Closed, open and isolated system, property, state, path and point function, process, quasi static process, work, modes of work transfer, Zeroth law of thermodynamics, concept of temperature and heat, concept of ideal and real.

First law of thermodynamics: Concepts of internal energy, specific heat capacities, enthalpy, energy balance for closed and open systems, energy balance for steady flow systems, steady and unsteady flow energy equation and its applications.

Module – II

Second law of thermodynamics: Thermal energy reservoirs, second law, Carnot cycle, Carnot theorem, thermodynamic temperature scale, Carnot heat engine, refrigerator and heat pump, Clausius inequality, concept of entropy, principle of entropy, reversible and irreversible processes, entropy change during process, available and un-available energy, availability for closed and open system, Third law of thermodynamics.

Module – III

Properties of pure substances: Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, P–V, P–T, T–V, T–S, H–S diagrams, PVT surfaces, thermodynamic properties of steam, calculations of work done and heat transfer in non– flow and flow processes.

Module – IV

Vapour power cycles: Carnot cycle, Rankine cycle, Reheat cycle, Regenerative cycle, Binary vapour cycle, thermal efficiency and work ratios, factors affecting efficiency and work output.

Module – V

Heat Transfer: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, combined modes of heat transfer, thermal diffusivity, overall heat transfer coefficient. Basic concept of convection and its application. Thermal Radiation: black and non black bodies, Kirchhoff's law, intensity of radiation, radiation exchange between black surface, geometric configuration factors.

TEXT & REFERENCE BOOKS:

1. Engineering Thermodynamics – P.K. Nag, Tata McGraw Hill Education.
2. Thermodynamics – An Engineering Approach – Cengel, McGraw Hill Education.
3. Fundamentals of thermodynamics – Sonntag & G. J. V. Wylen, John Wiley and Sons.
4. Fundamentals of Engineering Thermodynamics – M. J. Moran, H. N. Shapiro, D. D. Boettner & M. Bailey, John Wiley & Sons.
5. Engineering thermodynamics – J. B. Jones & R. E. Dugan, Prentice Hall.
6. Outline of Thermodynamics for Engineers – M. C. Potter & C. W. Schaum's Somerton, McGraw-Hill Education.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP03TPC01	Strength of Material	3	1	–	15	15	70	100	4

COURSE OBJECTIVES:

1. Use different material properties and characteristics for various mechanical and structural applications.
2. Categorize the stress and strain on the basis of different conditions/type of loading/nature of loading.
3. Determine the various parameter such as stress, strain and deflection for various specimens.
4. Compare the result using theoretical, graphical and experimental approach.
5. Draw stress strain curve to show mechanical properties of material.
6. Propose technique/methods to solve problems that match the one's strength.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Propose material properties for different mechanical and structural applications.

CO2: Formulate the fundamental concepts of stress/strain.

CO3: Suggest various techniques to solve structural/mechanical members subjected to combined loading.

CO4: Apply various failure criteria for general stress states at points.

CO4: Use method of solution that matches one's capability.

COURSE CONTENT:

Module – I

Simple stresses and strains: Concept of stress and strain, St. Venant's principle, stress and strain diagram, elasticity and plasticity, types of stresses and strains, Hooke's law, stress–strain diagram for mild steel, working stress, factor of safety, lateral strain, Poisson's ratio, volumetric strain. Elastic moduli and relationship between them: bars of varying section, composite bars, temperature stresses. Strain energy, resilience, gradual, sudden, impact and shock loadings, simple applications.

Module –II

Compound stresses and strains: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress–strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain, relationship between elastic constants.

Module – III

Bending moment and Shear force diagrams: Bending moment (BM) and shear force (SF) diagrams. BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs.

Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Shear stresses: Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Module – IV

Flexural Stresses, theory of simple bending, assumptions, derivation of bending equation: M/I = f/y = E/R, Neutral axis, determination of bending stresses, section modulus of rectangular and circular sections (solid and hollow), I, T, angle and channel sections, design of simple beam sections.

Slope and deflection: Relationship between moment, slope and deflection, moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

Module – V

Torsion: Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close coiled helical springs.

Thin Cylinders and Spheres: Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder and sphere subjected to internal pressures.

TEXT & REFERENCE BOOKS:

1. Elements of Strength of Materials – S.Timoshenko and D. H. Young, Affiliated East-West Press.
2. Solid Mechanics – S. M. A Kazmi, McGraw-Hill.
3. Mechanics of Materials – R.C. Hibbeler, Pearson.
4. An Introduction to the Mechanics of Solids – S. H. Crandall, N. C. Dahl and T. J. Lardner, Tata McGraw Hill Education Private Limited (2012).
5. Laboratory Manual of Testing Materials – William Kendrick Hall, Prentice Hall of India.
6. Mechanics of Materials – Ferdinand P. Beer, E. Russel Jhonston Jr., John T. D E Wolf, McGraw Hill.
7. Strength of Materials– R. Subramanian, Oxford University Press.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP03TPC02	Theory of Machines	3	1	–	15	15	70	100	4

COURSE OBJECTIVES:

1. To impart knowledge of various types of links, mechanisms and machines and kinematics inversions.
2. To familiarize the kinematics of mechanisms by drawing the velocity and the accelerations diagrams.
3. To solve practical problems related to design of linkage mechanisms and cam and follower systems to generate specified output motions.
4. To explain the importance of kinematics of gear and gear trains.
5. To acquire knowledge about the fundamental principles of flywheel.
6. To explain the types of mechanical governors and to analyze its performance parameters.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Solve static and dynamic analysis of mechanisms and synthesize four bar mechanism.

CO2: Analyse the position, velocity and acceleration of mechanisms.

CO3: Construct cam profiles and analysis of their velocity and acceleration.

CO4: Know different types of gears, gear terminology and understand important gear trains and their practical applications.

CO5: Construct turning moment diagram and have the knowledge of flywheels.

CO6: Know the various types of governor and application of governor.

COURSE CONTENT:

Module – I

Classification of mechanisms, basic kinematic concepts and definitions, degree of freedom, mobility, Grashof's law, kinematic inversions of four bar chain and slider crank chains, limit positions, mechanical advantage, transmission angle, description of some common mechanisms, quick return mechanism, straight line generators, universal joint, rocker mechanisms.

Module – II

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centre, velocity and acceleration analysis using loop closure equations kinematic analysis of simple mechanisms, slider crank mechanism dynamics, coincident points, Coriolis component of acceleration, introduction to linkage synthesis, three position graphical synthesis for motion and path generation.

Module – III

Classification of cams and followers, terminology and definitions, displacement diagrams, uniform velocity, parabolic, simple harmonic and cycloidal motions, derivatives of follower motions, specified contour cams, circular and tangent cams, pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers.

Module – IV

Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting, helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics, compound, reverted and epicyclic gear trains, velocity ratio of epicyclic gear trains.

Module – V

Turning moment of Flywheel: Function of a flywheel, crank effort diagrams, fluctuation of speed and energy, effect of centrifugal tension of flywheel, inertia torque and its effects on crank effort diagrams.

Governors: Characteristics of centrifugal governors, Gravity controlled governors, Porter and Proell. Spring controlled centrifugal governor: Hartung, & Hartnell governor. Performance parameter: sensitivity, stability, isochronisms, governor effort and power.

TEXT & REFERENCE BOOKS:

1. Theory of Machines – Thomas Bevan, CBS Publishers.
2. Mechanisms of Machines – W.L. Cleghorn, Oxford University Press, 2015.
3. Kinematics and Dynamics of Machinery – L. Norton Robert, McGraw-Hill.
4. Theory of Mechanisms and Machines – A. Ghosh, A. K. Mallik – EWP Press.
5. Theory of Machines and Mechanisms - J.Uicker, Gordon R Penstock & J.E. Shigley – Oxford International Edition

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP03TPC03	Manufacturing Processes– I	3	–	–	15	15	70	100	3

COURSE OBJECTIVES:

1. To inculcate the principle, thermal and metallurgical aspects during solidification of metal.
2. To impart knowledge about principles/ methods of casting with detail design of gating/ riser system needed for casting, defects in cast objects and requirements for achieving sound casting.
3. Interpret foundry practices like pattern making, mould making, core making and Inspection of defects.
4. To impart knowledge about principles and criteria of yielding during forming of metals, analysis of different bulk metal forming processes following different analysis approach.
5. To understand the application of jigs and fixtures.
6. To study various metal forming processes and plastic deformation during forming processes.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Decide yielding of a material according to different yield theory for a given state of stress.

CO2: Analyze the different bulk metal forming process mechanics using different analysis approach and calculate the force, power requirements etc.

CO3: Evaluate the effect of process parameters on the process mechanics during bulk metal forming.

CO4: Learn appropriate design of gating systems and manufacturing processes in order to design products.

CO5: Recognize the various metal forming techniques and the theory of plasticity and its application for analyzing various metal forming Processes.

CO6: Recognize and use jigs and fixtures in various engineering applications.

COURSE CONTENT:

Module – I

Foundry: Molding method and materials, sand-clay-water system, additives, pattern making and types, pattern allowances & design considerations, types of molding sand & their properties, testing, cores and sand core boxes, core making, molding machine.

Gating system: Elements & design of gating system, design of riser, solidification of casting.

Module – II

Melting furnaces and practices: Melting cast iron, steel and non ferrous material, cupola, charge calculation, open furnaces, converter and crucible furnaces, electric, direct arc furnace, inductive furnace.

Module – III

Special casting processes: Centrifugal and investment casting, shell, types and principle of die casting, squeeze casting, gravity and pressure die casting, die casting consideration, continuous casting, centrifugal casting, slush casting, casting defects.

Module – IV

Metal forming: Need and classification, elastic and plastic deformation, yield criteria, fundamentals of hot and cold working processes.

Drawing: Drawing process geometry and analysis of wire and sheet drawing for load and power calculations, maximum reduction possible.

Rolling: Classification of rolling, process geometry and analysis of plate rolling for rolling load, rolling pressure and power calculations, defects in rolled products.

Forging: Classification of Forging, determination of forces in disc forging considering sticking and slipping, forging defects.

Extrusion: Classification, process geometry and analysis of rod and sheet extrusion for load and power calculations, maximum reduction possible, defects in extruded product.

Module – V

Work holding device: Introduction to jigs, fixtures and their types, design criteria, economic justification, fundamental principles of design of jigs and fixtures, location and clamping in jigs and fixtures, drilling jigs, milling fixtures, indexing jigs and fixtures.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for engineering materials - Kalpakjian and Schmid, Pearson India.
2. Manufacturing Science- A. Ghosh and A. K. Mallik, East-West Press Pvt. Ltd. New Delhi.
3. Manufacturing Technology (Foundry, Forming and Welding) – P. N. Rao, Tata McGraw Hill Publishing Company.
4. Materials and Processes in Manufacturing - E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi.
5. Production Engineering Sciences - P. C. Pandey and C. K. Singh, Standard Publishers Ltd.

.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.Tech III Sem.	IP03PPC01	Theory of Machines Lab	–	–	2	30	20	50	1

COURSE OBJECTIVES:

1. Be proficient in the use of mathematical methods to analyze the forces and motion of complex systems of linkages, gears and cams.
2. Be able to design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship.
3. Be able to analyze the motion and the dynamical forces acting on mechanical systems composed of linkages, gears and cams.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Identify mechanisms in real life applications.

CO2: Perform kinematic analysis of simple mechanisms

CO3: Perform static and dynamic force analysis of slider crank mechanism.

CO4: Determine moment of inertia of rigid bodies experimentally.

LIST OF EXPERIMENTS:

1. Study of Gyroscopic effect and determination of gyroscopic couple.
2. Determination of jump sped of cam–follower system.
3. Dynamic balancing of the rotating mass system.
4. To determine radius of Gyration “K” of given pendulum.
5. To study the free vibration and to determine the natural frequency of vibration of Tow–Rotor system.
6. To study the torsional vibration and to determine the natural frequency vibration of single rotor system.
7. Study of longitudinal vibration and to determine the frequency of vibration.
8. To study the damped torsional vibration and determine the damping coefficient.
9. To verify the relation $T = 2 \Pi \sqrt{1/g}$ for a simple pendulum.
10. Determination of whirling speed of shafts.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.Tech III Sem.	IP03PPC02	Material Testing Lab	–	–	2	30	20	50	1

COURSE OBJECTIVES:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Ability to communicate effectively the mechanical properties of materials

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Perform the function on multi-disciplinary teams in the area of materials testing.

CO2: Use the techniques, skills and modern engineering tools necessary for engineering.

CO3: Apply professional and ethical responsibility in the areas of material testing.

LIST OF EXPERIMENT:

1. Tension test.
2. Bending tests on simply supported beam and Cantilever beam.
3. Compression test on concrete.
4. Impact test.
5. Shear test.
6. Investigation of Hook's law that is the proportional relation between force and stretching in elastic deformation.
7. Determination of torsion and deflection.
8. Measurement of forces on supports in statically determinate beam.
9. Determination of shear forces in beams.
10. Determination of bending moments in beams.
11. Measurement of deflections in statically determinate beam.
12. Measurement of strain in a bar.
13. Bend test steel bar.
14. Yield/tensile strength of steel bar.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.Tech III Sem.	IP03PBS03	Programming in C & MATLAB	–	–	2	30	20	50	1

COURSE OBJECTIVES:

1. To familiarize the student in introducing and exploring MATLAB & C softwares.
2. To enable the student on how to approach for solving engineering problems using simulation tools.
3. To prepare the students to use MATLAB/C in their project works.
4. To provide a foundation in use of this softwares for real time applications

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Perform the programming & simulation for engineering problems.
CO2: Learn importance of this software for lab experimentation.
CO3: Articulate importance of software's in research by simulation work.
CO4: In-depth knowledge of providing virtual instruments on C language environment.
CO5: Ability to write basic mathematical, numerical method problems in MATLAB.

LIST OF EXPERIMENT:

1. Write a programme which creates and uses array of object of a class (for example implementing the list of student of their department having details such as name, age etc).
2. Write a programme to find maximum out of two numbers.
3. Write a programme using copy constructor to copy data of an object to another object.
4. Write a programme to over load new/delete operators in a class.
5. Write a programme to illustrate the use of pointers two object which are related by inheritance.
6. Write a programme showing data conversion between objects of different classes.
7. Write a programme to show conversion from string to integer and vice versa.
8. To know the history and features of MATLAB & the local environment of MATLAB.
9. Find the roots of equations find the values at different points and plot the graph.
10. Find the derivative of an equation in MATLAB.
11. Find the area enclosed between the curves in MATLAB.
12. Find the addition, subtraction, multiplication, transpose and inverse of matrices.
13. Find the rank: Eigen values and Eigen vector of matrices.
14. Write a program to find the roots of an equation using Bi–section method, Regula–falsi method and Newton Raphson method.
15. Plot the surface for an equation.

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
CBCS–New, Study & Evaluation Scheme W.E.F. Session: 2020–21
B.TECH SECOND YEAR, IV SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
1.	IP04TBS06	Statistical Methods	3	–	–	30	70	100	3
2.	IP03TPC04	Marketing Management	3	–	–	30	70	100	3
3.	IP04TPC05	Material Science	3	–	–	30	70	100	3
4.	IP04TPC06	Fluid Mechanics	3	1	–	30	70	100	4
5.	IP04TPC07	Manufacturing Processes–II	3	–	–	30	70	100	3
6.	IP04THS02	Electives From Humanity Science–02	3	–	–	30	70	100	3
Total			**18**	**1**	**–**	**180**	**420**	**600**	**19**
PRACTICALS									
1.	IP04PPC03	Modelling Software Lab	–	–	2	30	20	50	1
2.	IP04PPC04	Fluid Mechanics Lab	–	–	2	30	20	50	1
Total			**–**	**–**	**4**	**60**	**40**	**100**	**2**

Total Credits: **21**
Total Contact Hour: **23**
Total Marks: **700**
INTERNAL ASSESSMENT:–two class tests of 15 marks each will be conducted.
L–LECTURE, T–TUTORIAL, P–PRACTICAL, ESE –END SEMESTER EXAMINATION

Electives From Humanity Science–02	
IP04THS021	Business Communication and Presentation Skill
IP04THS022	Occupational Health and Safety
IP04THS023	Energy and Environment Management

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech IV Sem.	IP04TBS06	Statistical Methods	3	–	–	15	15	70	100	3

COURSE OBJECTIVES:

1. The objective of this course is to provide an understanding for the graduate engineering student on statistical concepts to include measurements of location and dispersion, probability, probability distributions, sampling, regression, and correlation analysis.

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1: Calculate and apply measures of location and measures of dispersion grouped and ungrouped V data cases.

CO2: Apply discrete and continuous probability distributions to various business problems.

CO3: Perform test of hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases and learn the concept of p–values.

CO4: Identify non–parametric test such as the Chi–square test for Independence as well as goodness of fit.

COURSE CONTENT:

Module – I

Introduction to statistics, mathematical statistics, variable, frequency distribution, exclusive and inclusive class intervals, type of series. Graphical representation: histogram, frequency polygon, O give measure of central tendency various types of averages, mean median mode for grouped and ungrouped data, geometric mean, harmonic mean, measure of dispersion Skewness and Kurtosis.

Module – II

Curve fittings by method of least square, straight line parabola correlation, scatter Cliagrem's Karl Pearson's coefficient of correlation, limits for correlation coefficient, rank correction, regression linear regression, equation to the line of regression, regression coefficient, angle between two lines of regression.

Module – III

Theory of probability: Mathematical and statistical definition of probability sample space, finite sample space sample point, events theorem of total probability, sample and compound event, conditional probability, theorem of compound probability, Baye's theorem, use of binomial theorem.

Module – IV

Theoretical distribution: Binominal distribution mean, standard deviation and Pearson's β and γ coefficient, Poisson distribution, mean, variance normal distribution.

Module – V

Random and simple sampling: Mean standard deviation in simple sampling of attribute, test of significant for large sample test of significance based on Chi square, T, F and Z distribution degree of freedom, condition for applying.

TEXT & REFERENCE BOOKS:

1. Mathematical Statistics – M. Roy, Ram Prasad Publications, Agra.
2. Probability & Statistics – P.C. Biswal, PHI Learning.
3. Statistics Analysis – A.A. Afti, Orioited Approach Academic Press.
4. Fundamental of Mathematical Statistics – S. C. Gupta and Kapoor, Sultan Chand and Sons, 1980.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech IV Sem.	IP08TPC04	Marketing Management	3	0	–	15	15	70	100	3

COURSE OBJECTIVES:

1. To learn about basic concepts of marketing and selling.
2. To demonstrate importance of need, wants and demand.
3. To learn implicating strategies in different phases of product lifecycle.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Apply enriched knowledge towards developing product, production means and philosophies.

CO2: Apply high performance business ethics and culture in behaviour.

CO3: Identify, analyze, develop & manage development program, sales promotion and public relation.

COURSE CONTENT:

Module – I

Introduction to marketing management: What is marketing, the core concept, need, wants, demands, product, value cost and its functions.

Marketing management: Production concept, product concept and selling, marketing concept, role of marketing in modern organization, marketing philosophies.

Module – II

The nature of high performance business: Corporate and division strategic planning, business strategic planning, marketing process, analyzing consumer markets and buying behaviour.

Module – III

The product life cycle: Conditions and strategies in different phases, marketing strategies through PLC.

New product decisions: Definitions and factors contributing to new production development, new product development process.

Module – IV

Deciding on the marketing program: Product, promotion, pricing, place (distribution channel), managing advertising, sales promotion, public relation, developing and managing development program, sales promotion and public relation.

Module – V

Managing retailing whole selling and logistic: Types of retailers and levels of services, trends in retailing, types of whole selling, market logistics.

The role of marketing communication: Communication process model and developing effective e-communication, characteristics of marketing communication mix, factors in setting the communication mix.

TEXT & REFERENCE BOOKS:

1. Product Design and Manufacturing – Chitale & Gupta, PHI.
2. Marketing Management – Philip Kotler, PHI Publication.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP03TPC05	Material Science	3	–	–	15	15	70	100	3

COURSE OBJECTIVES:

1. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
2. To provide a detailed interpretation of equilibrium phase diagrams.
3. Learning about different phases and heat treatment methods to tailor the properties of Fe–C alloys.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Identify crystal structures for various materials and understand the defects in such structures.
CO2: Understand how to tailor material properties of ferrous and non–ferrous alloys.
CO3: Quantify mechanical integrity and failure in materials.

COURSE CONTENT:

Module – I

Crystal Structure: Unit cells, metallic crystal structures, ceramics. Imperfection in solids: point, line, interfacial and volume defects, dislocation strengthening mechanisms and slip systems, critically resolved shear.

Module – II

Mechanical property measurement: Tensile, compression and torsion tests, Young's modulus, relations between true and engineering stress–strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery.
Hardness: Rockwell, Brinell and Vickers and their relation to strength.

Module – III

Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von–mises, maximum normal stress, Mohr–Coulomb and modified Mohr–Coulomb.

Fracture mechanics: Introduction to stress intensity factor approach and Griffith criterion.

Fatigue failure: High cycle fatigue, stress–life approach, SN curve, endurance and fatigue limits, effects of mean stress using the modified Goodman diagram, fracture with fatigue.

Module – IV

Introduction to non–destructive testing (NDT) alloys, substitutional and interstitial solid solutions. Phase diagrams: interpretation of binary phase diagrams and microstructure development, eutectic, peritectic, peritectoid and monotectic reactions. Iron, iron–carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

Module – V

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe–C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties: austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo–nitriding, flame and induction hardening, vacuum and plasma hardening alloying of steel.

Properties of stainless steel and tool steels, maraging steels, cast irons, grey, white, malleable and spheroidal cast irons, copper and copper alloys, brass, bronze and cupro–nickel, aluminium and Al–Cu–Mg alloys, nickel based super alloys and titanium alloys.

TEXT & REFERENCE BOOKS:

1. Materials Science and Engineering: An Introduction – W. D. Callister.
2. Engineering Materials – Kenneth G. Budinski and Michael K. Budinski.
3. Material Science and Engineering – V. Raghavan.
4. Engineering Materials and Metallurgy – U. C. Jindal.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.TechIV Sem.	IP04TPC06	Fluid Mechanics	3	1	–	15	15	70	100	4

COURSE OBJECTIVES:

1. To introduce and explain fundamentals of fluid mechanics, which is used in the applications of aerodynamics, hydraulics, marine engineering, gas dynamics etc.
2. To give fundamental knowledge of fluid, its properties and behaviour under various conditions of internal and external flows.
3. To develop understanding about hydrostatic law, principles of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.
5. To inculcate the importance of fluid flow measurement and its applications in Industries.
6. To determine the losses in a flow system, flow through pipes and flow past immersed bodies.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Describe the physical properties of a fluid.
CO2: Calculate the hydrostatic pressure and force on plane and curved surfaces.
CO3: Demonstrate the application point of hydrostatic forces on plane and curved surfaces.
CO4: Calculate the pressure distribution for incompressible fluids.
CO5: Apply the similitude concept and set up the relation between a model and a prototype.

COURSE CONTENT:

Module – I

Introduction of Fluid: Introduction, continuum, density, specific weight, specific gravity, kinematic and dynamic viscosity, variation of viscosity with temperature, Newton law of viscosity, vapour pressure, boiling point, cavitation, surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Fluid Statics: Fluid Pressure, pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Hydrostatic pressure and force: horizontal, vertical and and inclined surfaces. Buoyancy and stability of floating bodies.

Pressure measurement devices: Piezometer, U–tube manometer, single column manometer, U–tube differential manometer, micro–manometers, pressure gauges.

Module – II

Fluid Kinematics: Classification of fluid flow: steady and unsteady flow, uniform and non–uniform flow, laminar and turbulent flow, rotational and irrotational flow, compressible and incompressible flow, ideal

and real fluid flow, one, two and three dimensional flows. Stream line, path line, streak line and stream tube, stream function, velocity potential function. One, two and three – dimensional continuity equations in cartesian coordinates.

Module – III

Fluid Dynamics: Surface and body forces, equations of motion, Euler's equation, Bernoulli's equation, derivation, energy principle, practical applications of Bernoulli's equation, Venturimeter, Orifice meter and Pitot tube, momentum principle, forces exerted by fluid flow on pipe bend, vortex flow: free and forced.

Module – IV

Dimensional analysis and dynamic similitude: Definitions of Reynolds number, Froude number, Mach number, Weber number and Euler number, Rayleigh's method, Buckingham's π–theorem. Model studies: similitude, dimensionless number and its significance.

Module – V

Laminar Flow: Reynold's experiment, flow of viscous fluids in circular pipe, shear stress and pressure gradient relationship, velocity distribution, Hagen-Poiseuille equation, flow of viscous fluids between two parallel plates (Coutte flow), shear stress and pressure gradient relationship, velocity distribution, drop of pressure head.

Turbulent Flow: Effect of turbulence, expression for loss of head due to friction in pipes (Darcy-Weisbach equation) and expression for co-efficient of friction in terms of shear stress.

Flow through pipe: Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe power transmission through pipe, water hammer in pipes.

TEXT & REFERENCE BOOKS:

1. Fluid Mechanics and Machinery – C.S.P. Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.
2. Hydraulics and Fluid Mechanics – P. M. Modi and S. M. Seth, Standard Book House.
3. Theory and Applications of Fluid Mechanics – K. Subramanya, Tata McGraw Hill.
4. Fluid Mechanics with Engineering Applications – R.L. Daugherty, J.B. Franzini and E. J. Finnemore, International Student Edition, McGraw Hill.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech IV Sem.	IP04TPC07	Manufacturing Processes – II	3	–	–	15	15	70	100	3

COURSE OBJECTIVES:

1. To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional machining methods.
2. To study the fundamentals of various metal removal processes by multi point cutting tools.
3. Methods of machining/ manufacture of gears used in power transmission.
4. Characteristics of various machine tools and to familiarize with the different types of machine tool drives.
5. Train in knowing the fundamental parts of various machine tools and their kinematic schemes.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Understand the different conventional machining methods employed for making different products

CO2: Select a machining operation and corresponding machine tool for a specific application in real time.

CO3: Identify basic parts and operations of machine tools including lathe, shaper, planer, drilling, boring, milling and broaching machine.

COURSE CONTENT:

Module – I

Sheet metal working: Role of sheet metal components, cutting mechanism, description of cutting processes like blanking, piercing, lancing etc., description of processes like deep drawing, bending, coining, embossing etc., basic elements of presses for sheet metal working, punch and die clearances, die elements.

Module – II

Lathe: Lathe design and terminology specification, types of lathe: center lathe, capstan and turret lathe, various operations performed on lathe, operating conditions calculation of material removal rate.

Drilling: Fundamental of drilling process, types of drilling machine, types of drills, geometry of twist drill, and various operations performed on drilling machine.

Boring: Introduction to boring, reaming, tapping and taps, other hole making operations.

Module – III

Milling: Milling machine, milling cutters, milling process: up milling, down milling, different type of milling operation: end milling, plain milling, side and face milling, work holding devices for milling, indexing and types, operating condition, calculation of material removal rate.

Broaching: Introduction to broaching, fundamental of broaching, broaching machine.

Module – IV

Shaping: Introduction to shaping, shaping operation, types of shaping machine, mechanism of quick return motion, operating conductions, calculation of material removal rate.

Planning: Introduction to planning, planning operation, types of planning machine, operating conditions, calculation of material removal rate.

Module – V

Gear Manufacturing: Introduction to gear cutting, gear types, gear manufacturing processes: gear forming, gear shaping, gear planning, gear hobbling etc, gear finishing, gear inspection.

Plastic Working: Plastic processing, injection, compression & blow moulding, plastic design principles processes, machines and equipments, parameters and force calculations.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for engineering materials (5th Edition) - Kalpakjian and Schmid, Pearson India.
2. A Course in Workshop Technology, Vol II – B. S. Raghuwanshi, Dhanpat Rai & Co.
3. Fundamentals of Metal Machining and Machine Tools - G. Boothroyd, CRC press, 3rd edition.
4. Elements of Workshop Technology Vol. I – Hazra Choudhary, Dhanpat Rai Publication, New Delhi
5. Production Technology- R. K. Jain, Khanna Publications.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.TechIV Sem.	IP04THS021	Business Communication and Presentation Skill	3	–	–	15	15	70	100	3

COURSE OBJECTIVES:

1. The course is introduced to develop one's outer and inner personality tremendously and enrich the abilities to enable one to meet the challenges associated with different job levels.
2. Personality development is essential for overall development of an individual apart from gaining technical knowledge in the subject.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: To provide the concept of personality and image.

CO2: Develop leadership, listening and interacting skills.

CO3: Develop attitudinal changes.

CO4: Develop decision–making qualities and communication skill.

COURSE CONTENT:

Module – I

Business communication: Role of communication in information age, concept and meaning of communication, skills necessary for technical communication, communications in a technical organization, barriers to the process of communication and sola.

Module – II

Style and organization in technical communication: Listening, speaking, reading and writing as skills, objectivity, clarity, precision as defining features of technical communication, various types of business writing: letters, reports, notes, memos, language and format of various types of business letters, language and style of reports, report writing strategies, analysis of a sample report.

Module – III

Communication and personality development: Psychological aspects of communication, cognition as a part of communication, emotional intelligence, politeness and etiquette in communication, cultural factors that influence communication, mannerisms to be avoided in communication, language and persuasion, language and conflict resolution.

Module – IV

Language laboratory: Emphasizing listening and comprehension skills, reading skills, sound structure of English and intonation patterns.

Module – V

Oral presentation and professional speaking: Basics of English pronunciation, elements of effective presentation, body language and use of voice during presentation, connecting with the audience during presentation, projecting a positive image while speaking, planning and preparing a model presentation, organizing the presentation to suit the audience and context, basics of public speaking, preparing for a speech.

TEXT & REFERENCE BOOKS:

1. Organizational Behaviour – Fred Luthans, McGraw Hill.
2. Report writing for Business – Lesikar and Petit.
3. Effective Technical Communication – M. Ashraf Rizvi, McGraw Hill.
4. Personal Development for Life and Work – Wallace and Masters, Thomson Learning.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.TechIV Sem.	IP04THS022	Occupational Health and Safety	3	–	–	15	15	70	100	3

COURSE OBJECTIVES:

1. The objective of the study this course is to acquire the knowledge, skills, and judgement to function as an entry–level practitioner in occupational health and safety.
2. A contribution towards the development and maintenance of a healthy and safety working environment.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Interpret and apply legislative requirements, industry standards and best practices in a variety of workplaces.

CO2: Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.

CO3: Design, support, and evaluate health and safety programs and implement procedures using project management principles and processes appropriate to the task.

CO4: Set and achieve work priorities and goals individually and as a team member.

CO5: Use a range of effective communication skills and methods to clearly and briefly convey regulatory and technical information and data to designated audiences.

COURSE CONTENT:

Module – I

Introduction: Environmental law: legal control of hazardous substances and processes, environmental issues and judicial trends, health and safety law, common liabilities and work place injuries, health and safety at work, the principle legal requirements, health, safety and industrial relation law.

Module – II

Health and safety management: Safety management and policy, investigation reporting and recording of accidents, health and safety monitoring, comprehensive exposure assessment, principles of evaluating workers exposure, risk assessment in the work place, major incidents and procedures, health and safety training and communication, the cost of accidents. Principles of accident prevention, safe system of work, surveys and audits.

Module – III

Occupational health and hygiene: The organization of working environment, temperature, lighting and ventilation, welfare amenity provision, cleaning and hygiene. Toxicology and health, occupational disease and conditions, occupational audiometry, nihl, cardiovascular disease, physiological and psychological parameters. Occupational health practice, noise and vibration, dust and fumes, radiation and radiological protection, personal protection, occupational hygiene practice, prevention and control strategies in occupational hygiene, manual handling, first aid, human factor and safety, stress, safety technology.

Module – IV

Assessment of Exposure: Measurement of noise and vibration exposure. Noise, vibration and control, heat stress monitoring, dust exposure and respiratory health. Work posture, musculo skeletal disorders, strain index, lifting equation, maximum acceptable weight limits, occupational audiometry. Cardiovascular health, occupational determinants of heart rate variability, pulmonary functions and respiratory health, government schemes and norms related to health and nourishment, policies of government in special context to Chhattisgarh state.

TEXT & REFERENCE BOOKS:

1. Handbook of Health and safety Practice – Jeremy W. Stranks, Pitman Publishing.
2. Environmental law – Dharmendra S. Sengar, Prentice Hall of India, New Delhi.
3. Noise and Noise Control – Malcolm J. Crocker, CRC Press.
4. Clinical Guide to cardiac Autonomic Tests – Marek Malik, Kulwer Academic Publishers.
5. Hear rate variability – Marek Malik, Futura Publishing Co. NY
6. Handbook of Noise control – Cyril M. Harris, McGraw Hill Book Company, NY.
7. Occupational Audiometry – Maryanne Maltby, Butterworth–Heinemann Immprint of Elsevier.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.TechIV Sem.	IP04THS023	Energy and Environment Management	3	–	–	15	15	70	100	3

COURSE OBJECTIVES:

1. To achieve and maintain optimum energy procurement and utilization throughout the organization and to minimize energy costs/waste without affecting production and quality. To minimize environmental effects.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Develop their understanding of the technologies involved in energy production and their importance to climate change in relation to energy policies.

CO2: Analyse the roles of renewable energy systems such as wind, wave, tidal, solar and biofuels.

COURSE CONTENT:

Module – I

Basic concepts of energy: Theoretical treatment of energy, laws of thermodynamics, Carnot efficiency, energy quality and energy budget. Energy balance of earth: sunlight electromagnetic spectrum, major flows in global hydrological cycle, ocean currents and heat flux, atmospheric circulation, earth's energy budget.

Module – II

Energy resources: Non–renewable energy resources, fossil fuels origin, development of coal fired power plants, cleaner coal combustion, origin and reserves of petroleum and natural gas, composition and classification of petroleum, petroleum refining. Environmental problems associated with petroleum.

Module – III

Renewable energy resources: New developing renewable energy sources, nuclear fission reactors, fission power and the environment, Solar energy – collection and storage – present scenario in India, Wind energy and management, Tidal energy and management, Geothermal energy, Bio–gas plants and energy management.

Module – IV

Importance of management of energy sources: Management of fossil fuel sources, oil crisis and economic development, OPEC Market behaviour, management of oil and natural gas, extraction and processing, management strategies of renewable energy sources.

Module – V

Waste heat boilers: Various types and design aspects, heat pipes: theory and applications in waste heat recovery. Prime movers: sources and uses of waste heat, fluidized bed heat recovery systems utilization of waste heat in refrigeration, heating, ventilation and air conditioning systems.

TEXT & REFERENCE BOOKS:

1. Environmental Management and Development – C. J. Barrow, Taylor and Francis Group, London, New York.
2. Renewable Energy in the Sundarbans – S.P. G. Chaudhuri.
3. Environmental management systems handbook for refineries – N.P. Chremisinoff, Gulf Publishing Company, Houston, Texas.
4. Installing Environmental Management Systems – S. Christopher and Y.Mark, EarthScan London.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.TechIV Sem.	IP04PPC03	Modelling Software Lab	–	–	3	30	20	50	1

COURSE OBJECTIVES:

1. To establish the scientific and regulatory basis of graphical representation in the general context of Industrial Engineering, as a means of expression and communication for the design, creation.
2. Development of an industrial installation and/or product making practical use of the current technological means available, consistent with the scientific teaching framework and in response to technological evolution.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Use their capacity of vision to interpret and/or convey the technical information in an industrial drawing.

CO2: Know and apply graphical representation techniques using traditional metric geometry and descriptive geometry methods.

CO3: Know, identify, interpret and apply the current standards on Industrial Technical Drawing. Computer aided design applications that allow students to elaborate and use graphical and technical information.

LIST OF EXPERIMENTS:

1. Introduction to CAD (layout and sketching, elements of drawing, draw commands).
2. Understanding the 3D function / tool bars in CAD software.
3. How to draw sketch for 3D modelling.
4. 3D modelling of different components using CAD software.
5. Drawings of different components using CAD software.
6. Surface modelling of different mechanical components in CAD software.
7. Presenting different orthographic/isometric views of 3D models in CAD.
8. Assembly of different mechanical component.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.TechIV Sem.	IP04PPC04	Fluid Mechanics Lab	–	–	3	30	20	50	1

COURSE OBJECTIVES:

1. To provide practical knowledge in verification of principles of fluid flow
2. To impart knowledge in measuring pressure, discharge and velocity of fluid flow
3. To understand Major and Minor Losses

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Calculate performance analysis in turbines and pumps and can be used in power plants

CO2: Analyze practical problems in all power plants and chemical industries

CO3: Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports

CO4: Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design

CO5: Select the proper pump to optimize the pumping efficiency

CO6: Use modern computational techniques in fluid dynamics.

LIST OF EXPERIMENT:

1. Measurement of viscosity.
2. Study of Pressure Measuring Devices.
3. Stability of Floating Body.
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces.
5. Verification of Bernoulli's Theorem.
6. Venturimeter.
7. Orifice meter.
8. Impacts of jets.
9. Flow Visualization –Ideal Flow.
10. Length of establishment of flow.
11. Velocity distribution in pipes.
12. Laminar Flow.

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2020-21
B.TECH. THIRD YEAR, V SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP05TPC08	Design of Machine Elements	3	1	-	30	70	100	4
2.	IP05TPC09	Metal Cutting	3	0	-	30	70	100	3
3.	IP05TPC10	Statistical Quality Control	3	0	-	30	70	100	3
4.	IP05TPE01	Professional Electives-01	3	0	-	30	70	100	3
5.	IP05TPE02	Professional Electives-02	3	0	-	30	70	100	3
6.	IP05THS04	Electives from Humanity Science-03	3	0	-	30	70	100	3
Total			**18**	**1**	**-**	**180**	**420**	**600**	**19**
PRACTICALS									
1.	IP05PPC05	Metal Cutting Lab	-	-	2	30	20	50	1
2.	IP05PSC01	Seminar	-	-	2	50	-	50	1
Total			**-**	**-**	**4**	**80**	**20**	**100**	**2**

Total Credits: **21**

Total Contact Hour: **23**

Total Marks: **700**

INTERNAL ASSESSMENT: - Two class tests of 15 marks each will be conducted.

L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP05TPE01 Professional Electives-01
IP05TPE11 Industrial Engineering
IP05TPE12 Work Study and Ergonomics
IP05TPE13 Employee Relation
IP05TPE02 Professional Electives-02
IP05TPE21 MEMS & Nanotechnology
IP05TPE22 I. C. Engine
IP05TPE23 Mechatronics
IP05THS04 Electives from Humanity Science-03
IP05THS41 Financial Management
IP05THS42 Managerial Economics
IP05THS43 Financial Accounting and Costing

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPC08	Design of Machine Elements	3	1	-	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

1. To familiarize the various steps involved in the design process.
2. To evaluate the shape and dimensions of a component by considering various principles.
3. To satisfy functional and strength requirements.
4. To learn to use standard practices, catalogues, standard data and standard machine components.
5. To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
6. To develop an ability to identify, formulate, and solve engineering problems.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Describe the design process, material selection, calculation of stresses and selection of theory of failure.
CO2: Design the solid, hollow shafts and to finding the critical conditions and effective use of key in shaft.
CO3: Analyze riveted and bolted joints in eccentric loading.
CO4: Examine the welded joints for structural applications.
CO5: Demonstrate knowledge on brakes, clutches and belt drive used in different application under static loading.
CO6: Analyze the bending and wear conditions in spur gear and knowledge to summarize the failure criteria.

COURSE CONTENT:

Module - I

Basic design concepts and design against static loading: Objective and scope of mechanical engineering design, design considerations, review and selection of materials and manufacturing processes, codes and standards, modes of failure, design/allowable stress, factor of safety (FoS), theories of failure – maximum normal stress theory, maximum shear stress theory, distortion energy theory, choice of failure criteria.

Module - II

Design of shafts and keys: Shaft subjected to twisting moment, bending moment, combined twisting moment and bending moment, fluctuating loads, design of shaft on the basis of rigidity. Flat and square keys, woodruff keys.

Module - III

Design of riveted, bolted and welded joints: Failure of riveted join, strength and efficiency of riveted joint, eccentrically loaded riveted joint. Bolted joint in tension, torque requirement for bolt tightening, bolted joint under fluctuating load. Eccentrically loaded joint in shear, bolted joint with combined stresses. Stresses in butt and fillet welds, strength of welded joints, eccentrically loaded joint, welding joint subjected to Bending moment.

Module - IV

Design of clutches and brakes: Friction clutches, friction materials, torque transmitting capacity, single & multiple plate clutches, centrifugal clutches. Band and block brakes.

Design of belt drive: Flat and V-belts, belt constructions, geometrical relationships for length of the belt, analysis of belt tensions, condition for maximum power.

Module - V

Design of spur gears: Spur gears**,** gear drives, classification of gears, selection of type of gears, law of gearing, force analysis, gear tooth failures, selection of material, number of teeth, face width, beam strength of gear tooth, effective load on gear tooth, estimation of module based on wear strength, Lewis equation.

TEXT & REFERENCE BOOKS:

1. Design of Machine Elements – V. B. Bhandari, TMH, New Delhi.
2. Mechanical Engineering Design - Shigley, J.E., Charles, R.M. and Richard, G.B., McGraw Hill, 2004.
3. Machine Design – Spott, TMH.
4. Machine Design – Khurmi& Gupta, Khanna Publisher.
5. Machine Design – Sharma &Agrawal, DhanpatRai Publications.
6. Design of Machine Elements – Sharma &Purohit, PHI.
7. Design Data: Data Book of Engineers, PSG College of Technology.
8. Machine Design - T.V. Sundararajamoorthy and N. Shanmugam, Anuradha Agencies, 2003.
9. Machine Design Data Book - V. B. Bhandari, TMH, New Delhi.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPC09	Metal Cutting	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To study the basics of metal machining and mechanics of metal machining
2. To study the different cutting tool materials and types & geometry of cutting tools
3. To learn introductory concepts of various advanced machining processes
4. To study various super finishing processes.

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1: The students have learned the basics of metal machining

CO2: Understand and apply the principles of mechanics to metal cutting process and develop analytical relation between input and output process parameters.

CO3: Understand, analyze and apply the concept of shear deformation of materials in metal cutting.

CO4: Understand the models of the machining economics and optimization, tool wear and its measurement.

CO5: Apply the fundamentals of abrasive machining to develop theoretical relations for different types of grinding and honing operations

CO6: The students have also studied the introductory concepts of various advanced machining processes

COURSE CONTENTS:

Module -I

Introduction: Definition and classification of metal cutting and tools, geometry of single point and multipoint cutting tool, various angles of cutting tool and their functions, factors affecting tool geometry, orthogonal and oblique cutting ,cutting tool signature, types of chips,their formation and factors. Merchant's force diagram.

Mechanism of chip formation: Forces on the chips, methods of chip breaking, Design principal of simple step type chip breaker, working principle of chip breakers, effect of chip breaking, Merchant theory and other theories of metal cutting, stresses and strain in chips, shear and strain rate, Power and energy calculation.

Module -II

Heat generation and cutting temperature in machining: Causes and sources of heat in cutting, heat distribution, their measurernent, tool dynamometer and their types and working.

Tool failures and tool life, mechanism of tool failure, types of tool failure, tool wear and types, Taylors tool life Equations, relationship between tool life, cutting speed, feed, depth of cut, factors affecting tool life.

Machinability -Definitions, evaluations, factors affecting machinability, machinability index.

Module - III

Cutting fluids- functions characteristics and types of cutting fluids and their application, criteria for selection of cutting fluids'

Cutting tool materials- requirements, types and characteristics of various cutting tool materials, comparison and selections of cutting tool.

Economics of machining - cost analysis and optimization of machining, various parameters for calculation of machining cost'

Module - IV

Grinding: Mechanics of grinding, cutting action, grit, Grain, Structure, Grinding Wheel Specification, Wheel Life; Balancing, Truing and Dressing of Wheels; Classifications of Abrasive Grinding Processes; wheel wear, mechanics of lapping and honing, Polishing and Buffing Chipping action in grinding,

Module - V

Unconventional Machining Processes: Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits.

Electro-chemical machining (ECM), process parameters, MRR and surface finish.

Abrasive jet machining and ultrasonic machining working principles and process parameters.

Mechanism of material removal, tooling and equipment, process parameter, surface finishing obtained by Laser beam machining (LBM) and Electron beam machining.

TEXT & REFERENCE BOOKS:

1. Metal Cutting Theory and Practice - A. Bhattachary, New Central Book Agency (P) Ltd.
2. Machining and Machine Tools - A. B. Chattopadhyay, Wiley India Publication.
3. Metal Cutting Principles - M. C. Shaw, Oxford University Press.
4. A Course in Workshop Technology, Vol II – B. S. Raghuwanshi, DhanpatRai& Co.
5. Production Technology- R. K. Jain, Khanna Publishers.
6. Fundamentals of Metal Machining and Machine Tools- G. Boothroyd, McGraw Hill.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPC10	Statistical Quality Control	3	0	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

1. Define and understand various terms associated with quality control.
2. Enhance the students understanding of the complexity of statistical analysis and interpretation.
3. Provide an introduction to the fundamental concept of SPC, total quality management, six sigma, quality function deployment and applications of these concepts.
4. Analyze the philosophies of TQM in order to better evaluate the TQM implementation proposals.
5. Assess exactly where an organization stands on quality management with respect to ISO 9000 quality management.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the importance of quality & role of statistical quality control.

CO2: Apply methods and techniques of statistical quality control, to studies and interpret the results in business.

CO3: Demonstrate motivation and responsibility to advocate for quality in business.

CO4: Develop quality management philosophies and frameworks.

CO5: Develop in-depth knowledge on various tools and techniques of quality management.

COURSE CONTENT:

Module - I

Basic concepts of quality: Inspection definition of quality, quality control cost of quality, value of quality, statistical quality control, need and advantages of SQC

Frequency distribution: Variables & attributes, quality characteristics, theory of control charts, control chart for variable X & R chart, control chart for attribution P, NP, C, chart & process capability.

Module - II

Quality assurance: Quality assurance manual, quality circle, characteristics of quality circle and the process of operation of quality circle, quality policy & procedure & objectives,

Acceptances sampling Concept of sampling, O-C curve & its construction, sampling plans, single, doubles & multiple sampling plans.

Module - III

Contribution of various quality management gurus: Jurantriology, Deming's 14 Points, P-D-C-A wheel, Taguchi's philosophy, design of experiment, old and new seven QC tool of quality, Philip Crosby's zero defect, seven types of waste, 5's, quality function deployment.

Module - IV

Introduction to ISO 9000: Various models of ISO 9000, clauses of 9000, total quality control, total quality management, tool for TQC & TQM, Kaizen, 6 sigma quality, procedure of six sigma; TQM and Six Sigma.

Module - V

Reliability: Definitions, bathtub curve, design for reliability, failures & causes of failures, FMECA, maintainability & availability, MTBF, reliability models, system with components in series & in parallel, mixed arrangement, fault–tree-technique.

TEXT & REFERENCE BOOKS:

1. Statistical Quality Control– Grant &Leowowworth, Tata Mc. Hill.
2. Quality Planning & Analysis–Juran&Gryana, Tata Mc. Hill.
3. Total Quality Control – A. Feigenbaum, Mcgraw Hill.
4. Statistical Quality Control–M. Mahajan, DhanpatRaiPublication.
5. Total Quality Management – Besterfield, Tata Mc. Hill.
6. Total Quality Management – PurnimaCharantimath , Low Pearson Education.
7. Total Quality Management – Krishnaiya, PHI.
8. Total Quality Management – Suganthi&Sannuel, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB - TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE11	Industrial Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To impart capability of successfully planning, controlling, and implementing projects.
2. To apply the principles of engineering science, maths, technology and human engineering, involving industry-relevant problems.
3. To contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches and systems thinking methodologies.
4. To recognize the tools of efficiency, effectiveness and productivity for the resources of the plant and facility.
5. To implement the policy of wage administrations for making the labour more and higher productive in their work.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to apply mathematics and science in Industrial engineering.

CO2: Ability to design and conduct experiments, as well as to analyse and interpret data.

CO3: Ability to identify, formulate and solve engineering problems.

CO4: Ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering practice.

COURSE CONTENT:

Module-I

Introduction: History & development of industrial engineering. Productivity, means of increasing productivity, work study, productivity and work study, human factor in the fabrication, work of F. W. Taylor, Frank and Lillian Gilberth and their contribution.

Module-II

Method study: Definition & basic procedure, selection of jobs.Recording technique: micro motion study, Therbligs, cyclograph,chronocyclograph, principle of motion economy, design of work place layout, analysts in the form of chart, operation chart, flow process chart, flow diagram, string diagram, man machine chart, two hand chart, Simo chart.

Module-III

Work measurement: Definition, objectives, application, number of cycles to be timed, time study equipment, performance rating, allowance, lumber of cycle to be studied, determination of standard time, predetermined motion time system, conducting work sampling study & establishing standard time.

Module-IV

Wages & incentives: Characteristics of a good wage or incentive system, method of wage payment, concept of wage & incentive schemes, financial and non-financial: Taylor's differential piece rate, Halsey premium plane, Merric's multiple piece rate system, group incentive scheme.

Ergonomics: Work space dimension, design of work place, environmental stresses & impacts on human work.

Module-V

Value engineering: Introduction, concept of value, value analysis approaches, job plan, value tests.

Industrial safety: Analysis of cost of accident, hazards in various fields like fire, electrical shocks, chemical; organization for safety, plant safety, govt. legislation for safety, safety rules.

TEXT & REFERENCE BOOKS:

1. Introduction to work study–I.L.O, Oxford Press.
2. Motion and time study – Mundel, Prentices Hall India.
3. Motion and Time Study– Ralph M Barnes, John Wiley and sons.
4. Industrial Engineering – M. I. Khan, New Age International Publication.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB - TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE12	Work Study and Ergonomics	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the knowledge of interaction of man, machine and integration of their tools.
2. To apply the principles of math, science, technology and engineering, involving industry-relevant problems.
3. To provide the comfort ability in working environment of allthe employee, labour.
4. To apply the concept in the examination of human and work in all their contexts.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to design and conduct experiments, as well as to analyse and interpret data.

CO2: Ability to identify, formulate and solve engineering problems.

CO3: Ability to use the techniques, skills, and modern engineering tools necessary for work study practice.

CO4: Assess the effect of physical environment factors on comfort and performance.

CO5: Explain the influence of ergonomic principles on work organization and culture.

Module - I

Introduction to man machine systems and ergonomics, human factors in design and engineering, needs of ergonomics and aesthetic design, physiological aspects of work.

Module - II

Work measurement through physiological tests, work physiology, paced and unpaced work performance, data logging, data collection, data reduction and analysis techniques, gross human anatomy, anthropometry, bio mechanics, muscle strength and exertion potential of different limbs.

Module - III

Work capacity, environmental effects, exercises for evaluation of pastoral form and work spaces, environmental conditions including temperature, illumination, noise and vibration.

Module - IV

Perception and information processing, design of displays, hand control, typography, and readability, layout and composition.

Module - V

Exercises in evaluation of human response to product interface, product safety and product liability, design consideration for appearance, colour, texture and form.

TEXT & REFERENCE BOOKS:

1. Applied Ergonomics– D. C. Alexander, Taylor & Francis.
2. Ergonomics for Beginners– Jan Dul, Taylor & Francis.
3. The Nature & Aesthetics of Design–David Pye, Cambium Press.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE13	Employee Relations	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To develop the knowledge on trade unions and its formation, structure, functions and legal framework.
2. To gain insight into the process of collective bargaining, its origin and development.
3. To describe the activities, include annual employee reviews and the on-going development of employees through training and managerial guidance.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to describe and critique the concept of employee engagement.

CO2: Ability to identify problems associated with both over-engagement and disengagement.

CO3: Ability to examine the extent to which emotional and aesthetic labour are positioned in some contemporary organizations.

CO4: Ability to critically evaluate the measurement of employee engagement.

CO5: Ability to align organizational and employee objectives for improved organizational effectiveness.

Module - I

Conceptual framework of employment relations: Concept, scope and approaches to industrial relations, evolution of industrial relations and current developments, constitutional and legal framework of industrial relations: conventions, id act, trade union act.

Module - II

Trade unionism: Trade union development and functions, trade union structure and recognition, managing trade unions, managerial unionism, employers' organisations.

Module - III

Collective bargaining: Nature and content of collective bargaining, negotiation skills, issues and trends in collective bargaining.

Module - IV

Employee involvement: Evolution, structure and process, design and dynamics of participative forums, strategies for implementing participation.

Module - V

Grievance handling and discipline: Grievance function in industrial relations, conciliation, arbitration and adjudication, discipline in industry.

TEXT & REFERENCE BOOKS:

1. Employee Relations Management– P. N. Singh, Pearson Education India
2. Personnel Management Theory And Practice– Arun Kumar, RachanaSharmam, Atlantic Publishers & Distribution
3. Industrial Relations and Personnel Management– A. Simon, M.V. PyleeGeorge, Vikas Publishing House Pvt Ltd.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE21	MEMS and Nanotechnology	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To explain students to basic concepts of nano devices and various sensors.
2. To provide knowledge about the applications of nanotechnology

COURSE OUTCOMES:

The after completion of the course the student will be able to

CO1: Understand the working of MEMS and NEMS

CO2: Understand the applications of nano sensors and detectors

COURSE CONTENT:

Module - I

Introduction of mems, micro sensor, micro actuators, microelectronic fabrications, mechanical thermal and magnetic mems, RF mems, MOEMS, mems design consideration.

Micromachining, photolithography, structural and sacrificial materials, methods of lithography. Thin film deposition, and its developments process, LPCVD, PECVD, impurity doping , etching ,problem with bulk micro machining, vapour bonding, LIGA.

Module - II

System modelling and properties of material: System types and basic modellingelements in mechanical,thermal, fluid system. Translational and rotational pure mechanical system, hybrid system, analogy between mechanical and electrical system.

Passive components and systems: System on a chip, passive electronics system, passive mechanical system.

Module - III

Mechanical sensors and actuators: Introduction,principals, micro plates, capacity impacts, piezoelectric materials, and their properties, mems gyroscope.

Thermal sensor and actuators: Introduction, thermocouple probe, micro hot plate gas sensors, mems thermo vessels, shape memory alloys.

Module - IV

Magnetic sensors and actuators: Different types and principals.

RF mems: introduction, RF based communication system, mems inductors, and tuner filter, Resonater.

Module -V

Nanotechnology: Introductions**,** nanotechnology materials, fullerenes, doping, CNT, SWCNT, MWCNT, development and application of CNT.

TEXT & REFERENCE BOOKS:

1. MEMS- Mahalik, McGrawHill
2. MEMS & MOEMS Technology & Application -Raichoudhary, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE22	I. C. Engine	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To study classifications of internal combustion engine.
2. To understand how and why actual cycles deviate from air standard cycle and fuel-air cycle.
3. To understand combustion in spark ignition engine and diesel engines.
4. To impart knowledge about carburetion, gasoline injection and diesel injection.
5. To impart knowledge about ignition, cooling, lubrication and governing systems.
6. To impart knowledge about various engine performance characteristics and its testing.

COURSE OUTCOME:

The after completion of the course the student will be able to

CO1: Demonstrate a basic understanding of engine design, function and performance.

CO2: Acquire knowledge and hands-on competence in the design and development of mechanical systems.

CO3: Work effectively with engineering and science teams as well as with multidisciplinary designs.

CO4: Demonstrate an understanding of the relationships between the design of the internal combustion engine and environmental issues.

COURSE CONTENT:

Module - I

Introduction of internal combustion engines: Engine classification, Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, comparison of Otto, Diesel, and Dual cycles. Stirling cycle, Ericsson cycles, two and four-stroke engines, SI and CI engines, valve timing diagram, fuel air cycle, factors affecting it, actual cycle analysis, actual Cycle.

Module – II

SI Engines: Combustion in SI engine, flame speed, ignition delay, abnormal combustion and it's control, combustion chamber design for SI engines, Carburetion, mixture requirements, carburetor types, theory of carburetor, MPFI, Ignition system requirements, Magneto and battery ignition systems, Ignition timing and sparkplug, Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect.

Module – III

CI Engine: Combustion in CI engines, Ignition delay, Knock and its control, combustion chamber design of CI engines.

Fuel injection in CI engines: Requirements, types of injection systems, fuel pumps, fuel injectors, injection timings.

Module - IV

Engine Cooling: Different cooling systems, Radiators, and cooling fans.

Lubrication: Engine friction, Lubrication principle, type of lubrication, lubrication oils, crankcase ventilation.

Fuels: Fuels for SI and CI engine, important qualities of SI and CI engine fuels, rating of SI engine and CI engine fuels, dopes, additives, gaseous fuels, LPG, CNG, Biogas, Producer gas, alternative fuels for IC engines.

Module – V

Testing and Performance: Performance parameters, basic measurements, blow by measurement, testing of SI and CI engines.

Emission and Pollution: S. I. Engine and C. I. Engine emissions and its control and comparison. Effect of pollution on human health and biosphere.

TEXT & REFERENCE BOOKS:

1. A Course in IC Engines - M.L. Mathurand R.P. Sharma, Laxmi Publication.
2. Internal Combustion Engines –V. Ganesan, TMGH Publication.
3. Internal Combustion Engines: Theory and Practice - G.F. Taylor.
4. Introduction to IC Engine -Stone, Richard.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE23	Mechatronics	3	1	-	15	15	70	100	4

COURSE OBJECTIVES:

1. To acquire the knowledge of basics of mechatronics and their scope.
2. To acquire the knowledge of sensors and transducers.
3. Analyse fundamental of hydraulic and electrical actuators.
4. To acquire the knowledge of data acquisition system and control system.
5. To develop the ability to analyse and design mechatronics system.

COURSE OUTCOMES:

The after completion of the course the student will be able to

CO1. Apply knowledge of mechatronics for understanding and solving engineering problems.

CO2. Acquire knowledge and hands-on competence in applying the concepts of mechatronics in the design and development of mechanical systems.

CO3. Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.

CO4. Identify, analyse and solve mechanical engineering problems useful to the society.

CO5. Work effectively with engineering and science teams as well as with multidisciplinary designs.

COURSE CONTENT:

Module -I

Introduction to mechatronics: Sensors and actuators type, selection and interfacing, digital electronics and microprocessors in mechatronic systems, mechatronic systems modelling, analysis and control of analogue, digital and hybrid systems, mechatronic systems design principles.

Module -II

Introduction to mechatronics systems: Measurement systems, control systems, mechatronics approach.

Sensors and transducers: Introduction, performance, terminology, displacement, position and proximity, velocity and motion-fluid, pressure-temperature, sensors-light, sensors-selection of sensors –signal processing.

Module -III

Microprocessor: Introduction, architecture pin configuration, instruction set-programming of microprocessor using 8085, instructions interfacing input and output devices, interfacing d/a convertors and a/d converter, applications, temperature control, steeper motor control, traffic light controller.

Module -IV

Programmable logic controller: Introduction, basic structure, input/output processing, programming, mnemonics timers, internal relays and counters data handling, analog input/output selection of a plc.

Module -V

Design and mechatronics: Stages in designing mechatronic systems, traditional and mechatronic design, possible design solutions, case studies of mechatronic systems, pick and place robot, automatic car park system, engine, management system.

TEXT & REFERENCE BOOKS:

1. Mechatronics–HMT Ltd.Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Mechatronics–D.A Bradley, D. Dawson, N.C. Burn and A.J. Loader, Chapman and Hall.
3. Mechatronics– Singh & Joshi, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05THS41	Financial Management	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. The objective of this course is to inform the students about the basic concepts of financial management and contemporary theory and policy in order to master the concepts, theories and technique of financial management, which represents the condition of profitable business operations and survival respectively in the development of business subjects and the economy as a whole.
2. Students should acquire the basic knowledge by means of combining theoretical cognitions and practical attitudes to enable them the understanding of financial problems in business practice after completed the vocational studies.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Start and manage new business.

CO2: Evaluate and monitor short term and long-term investments.

CO3: Evaluate and monitor current asset.

COURSE CONTENT:

Module – I

Introduction: Scope and objective, organisation of finance function.

Time value risk and return and valuation of money: Valuation of long-term securities, various model of pricing.

Module –II

Statement of changes in financial position: Sources and uses of working capital, cash flow statement, balance sheet, profit loss account and its process.

Financial ratio analysis: Meaning, types, importance and limitations**,** calculation of various ratios.

Module –III

Capital budgeting: Principals, techniques**,** various methods of capital budgeting, concept and measurement of cost and capital, and various approaches for measurement of cost of capital and computation.

Analysis of risk and uncertainty: Various approaches for risk evaluation.

Module –IV

Theory of working capital management: Concept and definition of gross, working capital and net working capital, trade-off between profitability and risk.

Module –V

Operating, financial and combined leverage: Introduction, definition and concept and various approaches.

TEXT & REFERENCE BOOKS:

1. Financial Management–Khan and Jain, TMGH.
2. Financial Management –Kuchhal, Vikas Publication.
3. Financial Management–Paresh Shah, Willey India Pvt. Ltd.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05THS42	Managerial Economics	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To prepare engineering student to analyse cost/revenue data and carry out economic analyses in the decision making.
2. Justify the process or reject alternatives/projects on an economic basis.
3. To prepare engineering students to function in the business and management side of professional engineering practice.

COURSE OUTCOME:

After completion of the course, student will be able to

CO1: Be able to make intelligent comparisons of project alternatives during the planning and implementation phases.

CO2: Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.

CO3: Be able to perform and evaluate payback period and capitalized cost on one or more economic alternatives.

CO4: Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives

COURSE CONTENT:

Module- I

Introduction to managerial economics: Different area of managerial economics, micro and macroeconomics, nature and scope of managerial economics, demand analysis, law of demand and its exceptions, elasticity of demand: definition, types, measurement and significance of elasticity of demand, supply analysis, law of supply, elasticity of supply: definition, types, measurement and significance of elasticity of supply.

Module- II

Law of return: Revenue analysis, theory of production and cost analysis: production function, Cobb-Douglas production function, ACMS production function, investment function.

Cost analysis: Cost concept, opportunity cost, fixed vs. variable cost, explicit costs vs. implicit costs, out of pocket costs vs. imputed costs, break-even analysis **(**BEA**),** determination of break-even point (simple problem), managerial significance and limitation of BEA.

Module-III

Introduction to market & pricing policies: Element of market, types of market, concept of market, classification of market based on the nature of competition, types of competition, features of perfect competition, feature of imperfect competition, monopoly and monopolistic competition, price-output determination in case of perfect competition and monopoly.

Objectives and policies of pricing: Introduction, full cost or cost-plus pricing, differential pricing, going rate pricing, marginal cost pricing, trade association pricing, loss leadership pricing, administered pricing

Module- IV

Forms of business organization: Introduction, definition, essential element of good organization, principles of organization, formal and informal organisation, organisation structure, concept of ownership organization, types of ownership, partnership, joint stock company, types of joint stock company, co-operative organization, public sector organisation.

Capital and capital budgeting: Capital and its classifications, need of working capital and its assessment, factors affecting working capital, fundamental of accounting, types of capital, method and sources of raising finance, nature and scope of capital budgeting, features of capital budgeting proposals, method of capital budgeting: payback method, accounting rate of return (ARR) and net present value method (simple problems).

Module- V

Fundamental of financial accounting: Nature of accounting, important accounting terminology, accounts and types of accounts, rules of debit and credit, system of book keeping, book of accounts, journal, ledger, trial balance, final account, trading account, profit and loss accounts and balance sheet.

Financial analysis through ratios: Classification of financial ratios, liquidity ratios, leverage ratios, activity ratios, profitability ratios, current ratio, acid test ratio, debt equity ratio, assets coverage ratio, debt service coverage ratio, inventory turnover ratio, debtor velocity ratio, creditor velocity ratio, gross profit ratio, net profit ratio, return on equity ratio.

TEXT & REFERENCE BOOKS:

1. Managerial Economics –YogeshMaheshwari, PHI.
2. Managerial Economics – Joel Dean, PHI.
3. Managerial Economics–Craig H. Petersen, W. Cris Lewis, Sudhir K Jain.
4. Financial Accounting For Management –Ambrish Gupta, Pearson Eduction.
5. Managerial Economics – H. Craig Peterson & W. Cris Lewis, PHI.
6. Managerial Economics – Suma Damodaran, Oxford University Press.
7. Managerial Economics and Financial Analysis –Aryasri, TMH.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05THS43	Financial Accounting and Costing	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To ascertain the cost per unit of the different products manufactured by a business concern.
2. To provide a correct analysis of cost both by process or operations and by different elements of cost.
3. To disclose sources of wastage whether of material, time or expense or in the use of machinery.
4. Equipment and tools and to prepare such reports which may be necessary to control such wastage.
5. To provide requisite data and serve as a guide for fixing prices of products manufactured or services rendered.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Appreciate the need for negotiable instruments and procedure of accounting for bills honoured and dishonoured.

CO2: Differentiate trade bills from accommodation bills.

CO3: Understand the concept of consignment and learn the accounting treatment of the various aspects of consignment.

CO4: Distinguish joint venture and partnership and to learn the methods of maintaining records under joint venture.

CO5: Distinguish between single entry and double entry.

CO6: Know the ascertainment of profit under single entry system.

CO7: Understand the meaning and features of non-profit organisations.

COURSE CONTENT:

Module- I

Financial accounting: Introduction to book keeping, double-entry accounting, journal & ledger posting, financial statements &analysis, trial balance, preparation of trading and profit & loss account and balance sheet.

Module-II

Ratio analysis: Balance sheet ratios, current ratio, fixed asset ratio, liquidity ratio, capital gearing ratio, profit-loss account ratios, gross margin ratio, net margin ratio, combined ratios, return on investment ratio, net profit to total assets ratio, creditors turnover ratio.

Module-III

Costing: Objectives of costing, elements of costing, methods of costing, preparation of cost sheet, job costing, marginal costing, absorption costing, process costing and standard costing-material, labour, overhead cost variance, activity based costing and target costing, cost-profit-volume analysis and problems on cost-volume-profit analysis.

Module-IV

Working capital management: Introduction, concepts of working capital, operating and cash conversion cycle, permanent and variable working capital, balanced working capital position, determinants of working capital, estimating working capital needs, policies for financing current assets, issues in working capital management.

Module-V

Capital budgeting: Nature and scope of capital budgeting, features of capital budgeting, methods of capital budgeting, DCF, NON-DCF techniques, accounting rate of return, net present value, payback period, discounted payback period, profitability index.

TEXT & REFERENCE BOOKS:

1. Accounting for Management–T. Vijaya Kumar, 1/e, Tata McGraw-Hill.
2. Financial Management–I. M. Pandey9/e, Vikas Publishing House.
3. Cost Accounting–M.Y. Khan and P. K. Jain, 2/e, TMH.
4. Management Accounting–M.Y. Khan and P. K. Jain, Text, Problems and Cases, 6/e TMH.
5. Basic Financial Management–M.Y. Khan, P. K. Jain, 3/e, TMH.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech. V Sem.	IP05PPC05	Metal Cutting Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Operate machine tool equipment commonly found in industry like lath machine, milling machine and grinding machine.
2. Manufacture parts from various materials in accordance with sp blueprints, electronic drawings and shop sketches.
3. Apply safety principles in a work environment to minimize hazards a to productivity.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Apply cutting mechanics to metal machining based on cutting force and power consumption.

CO2: Operate lathe, milling machines, drill press, grinding machines, etc.

CO3: Select cutting tool materials and tool geometries for different metals.

LIST OF EXPERIMENTS:

1. Introduction of general purpose machine lath and drilling machine, shaping machine, milling and grinding machine.
2. Facing and plain turning on lathe machine.
3. V-groove cutting on shaping machine.
4. Step turning and taper turning on lathe machine.
5. To perform the surface grinding operation.
6. Thread cutting and knurling on lathe machine.
7. To verify the Merchant's force diagram.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech. V Sem.	IP06PSC01	SEMINAR	-	-	2	50	-	50	1

COURSE OBJECTIVES:

1. To increase the self-confidence among students which helps in finding their own proficiency
2. To cultivate student's leadership ability and responsibility to perform and execute the given task.
3. To provide learners hands on practice within a real job situation.
4. Enhance and supplement the knowledge and skills of the students.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the role of self-efficacy, personal goals, and motivation in improving academic life.

CO2: Describe the behaviours and characteristics of an effective learner.

CO3: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2020-21
B. TECH THIRD YEAR, VI SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP06TPC11	Operation Research	3	1	0	30	70	100	4
2.	IP06TPC12	Metrology & Measurement	3	0	0	30	70	100	3
3.	IP06TPC13	Welding Engineering	3	0	0	30	70	100	3
4.	IP06TPE03	Professional Elective-03	3	0	0	30	70	100	3
5.	IP06TPE04	Professional Elective-04	3	0	0	30	70	100	3
6	IP06TOE01	Open Elective-01	3	0	0	30	70	100	3
Total			**18**	**1**	**0**	**180**	**420**	**600**	**19**
PRACTICALS									
1.	IP06PPC06	Metrology & Measurement Lab	0	0	2	30	20	50	1
2.	IP06PPC07	Welding Engineering Lab	0	0	2	30	20	50	1
Total			**-**	**-**	**4**	**60**	**40**	**100**	**2**

Total Credits: **21**

Total Contact Hour: **23**

Total Marks: **700**

INTERNAL ASSESSMENT: - Two class tests of 15 marks each will be conducted.

L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP06TPE03 Professional Electives-03
IP06TPE31 Material Management
IP06TPE32 Plant Layout& Material Handling
IP06TPE33 Maintenance & Reliability Engineering
IP06TPE04 Professional Electives-04
IP06TPE41 Automobile Engineering
IP06TPE42 Power Plant Engineering
IP06TPE43 Heat & Mass Transfer
IP06TOE01 Open Elective-01
IP06TOE11 Enterprise Resource Planning
IP06TOE12 Management Information System
IP06TOE13 Six Sigma and DOE

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPC11	Operation Research	3	1	-	15	15	70	100	4

COURSE OBJECTIVES:

1. To learn about the importance of decision making.
2. To design and analyze mathematical statement and equations.
3. To grasp importance of Network analysis, transportation problems.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Apply knowledge of optimization for formulating and engineering, decision problems in work culture

CO2: Work effectively with engineering departments.

CO3: Reflects towards resource optimization and allocation.

COURSE CONTENT:

Module -I

Introduction to linear programming: Graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, maximization & minimization function with or without constraints, sack surplus & artificial, variable method, degeneracy problem.

Module-II

Mathematical statement of the transportation problem: Transportation model, method for basic feasible solution, Degeneracy & unbalance problem, Mathematical statement of the assignment problem, solution of assignment problem, traveling sales-man problem.

Module-III

Game theory: Rule of game, method of solving game, graphically & arithmetic, saddle point & without saddle point, dominance method, mixed strategies 2 X 2 game, 2 X N game, M X 2 game, 3 X 3 game (method of matrix's, method of linear programming etc).

Inventory: Introduction, classification, function, level, control techniques, models, various costs associated, EOQ, optimum lot sizing.

Module-IV

Introduction of queuing theory: Elements of queuing system, operating characteristics of a queuing system, Poisson arrivals & exponential service time, waiting time & idle time cost, single channel queuing theory.

Replacement problems: Requirement policy, replacement of items, machinery various themes, group replacement policy, MAPI methods.

Module - V

Network analysis: Introduction of PERT & CPM, computation of PERT, time estimation, measure of deviation & variation , probability of completing project, arrow diagram & critical path method, scheduling , cost analysis & crushing of network.

TEXT & REFERENCE BOOKS:

1. Operation Reasearch Sharma & S D Kedarnath, Ramnath & Co Meerut.
2. Operation Research, Sasien Yaspan.
3. Operation Research – N. D. Vohra, TMH Publication.
4. Operation Research– Hira & Gupta, S. Chand & Co.
5. Operation Research – H. Gillette, TMH, New Delhi.
6. Operations Research – M. Taha, TMH, New Delhi.
7. Operations Research – Phillip Ravindran, Wiley Publications.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPC12	Metrology & Measurement	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To under standard, analyze the different measurement systems, Standards of Measurement, Measurement Errors.
2. To know about Limits, Fits, tolerance and gauges used in measurement and designing aspects for those.
3. To familiar with different types of comparators, optical metrology and their applications.
4. To enlighten students about various techniques of measurement of Screw threads, Gears, Geometric forms and Surface textures.
5. To accustom with various measuring devices for measurement of force, torque, strain, acceleration, online measurement and micro-nano measurements.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Distinguish between accuracy and precision, identify different measurement errors, able to select linear or angular measuring instrument for measurement of various components

CO2: Design limit gauges used for various components and purposes.

CO3: Explain principles and uses of comparators and optical instruments used in metrology.

CO4: Examine various screws threads and gears parameter using different methodology and explain capabilities of machining process by measuring surface finish.

CO5: Implement and analyse appropriate measurement methods for variables like force, torque, strain, acceleration and online measurement and micro-nano measurements.

COURSE CONTENT:

Module–I

Introduction: Historical development, Basics of Metrology, Need for Inspection, Accuracy and Precision, characteristic of measurement devices, calibration, concept of error, sources of error, analysis of error. standards of measurements, system of measurement, line, end & wavelength standards.

Linear metrology: Steel rule, callipers, Vernier calliper, Vernier height gauge, Vernier depth gauge, micrometres, universal calliper.

Miscellaneous measurements: Taper measurement, angle measurement, radius measurement, sine bar & Angle gauges

Module–II

Limit Fits and Gauge: Interchangeable manufacture, selective assembly, concept of limits, fits and tolerances, Types of fit, Basic-Hole System, Basic-Shaft System, Problems, Tolerance grades, Metric fits, Indian standard system, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials, Considerations of gauge design, Taylor's principle of gauging, Wear allowance on gauges

Module–III

Comparator and Optical gauges: Principle and uses of mechanical, optical, Electrical, electronic and pneumatic Comparators

Principle of interferometer, concept of optical flat, projector, microscope, autocollimator and interferometer

Types of machine tool tests, alignment tests for lathe, milling and drilling machine tools

Module–IV

Form measurement: Terminology of screw threads, Measurement of minor, major, thread angle and effective diameter of screw threads by 2-wire and 3- wire methods, best size wire. Screw thread gauges, Tool maker's microscope.

Gear tooth terminology, gear tooth thickness & pitch measurement, involutes profile testing of gear

Straightness, flatness and squareness and circularity tests, numerical evaluation, measurement of surface finish, related instruments.

Automated inspection system, Introduction & applications of Co-ordinate Measuring Machine (CMM)

Module–V

Dynamic measurement: Sensors and Transducers: Types of Sensors, types of transducers and their characteristics

Force and Torque measurement: Direct methods and indirect method, force measuring instruments-load cells, Dynamometer, Power Measurements

Measurement of strain: types of strain gauges, gauge factors, theory of strain gauges and method of measurement, Wheatstone bridge circuit

Vibration and Noise Measurement: Piezoelectric Accelerometer and decibel meters concept of on-line inspection & Micro-nano Measurement tools.

TEXT & REFERENCE BOOKS:

1. Mechanical Measurement - Beckwith and Buch,
2. Instrumentation – R.K. Jain.
3. Automatic Control Engineering – H. Raven.
4. Automatic Process Control - Donal P Eckman.
5. Instrumentation Measurement & Analysis - Nakra & Choudhary.
6. Theory & Application of Automatic Controls – B.C Nakra.
7. Modern Electric Instrumentation - D. Albert Cooper, PHI
8. A Text book of Engineering Metrology, I. C. Gupta, Dhanpat Rai, New Delhi
9. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication(KATSON).
10. Engineering Metrology, M. Mahajan, Dhanpat Rai & Co. New Delhi.
11. Metrology and Measurement, N V Raghavendra and Krishnamurthy,Engineering, Oxford University Press.
12. Metrology and Measurement, Anand Bewoor,VinayKulkarni, McGraw-Hill

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPC13	Welding Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To impart knowledge about welding behaviour of machine and process during welding, analysis of common and newer welding techniques and metallurgical and weldability aspects of different common engineering materials.
2. To impart knowledge on various advanced welding processes so that the students can apply them in engineering industry applications.
3. To develop the knowledge on the design of welded joints and the quality control of weldment.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: The difference between various welding processes and its industrial utilization

CO2: Apply the knowledge of solid state welding process for engineering applications.

CO3: Understand the principles of radiant energy metal joining process.

CO4: Understand the fundamental principles of special arc welding process

CO5: Understand the knowledge of plasma arc in metal joining and cutting process

CO6: Understand the knowledge of design principles in weld joints. Apply the concept of quality control and testing of weldment in industrial environment

COURSE CONTENTS

Module - I

Welding: Classifications, principle and equipments of gas welding and Arc Welding, different type of welding process and their equipments, features, Welding symbols, Positions of welding, types of Gas welding Flames, Welding Techniques, Gas welding Torches Submerged Arc Welding, TIG, MIG, Plasma Arc Welding and its Application

Physics of welding: weldability, weld thermal cycle, Heat affected zone, Arc efficiency, temperature distribution in the arc; arc forces, arc blow, electrical characteristics of an arc, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc.

Module - II

Arc Welding: Arc Welding Power Sources, Selection Factor for Power Sources, DC Generator, rectifiers, Constant Current & Constant Voltage Machines, welding Transformers, duty cycles

Welding Electrodes: Types, electrode coatings and its importance, selection of electrode, electrode coating ingredients and their functions, role of flux ingredients and shielding gases forces during metal transfer, modes of metal transfer in arc welding.

Module - III

Resistance welding process: Spot Welding, Seam, Projection, Butt welding, Flash Butt Welding, percussion welding.

Solid state welding process: Cold Welding, Diffusion Welding, Ultrasonic Welding, Explosive Welding, and Friction Welding'

Radiant energy welding process: Electrical Beam Welding, Laser Beam Welding.

Module - IV

Welding distortion: Distortion and Residual Stresses, Types, Control of welding Distortion, Various discontinuities in welds, Trouble shooting..

Brazing, Soldering and their Application:, Hydrogen Induced Cracking.

Module - V

Design of Weldment: Weld Geometry, Eccentric Loading Designing Torsion and bending, Designing welding fixtures.

Testing, Inspection and Specification: Destructive and Non-destructive methods of testing weldment, WPS, PQR, and ASME section IX Welding.

Robotics and Automation in Welding: Modes of Automation, Positioners, Welding Fixtures, and Arc Motion Devices, Under Water Welding'

TEXT & REFERENCE BOOKS:

1. Modern Arc Welding Technology - S.V. Nadkarni, Oxford IBH Publishers.
2. Welding and Welding Technology - R.L. Little, Tata McGraw-Hill.
3. Welding Technology - O.P, Khanna Dhanpat Rai & Sons.
4. Welding Processes & Technology- R.S. Parmar, Khanna Publishers.
5. Manufacturing Technology (Foundry, Forming and Welding Vol. 1) - P. N. Rao, Tata McGraw Hill.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE31	Material Management	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the concept of effective and efficient purchase, various inventory policies and models.
2. To provide the concept of effective and efficient store management by implementing modern techniques like JIT and MRP.
3. To provide the concept of various models of inventory control.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Develop an ability to perform the role of a materials manager in an organization.

CO2: Shall be able to manage the activities of materials manager like purchasing, inventory analysis, storage etc.in a scientific manner.

CO3: Shall be able to improve due date performance through use of MRP techniques with in capacity constraints.

CO4: Shall be able to practice material planning through modern materials management tools like JIT, DBR etc.

CO5: Understand ethical issues in purchasing and negotiations

COURSE CONTENT:

Module - I

Introduction: Definition and scope, concept of integrated materials management, materials research, materials planning and budgeting, codification, standardization.

Purchasing: Objective and function of purchasing department, purchasing procedure, negotiation and source-selection.

Module - II

Types of purchasing: Buying seasonal commodities, purchasing under uncertainty, purchasing of capital equipment, international purchasing, public buying, legal concept in buying, insurance buying, price forecasting.

Module-III

Stores management: Stores system and procedure, incoming material control, stores accounting and stock verification, obsolete, surplus and scrap management.

Module - IV

Basic inventory system: Concept of inventory, types of inventory, relevant costs of inventory, economic order quantity, inventory control techniques, basic models of inventory.

Spare parts management: Definition of spares and its classification, MUSIC-3D, view of spares, multi echelon spares inventory.

Module - V

Value analysis: Value importance, normal degree value analysis applied to purchase, organizing for value analysis, cost analysis and value analysis aid purchase research, material and process selection in VE design, material, process and supplier decisions.

TEXT & REFERENCE BOOKS:

1. Materials Management an integrated approach – P. Gopalkrishnan. & M Sundaresan (2002) Prentice Hall India Limited, New-Delhi.
2. Materials Management Text and Cases - A.K Chitlae & R..C. Gupta (2009) Prentice Hall India Limited, New-Delhi.
3. Maintenance and Spare parts Management – Pathak, Prentice Hall India Limited, NewDelhi.
4. Production and Operations Management - S.N. Chary, Tata McGraw Hill.
5. Material management: An integrated approach - Dutta.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE32	Plant Layout& Material Handling	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the basic concepts related to the interactions between the production system parameters and their impact on materials handling systems design.
2. To familiarize students with different methods available for the generation of plant layouts.
3. To provide students with information on materials handling systems design for various aspects of the manufacturing and service industry.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: To describe and determine the effect of product, process, and schedule design parameters on plant layout and materials handling systems design.

CO2: To identify the characteristics of product and process layouts and their needs in terms of materials handling.

CO3: To develop and analyze plant layouts using manual and computer aided software methodologies.

CO4: To identify and select various types of material handling equipment.

CO5: To design material handling systems for a variety of scenarios pertaining to manufacturing and service industry

Module - I

Plant facility locating: Concept of plant facility**,** its scope, importance and objectives nature of location decision, need for facility location planning, general procedures and factors influencing location decision, facility location models, economics and cost analysis, rural and urban location pattern in India.

Module - II

Layout designs: Industrial plant design consideration, types of production types of layout, factors affecting layout tools, techniques and procedure used in workstation and plant layout, quantitative technique in plant layout, developing product and process layout, comparing layouts, criteria for computerized facility layout, concept of computerized layout programs like CRAFT, CORELAP, ALDEP and PLANET.

Module - III

Flow pattern design: Overall system flow cycle, need and advantage of planned material flow, factors for consideration, designing flow pattern, flow patterns for production lines and assembly lines methods.

Module - IV

Material Handling: Scope and functions of material handling, manual mechanical handling ratio, principles of material handling, analysis of material handling problem, classification of material handling system, salient features and application of general purpose material handling equipment, material handling in stores and warehouses, automation in part handling and industrial robots, optimum allocation of material handling equipment.

Module - V

Automated material handling system: Concept of AGVs, AR/RS and methods to minimize cost of material handling, safety in material handling, evaluation of material handling process, design procedure of cranes, lifts.

TEXT & REFERENCE BOOKS:

1. Practical plant layout - Muther
2. Plant layout and design - James More
3. Manufacturing Management: A Quantitative approach - Robert Aolsem
4. Productions and Operation Management - Lockyer.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE33	Maintenance & Reliability Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2. To provide the concept of various types of maintenance system used in industries.
3. To impart knowledge on reasons for failure and the corrective and preventive measure adopted to reduce them.
4. To make the students to be familiar with the concept of reliability engineering
5. To make the students to understand the various maintenance and logistics means or the execution of various services.
6. To impart knowledge on creating various tools for maintainability of mechanical system.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Application of concepts of the course leads to the optimization of equipment, procedures, and departmental budgets to achieve better maintainability, reliability and availability of equipment.

Module - I

Concept of reliability: Objectives, applications, area of use, use of reliability in industry, reliability functions, mean time between failures, hazard rate function, bath tub curve, conditional reliability, probability density function, failure rate, failure density, hazard rate, uncertainty measures.

Module - II

Constant and time dependent failure models: Exponential, Webull, normal and lognormal distributions, discrete distribution, binomial distribution, Poission distribution.

Reliability of systems: Series, parallel, mixed connected systems, K-out –of –M system concept of redundancy, objectives, applications, redundant standby systems, system structure functions, minimal cuts and minimal paths, common mode failures, three state devices.

Module – III

Determination of reliability (state dependent systems): Markov analysis, load sharing system, standby systems, degraded systems.

Failure analysis: Introduction to failure mode and effect analysis, FMEA and FMECA, criticality analysis, fault tree diagram, event tree.

Availability: Concept and definitions, types of availability model, system availability.

Module - IV

Introduction: Objectives and policies of maintenance, maintainability terms and definitions, maintainability organization functions and tasks, estimation of maintenance cost.

Types of maintenance: Breakdown, predictive, replacement, on-line, off-line, preventive maintenance, reconditioning and correction maintenance, preventive maintenances v/s. repair, reliability centered maintenance, condition-based maintenance, principals and level of CBM.

Module - V

Total productive maintenance: Goals objective benefits of TPM, component of TPM, calculation of OEE, training for maintenance personal, objective and level of training, types of training methodology, evaluation of maintenance department.

TEXT & REFERENCE BOOKS:

1. Principles of Planned Maintenance – R. H Clifton, McGraw Hill Publications.
2. An introduction to Reliability and Maintainability Engineering – C.E Ebling, Tata McGraw Hill.
3. Reliability Engineering - L. S Srinath, Affiliated East-West Press Limited, New Delhi.
4. Engineering Maintainability – B. S Dhillon Prentice Hall of India, New Delhi.
5. Maintainace and spare parts management - P. Gopalkrishnan, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE41	Automobile Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the knowledge of basic structure of an automobile.
2. To provide the knowledge of transmission system and its various elements.
3. To provide the knowledge of clutches and suspension system
4. To provide the knowledge of braking system.
5. To provide the knowledge of steering system and engine emissions.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Graduates will gain a strong foundation in core automobile engineering, both in theoretical and applied concepts.

CO2: Acquire knowledge and hands-on competence in the design and development of automobile.

CO3: Graduates will develop an ability to identify and solve automobile engineering maintenance problems.

COURSE CONTENT:

Module - I

Introduction of an automobile: Component and basis structure of automobile, classification, difference between automobile and automotive, the chassis construction & classification, defect in frames, frameless construction & specifications. Wheel and tyres: Types of wheel, wheel dimension, desirable tyres properties, types of tyres, tyre material, tyre dimension, factors affecting tyre life.

Module - II

Transmission system: Function of transmission types, sliding mesh gear box, constant mesh gear box, synchro mesh gear box, torque converter, propeller shaft, universal joint, hook joint, final drive, differential, performance of gear box.

Module - III

Clutches: Requirement, function & type of clutch, dry friction clutch, wet friction clutch, clutch plate, single plate & multiple plate clutch, centrifugal clutch and fluid fly wheel.

Suspension system function and requirement, leaf spring, torsion bar, telescopic shock absorber.

Module - IV

Brakes: Function and requirement, brake efficiency, wheel skidding, types of brake, electrical, mechanical and hydraulic & pneumatic brakes, master cylinder, wheel cylinder, self-actualizing brakes, brake drum, brake liners, brake shoe, trouble shooting.

Module - V

Front axle and suspension wheel alignment purpose: Factor of front wheel alignment, steering geometry, correct steering angle, steering mechanism, under steer and over steer, steering gear, power steering, reversibility of steering gears, steering gear ratio, calculation of turning radius.

Engine emission: Emission standard of vehicle in India, Euro norms, emission, testing. Principle of multipoint fuel injection (MPFI), component of MPFI, different sensors of MPFI system, vehicle air conditioning.

TEXT & REFERENCE BOOKS:

1. Automobile Engineering - Kripal Singh Vol. I, II.
2. Automobile Mechanics - Joseph Heitner.
3. Automobile Engineering - N.K Giri
4. Automobile Engineering - Shrinivasan T.M.H.
5. Automobile Engineering - K.K. Jain, R.B. Asthana T.M.H.
6. Automobile Engineering - R.B. Gupta Tech India Publication Series.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE42	Power Plant Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the knowledge related to various sources of energy and steam power plant.
2. To provide the knowledge related to solar power plants and solar power plant.
3. To provide the knowledge related to nuclear power station.
4. To provide the knowledge related to geothermal power plant, wind energy and bio gas plant.
5. To provide the knowledge related to direct energy conversion systems.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Demonstrate a basic understanding of various types of power plants.

CO2: Acquire knowledge and hands-on competence in the design and development of mechanical systems associated with power plants.

CO3: Compare different energy resources and choose the most appropriate based on local conditions

CO4: Perform simple techno-economical assessments of energy resources

CO5: Design power plant that meet specific energy demands, which are economically feasible and have a minimal impact on the environment.

COURSE CONTENT:

Module - I

Sources of energy: Present power position in India, non-conventional energy and their application, steam power plant, high-pressure boilers and their classification and working, boiler accessories and mountings, condenser and their types.

Module - II

Solar Energy: Solar Insolation calculation, flat plates and concentrating collectors for liquid and gases, construction, collector area calculation, heat removal factor, efficiency.

Solar System: Power plants, low, medium and high temperature plants, solar dryers, solar cookers, solar refrigeration systems, solar panel.

Module - III

Nuclear Energy: Introduction to nuclear engineering, release of energy by nuclear reaction, chain reaction, moderation, components of nuclear reactor, types of reactor, pressured water reactor, CANDU reactor, gas cooled reactor, liquid metal cooled reactor, breeder reactor, nuclear materials.

Module - IV

Geothermal power plant, Wind energy: Sources of geothermal energy and its types, type of rotors, horizontal axis and vertical axis systems, system design and site selection blade material, wind power scenario in India.

Bio Gas Plant: Types, parameters affecting plant performance, plant design.

Module - V

Direct Energy Conversions: Fuel cells, thermo-electric, thermo ionic and MHD systems (magneto hydrodynamic system). Economic analysis of power plant tariffs.

TEXT & REFERENCE BOOKS:

1. Power Plant Engineering - Domkundwar & Arora, Dhanpat Rai Publication.
2. Solar energy - S.P. Sukhatme, TMH Publication.
3. Solar Energy Thermal Processes - Duffie and Beckman, John Wiley.
4. Power plant Engineering - P.K.Nag, TMH Publication.
5. Power Plant Enginering - Wakil, TMH.
6. Non-Conventional Energy Sources - B.H. Khan, TMH Publication.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE43	Heat & Mass Transfer	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the basic principles of heat transfer due to conduction, convection and radiation.
2. To provide the knowledge of fin design to enhance the heat transfer in real time situation.
3. To provide the fundamentals of convection process and distinguish between natural and forced convection.
4. To design novel heat exchangers for domestic and industrial use.
5. To provide the knowledge radiation heat transfer and the principles of mass transfer.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Classify and differentiate between various modes of heat transfer.

CO2: Design an extended surface for enhancing heat transfer for any device/equipment.

CO3: Calculate heat transfer through any substance for both steady and unsteady state conditions.

CO4: Identify the type of convection process and calculate heat transfer in any real time given situation.

CO5: Design an improved heat exchanger to maximize the heat transfer efficiently.

CO6: Explain the radiation heat transfer phenomenon and apply the knowledge to design a new engineering device.

COURSE CONTENT:

Module - I

Introduction: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, combined modes of heat transfer, thermal diffusivity, overall heat transfer coefficient.

Conduction: Thermal conductivity of solids, liquids and gases, factors in influencing conductivity measurement, general differential equation of conduction, one dimensional steady state conduction, linear heat flow through a plane and composite wall, tube and sphere, critical thickness of insulation, conduction with heat generation in flat and cylinders.

Module - II

Fins: Conduction convection system, extended surfaces rectangular, triangular circumferential and pin fins, general conduction analysis, fins of uniforms cross section area, heat dissipated by a fin, effectiveness and efficiency of fin.

Transient (Unsteady state) heat conduction: Transient conduction in solids with infinite thermal conductivity, Transient conduction in solids with finite conduction and convective resistance.

Module - III

Forced Convection: Physical mechanism of forced convection, dimensional analysis for forced convection, velocity and thermal boundary layer, flow over plates, flow across cylinders and flow in tube, Reynolds analogy.

Natural Convection: Physical mechanism of natural convection, dimensional analysis of natural convection, empirical relationship for natural convection.

Module - IV

Boiling and Condensation: Boiling heat transfer, pool boiling, condensation heat transfer, film condensation.

Heat Exchangers: Different type of heat exchanger, determination of heat exchanger performance, heat exchanger transfer Module, analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method).

Module-V

Thermal Radiation: Introduction, absorption and reflection of radiant energy, emission, radiosity and irradiation, black and non-black bodies, Kirchhoff's law, intensity of radiation, radiation exchange between black surface, geometric configuration factors.

Introduction to Mass Transfer: Mass transfer processes: classification, concentrations, velocities and fluxes, molecular diffusion, eddy diffusion, convective mass transfer.

TEXT & REFERENCE BOOKS:

1. Heat transfer -S.P. Sukhatme, TMH.
2. Heat & Mass Transfer- P K Nag, TMH Publications.
3. Fundamentals of Heat and Mass Transfer - Frank P. Incropera, David P. Dewitt, Wiley.
4. Heat & Mass Transfer - Arora and Domkundwar, Dhanpat Rai Publications.
5. Heat Transfer - C.P. Arora, TMH.
6. Heat & Mass Transfer - R.C. Sachdeva, New Age Publications.
7. Heat Transfer - J.P. Holman, TMH.
8. Heat Transfer : A Practical Approach- Yunus A. Cengel, TMH Publications.
9. Heat & Mass Transfer Book – C P Kothandaraman S Subramanyan, New Age International Publishers.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TOE11	Enterprise Resource Planning	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide and gain insight into process views of organizations and tools and techniques used to model both as-is and to-be models.
2. Apply the process modeling techniques in one or more modelling environments.
3. Summarize basic concepts, tools and techniques of enterprise resource planning (ERP).
4. Describe the key implementation issues of ERP.
5. Reorganize the current and future trends in ERP.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Capable to apply key technical terminology in enterprise information systems as they apply in different ERP products and development methods.

CO2: Understand key differences between the major ERP applications (such as SAP R/3).

CO3: Analyze a current architecture and perform an effective gap analysis before an ERP implementation

CO4: Be able to map enterprise architectural resources to a contemporary Enterprise Architecture mapping tool

COURSE CONTENT:

Module – I

Introduction to Enterprise resource planning: Evolution of ERP, MRP, MRP-II, e-ERP, generic business model with reference to ERP, structure of ERP: Two tier architecture client, server, three tier architecture, repository, RDBMS, operating systems, generic model of ERP system - design tree node structure, design of, role/activity diagrams, benchmarking, types of benchmarking, process of benchmarking.

Module – II

Introduction to Business Process Re-engineering: Procedure of BPR, principle of BPR, process improvement, process redesign.

Module – III

Analysis of risk and uncertainty: Various approaches for risk evaluation.introduction: supply chain management and ERP, understanding the supply chain with case examples, supply chain performance

with measures, achieving strategic fit and scope, supply chain drivers, supply chain obstacles, ERP vs SCM, benefits of supply chain improvement, introduction of logistics types of logistics, types of logistics, benefits of logistics.

Module – IV

Integrated SAP model: Integrated data, master data, transactional data, integrated processes, evolution electronic data interchange (EDI), use of EDI, and benefits of EDI, selection of ERP, introduction opportunities and problems in ERP selection, approach to ERP.

Module – V

Origins of SAP: SAP's markets, SAP architecture and integration, SAP business structure, customization of SAP, SAP R/3 material management, sales and distribution, production, plant maintenance, quality management, methodology for ERP implementation, implementation phases, implementation of life cycle implementation failure.

TEXT & REFERENCE BOOKS:

1. Enterprise Resource Planning: Theory and practice - V. Rahul, PHI Publication.
2. Enterprise Resource Planning: Concepts and practice - V.K. Garg, TMH Publication.
3. Enterprise Resource Planning - Alexis Leon, McGraw-Hill Publication.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TOE12	Management Information System	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. Describe the major technological, organizational, behavioral and ethical issues facing today's information systems professional.
2. Retain currency in the face of rapid technological change by reading and understanding technical literature.
3. Critically and comparatively evaluate technical descriptions of computer hardware and software products.

COURSE OUTCOME:

After completion of the course, the students will be able to

CO1: Summarize the foundation for design and analysis of supply chains and synthesize advanced and specialized concepts, principles and models for operational and strategic improvement.

CO2: Analytically examine the supply chain of organizations and measure performance improvement.

CO3: Summarize basic concepts, tools and techniques of enterprise resource planning.

COURSE CONTENT:

Module - I

Organization & types, decision making, cost & value of information**,** introduction to information in business, types of information system, need, importance, scope and characteristics of information system, component of information system, developing information system. MIS concept evaluation and characteristics structure of MIS, MIS v/s data processing, MIS and DSS.

Module - II

Solving business problems with information system, concept of balanced MIS, effectiveness & efficiency criteria, tool and techniques of MIS- dataflow diagram, flow chart etc.

Data base technology: Introduction, data base and enterprise management, data independence data base approaches, data base architecture, data models, DBMS SQL and working, 4GL, data administration.

Module - III

Business application of information technology, electronic commerce internet, intranet, extranet & enterprise solutions, information system for business operations, information system for managerial decision support, information system for strategic advantage.

Module - IV

Managing information technology, enterprise & global management, security & ethical challenges, planning & implementing change reports, various types of MIS reports, GUI & other presentation tools.

Module - V

Advanced concepts in information system, enterprise resource planning: introduction, various Modules like human resources, finance, accounting, production & logistics. Supply chain management, CRM, procurement, management system object oriented modeling case studies.

TEXT & REFERENCE BOOKS:

1. Introduction to Information System - O.Brian, TMH.
2. Management Information System - Rahul De, Wiley.
3. Management Information System - Louden and lauden, PHI.
4. Information System Analysis & Design - Bansal, TMH.
5. Management Information System - Jawadegar, TMH.
6. Information System for Modern Management - Murdick, PHI.
7. Management Information System - Sadagopan, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TOE13	Six Sigma and DOE	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. Improve the customer's satisfactions and quality of product and services.
2. Reduce the process cycle time and cost saving and developing staff scale.
3. Understanding the issue and principle of design of an experiment.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Explain the practical implications of Design of experiments.

CO2: Adopt ANOVA techniques to identify sufficient factors.

CO3: Apply Taguchi techniques to conduct experiments in research work.

CO4: Execute various phases of Six Sigma for real time projects.

COURSE CONTENT:

Module - I

Quality perception: Quality in manufacturing, quality in service sector, differences between conventional and six sigma concept of quality.

Probability distribution: Normal, binomial, poisson distribution.

Basics of Six Sigma: Concept of six sigma, defects, DPMO, DPU, attacks on X"S, customer focus, six sigma for manufacturing, six sigma for service, Z score, understanding six sigma organization, leadership council, project sponsors and champions, master black belt, black belt, green belts.

Module - II

Methodology of Six Sigma: DMAIC, DFSS, models of implementation of six sigma, selection of six sigma projects, introduction to software for six sigma, understanding minitab, and graphical analysis of minitab plots.

Module - III

Six Sigma tools: Project charter, process mapping, measurement system analysis, hypothesis testing, quality function deployment, failure mode effect analysis.

Module - IV

Design of experiments: Applications of experimental design, basic principles, design guidelines, statistical design and problems, experimental design, statistical analysis of data, loss function and its calculations.

Module - V

Comparative experiments: Statistical concepts**,** sampling and sampling distributions, inferences about the differences in means, randomized design and inference about differences in means paired comparison design, inferences about the variances of normal distributions, experiment with single factor: the analysis of variance (ANOVA), analysis of fixed effects models, model adequacy checking, practical interpretation of results, sample computer output, determining the sample size, discovering the dispersion effect, the regression approach to the ANOVA, and non parametric method in the ANOVA.

TEXT & REFERENCE BOOKS:

1. Lean Six Sigma Using Sigma XL and Minitab - Issa Bass, Barbara Lawton, 1/e, Tata Mc Graw-Hill, 2010.
2. Design of Experiments - Phillip Ross PHI.
3. What is Six Sigma, 1/e - P. Pande & L. Holpp, Tata McGraw-Hill.
4. The Six Sigma Way, 1/e - P. Pande, Tata McGraw-Hill.
5. What is Design for Six Sigma 1/e - R. Cavanagh, R. Neuman, P. Pande, Tata McGraw- Hill.
6. Six Sigma - K K Bhote Mc-Graw Hill.
7. Design and Analysis of Experiments - D.C. Montgomery, 8th Edition, John Wiley.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech VI Sem.	IP06PPC06	Measurement & Metrology Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Identify and classify different measuring tools related to experiments.
2. Identify, define and explain accuracy, precision and some additional terminology.
3. Conduct, analyze, interpret and present measurement data from measurements experiments.
4. Identify sources of variability, error and uncertainties.
5. Demonstrate excellent laboratory skills and techniques including the proper use of relevant instruments and related technology.
6. Enhance the ability to apply knowledge of mathematics, statics, physics and engineering sciences.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc).

LIST OF EXPERIMENTS:

1. To measure pressure using Bourdon pressure gauge.
2. To calibrate pressure gauge using Dead weight pressure gauge tester.
3. To measure temperature using thermister.
4. To measure flow rate using Rota meter.
5. To measure angle using Angular sensor.
6. To measure torque using Torque transducer.
7. To measure pressure using pressure transducer.
8. To measure temperature by thermocouple.
9. Measurements of lengths, heights, diameter by Vernier Calipers, Vernier height gauge, Micrometers.
10. Measurement of various angles using Bevel protractor, Sine bar & Combination set.
11. Calibration of Vernier caliper, Micrometer, Height gauge, Depth micrometer using slip.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech VI Sem.	IP06PPC07	Welding Engineering Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Availability of various manual and automated welding processes.
2. To provide information related to concepts, operating procedures of various welding processes.
3. To gain knowledge on practical aspects of different welding processes and apply effectively on various engineering applications.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: To acquire the knowledge and skills of modern welding techniques.

CO2: To develop the skills of conventional welding techniques.

CO3: To have a practical exposer various testing methods of welding joint.

LIST OF EXPERIMENTS:

1. To make a Lap joint, using the given two M.S pieces by arc welding.
2. To make a corner joint, using the given two M.S pieces by arc welding.
3. To prepare a butt joint with mild steel strips using brazing technique.
4. To prepare a butt joint with mild steel strip using GMAW technique.
5. To study and observe the welding and brazing techniques through demonstration and practice (Gas, MIG, TIG, Brazing).

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2021-22
B. TECH FOURTH YEAR, VII SEMESTER

S. No	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP07TPC14	Computer Aided Design & Manufacturing	3	1	-	30	70	100	4
2.	IP07TPC15	Production Planning and Control	3	-	-	30	70	100	3
3.	IP07TPE05	Professional Elective-05	3	-	-	30	70	100	3
4.	IP07TOE02	Open Elective-02	3	-	-	30	70	100	3
5.	IP07TMC02	Indian Constitution	3	-	-	-	-	-	-
Total			**15**	**1**	**-**	**120**	**280**	**400**	**13**
PRACTICALS									
1.	IP07PPC08	CAD/CAM Lab	-	-	2	30	20	50	1
2.	IP07PSC02	Seminar on Summer Training	-	-	4	50	-	50	2
3	IP07PPR01	Minor Project	-	-	8	100	-	100	4
Total			**-**	**-**	**14**	**180**	**20**	**200**	**7**

Total Credits: **20**
Total Contact Hour: **30**
Total Marks: **600**
INTERNAL ASSESSMENT: two class tests of 15 marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP07TPE05 Professional Electives-05
IP07TPE51 Fundamentals of Green Manufacturing
IP07TPE52 Product Design & Development
IP07TPE53 Engineering Economics
IP07TOE02 Open Elective-02
IP07TOE21 Advanced Manufacturing Processes
IP07TOE22 Principles of Management
IP07TOE23 Maintenance Management

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TPC14	Computer Aided Design & Manufacturing	3	1	-	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To introduce the student to be familiar with CAD/CAM terminology and its capabilities.
- To recognize geometric and graphical elements of engineering design problems.
- To study Basic features of CAM so as to be capable of accepting professional responsibilities and to understand the associativity between design and manufacturing.
- Integrate the CAD system and the CAM system by using the CAD system for modelling design information and converting the CAD model into a CAM model for modelling the manufacturing information.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Understand the various CAD/CAM and CNC processes.
- Recognize various types of Curves, surface and Solid and their application as used in geometric modelling.
- Analyse the NC programs to generate and verify the tool path for milling and drilling manufacturing processes.
- Appreciate the concept of parametric modelling which is the mainstay of most of the 3D modelling system.

COURSE CONTENT:

MODULE-I

Basics of CAD: Basics fundamental of computer graphics, principle of computer graphics, product life cycle, concept of computer aided design (CAD) and architecture, hardware and software, color management, raster graphics, graphic primitives, lines, and circle drawing algorithms, software documentations, CAD standards GKS, open GL, data exchange standards: IGES, STEP, CALS etc., communication standards, standards for exchange images.

MODULE - II

Geometric modeling of curves, surface and solid: Basics representation of curves, parametric and non- parametric curves, mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves, basic of surface, techniques of surface modeling, plane surface,

rule surface, surface of revolution and sweep, coons and bi-cubic patches, concept of Bezier and B-spline surfaces, basic concept of solid modeling technique, CSG and B-rep method for solid generation.

MODULE – III

Geometric transformation: Computer Aided Design (CAD) methodology, coordinate systems, theory and applications, 2D and 3D geometric transformation, homogeneous transformation, concatenation, assembly modeling, interferences of positions and orientation, tolerance analysis, mass property calculations, visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, concurrent engineering.

MODULE – IV

Basics of CAM: Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, application of NC, concepts of computer numeric control (CNC) system, problems with conventional, NC, CNC.

Part Programming: Introduction to NC part programming, manual part programming, computer assisted part programming, automatically programming tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

MODULE - V

Advance manufacturing system: Concept of distributed numeric control (DNC) system, and its advantages and disadvantages of over NC and CNC, Concept of computer integrated method (CIM), Flexible manufacturing system (FMS), benefits and applications of CIM and FMS, group technology (GT), parts classification and coding systems, benefits and applications of GT, automated storage and retrieval system (AS/RS), automated guided vehicle (AGV).

TEXT & REFERENCE BOOKS:

1. Principles of Computer Graphics, W. M. Neumann and R.F. Sproul, McGraw Hill.
2. Computer Graphics, D. Hearn and M.P. Baker, Prentice Hall Inc.
3. CAD/CAD Theory & Practice, I. Zeid & R. Sivasubramanium, TMH.
4. CAD/CAM, Groover & Zimmer, Prentice Hall, India.
5. Computer Graphics & CAD, Ramamurthy, T.M.H.
6. Industrial Robotics & CIM, Surendra Kumar I.B.H.
7. CAD/CAM, P.N. Rao, Prentice Hall, India.
8. Mastering CAD CAM, Ibrahim Zeid, Tata McGraw Hill Publishing Co.
9. CAD/CAM Principles, C. McMohan & J. Browne, Pearson Education.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TPC15	Production Planning and Control	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To originate engineering skills to identify, formulate, and solve industrial process problems.
- To demonstrate the concept of organization, production systems and cost analysis.
- To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
- To develop an ability to apply PPC concepts in a various areas like marketing, accounting, finance, engineering, personnel management, logistics, etc.
- To integrate operations concepts with other functional areas of business and to compile several important contemporary topics relevant to business managers under functional disciplines, including quality management, production concepts, and sustainability issues.
- To evaluate the PPC function in both manufacturing and service organizations and to examine several dilemmas related to operations management, production planning and inventory control.

COURSE OUTCOMES:

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

- Recognize the objectives, functions and applications of Production management and allied techniques.
- Categorize and solve different inventory control techniques, forecasting dilemmas, routing problems and scheduling troubles.
- Summarize various aggregate production planning techniques and integrating them to different departments to execute effective PPC functions.
- Inspect organizational performance, production systems, demand trends, location feasibility and cost analysis.
- Elaborate and estimate methods of line balancing, process sheets, production strategies, sales forecasting and maintenance.

COURSE CONTENT:

MODULE – I

Introduction: Introduction to various types of production system viz. mass production, job shop, batch production system, continuous production system, concept of production and operation management, objective & functions of PPC.

Forecasting: Time series method, moving average, weighted average, trend, seasonality, regression technique, delphi method.

MODULE – II

Aggregate planning: Definition, strategies, pure and mixed strategies, methods.

Master production schedule: Objective and functions, design of MPS, bill of materials.

Material requirement planning: Objectives, functions, MRP, MRP-II, limitations.

Capacity requirement planning: Definition, objectives, process of CRP, process sheet, rough cut capacity planning, loading, and preparation of CRP chart.

MODULE – III

Scheduling: Types, single machine scheduling, job shop scheduling, flow scheduling;

Sequencing: Various priority rules, line of balancing, rank and positional weight method, Kilbridge westner method.

Facility location and facility location problems: Factors affecting plant locations, single facility locations problems and its methods.

MODULE – IV

Types of layouts: layouts design procedure such as CORELAP, CRAFT etc., material handling system & their classification, principles, JIT & KANBAN, depreciation & methods of depreciation.

MODULE -V

Maintenance management: Types of maintenance strategies, breakdown and preventive maintenance, predictive and total productive maintenance, condition monitoring, individual and group replacement policies, make or buy decision, concept of original equipment effectiveness.

TEXT & REFERENCE BOOKS:

1. Production and operation management, O. Paneerselvem, TMH.
2. Production and operation management, Adem Ebert.
3. Production and operation management, Charry S.N. TMH.
4. Production and operations management Theory and practice Mahadevan. B.
5. Production and operation management, Joseph G. Monks, TMH.
6. Handbook of Material Handling, Ellis Horwood limited.
7. Operations Management: Design Planning and control for the manufacturing and services.
8. Lawrence P. Atkin, James B. Dilworth Tata Mc Graw Hill.
9. Production and Operations management, R.B Khanna, PHI.
10. Production operations management, S.N. Buffa, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TPE51	Fundamentals of Green Manufacturing	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To originate engineering skills to identify, formulate, and solve industrial process problems.
- To demonstrate the concept of organization, production systems and cost analysis.
- To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
- To develop an ability to apply PPC concepts in a various areas like marketing, accounting, finance, engineering, personnel management, logistics, etc.
- To integrate operations concepts with other functional areas of business and to compile several important contemporary topics relevant to business managers under functional disciplines, including quality management, production concepts, and sustainability issues.
- To evaluate the PPC function in both manufacturing and service organizations and to examine several dilemmas related to operations management, production planning and inventory control.

COURSE OUTCOMES:

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

- Recognize the objectives, functions and applications of Production management and allied techniques.
- Categorize and solve different inventory control techniques, forecasting dilemmas, routing problems and scheduling troubles.
- Summarize various aggregate production planning techniques and integrating them to different departments to execute effective PPC functions.
- Inspect organizational performance, production systems, demand trends, location feasibility and cost analysis.
- Elaborate and estimate methods of line balancing, process sheets, production strategies, sales forecasting and maintenance.

COURSE CONTENT:

MODULE-I

Introduction: Sustainable development, indicators of sustainability, sustainability strategies, sustainable manufacturing, evolution of sustainable manufacturing, elements of sustainable manufacturing, theory of green manufacturing and its principles, need for green manufacturing, drivers and barriers of green manufacturing.

MODULE - II

Green manufacturing strategy: Manufacturing strategy, elements of manufacturing strategy, manufacturing out puts, competitive priorities: quality, delivery speed and reliability, cost efficiency, flexibility, order winners and order qualifier, tradeoff, production systems, manufacturing levers, competitive analysis, level of manufacturing capability, framework for formulating manufacturing strategy, implications of green manufacturing for manufacturing strategy.

MODULE – III

Life cycle approach of green manufacturing: Holistic and total Life-cycle approach, six step methodologies for green manufacturing (6-R approach), life cycle assessment (LCA), elements of LCA, life cycle costing, eco labelling target setting, data collection and processing, final evaluation by virtue of criteria, environmental management systems.

MODULE – IV

Green manufacturing technology: Definition of green manufacturing technology and practices, classifications of green manufacturing technology, advantages and disadvantages of implementation of green technology.

MODULE – V

Lean and Green manufacturing: Introduction, lean evolution & steps, introduction to lean manufacturing, definition of lean manufacturing, lean vs. green manufacturing: similarities and differences.

TEXT & REFERENCE BOOKS:

1. Cleaner Production: Environmental and Economic Perspectives, Misra Krishna B., Springer, Berlin, Latest edition.
2. Environmental Management Systems and Cleaner Production, Dr. Ruth Hillary, Wiley, New York, Latest edition.
3. Pollution Prevention: Fundamentals and Practice, Paul L Bishop, TMH.
4. Costing the earth, Cairncrss and Francis, Harvard Business School Press – 2009.
5. The principle of sustainability, Simon Dresner, –Earth Scan publishers (2008).
6. Manufacturing strategy: How to formulate and implement a winning plan, Jhon Miltenburg, Productivity Press Portland, Oregon-2017.

7. Manufacturing strategy, Voss C. A, Chapman & Hall-1992
8. Manufacturing the future, Steve Brown, Prentice Hall, 2000
9. Manufacturing strategy, Terry Hill, Homewood, IL- 1989
10. Becoming Lean - Inside Stories of U.S. Manufacturers, Jeffrey K. Liker, Productivity Press, Portland, Oregon
11. Handbook of Sustainable Manufacturing, G. Atkinson, S. Dietz, E. Neumayer, Edward Elgar Publishing Limited, 2007.
12. Industrial Development for the 21st Century: Sustainable Development Perspectives, D. Rodick, UN New York, 2007.
13. An Introduction to Sustainable Development, P.P. Rogers, , K.F. Jalal & J.A. Boyd, J.A, Earth scan, London, 2007.
14. Sustainable Development Indicators in Ecological Economics, P. Lawn, Edward Elgar Publishing Limited.
15. The Economics of Sustainable Development, S. Asefa, W.E. Upjohn Institute for Employment Research, 2005.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TPE52	Product Design & Development	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To introduce design concepts and techniques to develop design ability in a product design.
- To provide knowledge about estimating and evaluating the feasible manufacturing design.
- To make aware of legal issues pertaining to product design.
- To provide knowledge of management of product development projects.

COURSE OUTCOMES:

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

- Describe an engineering design and development process.
- Identify, formulate, and solve engineering problems.
- Design a system, component, or process to meet desired needs.
- Understand the professional and ethical responsibility.
- Recognize the legal issue pertaining to patents of product design.

COURSE CONTENT:

MODULE – I

Product design: Definition, design by evolution, innovation, essential factors of product design, production-consumption cycle, flow and value addition in the production-consumption cycle, the morphology of design, primary design phases and flow charting, role of allowance, concurrent engineering.

MODULE – II

Product design practice and industry: Introduction, product strategies, time to market, analysis of the product, three S's, standardization, Renard series, simplification.

Designer: Role, myth and reality, industrial design organization, basic design considerations.

MODULE – III

New products idea generation: Modification, product variants: adding, dropping, formal testing: new products, concept, product testing, market tests, evaluation, adoption, expansion and forecasting.

Economic factors influencing design: Product value, economic analysis, profit and competitiveness.

Product design for environment: Introduction, importance of DfE, environmental factors, scope of environmental impact, design guidelines for DfE.

MODULE – IV

Developing product strategy: Benefits of strategy, elements of a product strategy, setting objectives, selection of strategic alternatives, increasing sales/market share, increasing profitability, design for manufacturing and design for assembly, ergonomics in design, modular versus integral design.

Human engineering considerations in product design: Introduction, anthropometry, design of controls, the design of displays, man/machine information exchange.

MODULE -V

Intellectual property systems: Definition, concept of intellectual property, kinds of intellectual property, economic importance of intellectual property, importance of IPR, TRIPS and its implications.

Trademark: Introduction, historical development of the concept, need for protection, kinds of trademarks, and well-known trademarks, patents: historical development, concepts, novelty, utility, inventiveness/non-obviousness, copyrights, industrial design.

TEXT & REFERENCE BOOKS:

1. Product Design and Manufacturing, A. K. Chitale & R. C. Gupta, PHI.
2. Fundamentals of Design and manufacturing, V. Gupta, G.K. Lal & Reddy, Narosa Publishing.
3. Design and technology (1996), James Garratt, Cambridge University Press.
4. Product Management, Donald R. Lehman, S. Rusell Wines, 3rd Edition, TMH.
5. Product Life Cycle Engineering and Management, CEP Lecture notes, Prof B. Ravi, IIT Bombay.
6. Product Design & Development, Karl. T. Ulrich & Steven D. Eppinger, 3rd addition, TMH.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TPE53	Engineering Economics	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- Prepare students to analyse cost/revenue data and carry out economic analyses in the decision-making process to justify or reject alternatives/projects on an economic basis.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Describe the role of economics in the decision-making process and perform calculations in regard to interest formulas.
- Trained towards eestimating the present, annual and future worth comparisons for cash flows.
- Calculate the rate of return, depreciation charges and income taxes.
- Enumerate different cost entities in estimation and costing the elements of budgeting.
- Explain the importance of finance functions, financial ratios and solve related problems.

COURSE CONTENT:

MODULE - I

Basic concepts and definitions: Methodology of economics, demand and supply-elasticity, theory of the firm and market structure, price and output determinations in different types of market.

MODULE - II

Public sector economics: Welfare economics, central and commercial marks and their functions, industrial policies, theory of localization, weber & surgent florence theory, investment analysis - NPV, ROI, IRR, payback period, SWOT analysis.

MODULE - III

Monetary and fiscal policy: Tools, impact on the economy, inflation, business cycle, cash flow-2, 3, 4 model.

MODULE - IV

Business forecasting: Elementary techniques, cost and revenue analysis, capital budget, break even analysis.

MODULE - V

Indian economy: Urbanization, unemployment–poverty, regional disparities, unorganized sectors roll of plans, reforms-post independent period.

TEXT & REFERENCE BOOKS:

1. Principles of Economics, N. Mankiw Gregory (2002), Thompson Asia.
2. Managerial Economics, V. Mote, S. Paul, G. Gupta (2004), Tata McGraw Hill.
3. Indian Economy, Its Development Experience Misra, S. K. and Puri V. K., Himalaya Publishing House, Mumbai.
4. Textbook of Business Economics, Pareek Saroj (2003), Sunrise Publishers.
5. Indian economy since Independence, U. Kapila, Academic Foundation, New Delhi.
6. Indian Economy, R. Dutt & K.P.M. Sundharam, S. Chand & Company Ltd., New Delhi.
7. Indian Economic Policy and Reform, R. Mathur, RBSA Publisher, Jaipur.
8. Indian Economic Policy, B. Jalan, Penguin Books Ltd.
9. Economic Survey (Annual), Government of India, Economic Division, Ministry of Finance, New Delhi.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TOE21	Advanced Manufacturing Processes	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the principle of various advanced machining processes kinematics drive of machine tool.
- To impart knowledge about cutting different material removal, joining processes.
- To understand about various advanced metal forming processes.
- Explain how to identify suitable hybrid welding processes for joining dissimilar materials.
- To understand about various advanced casting processes.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Analyze real-life application in various organizations.
- Categorize different material removal, joining processes as per the requirements of material being used to manufacture end product.
- Choose material processing technique with the aim of cost reduction, reducing material wastage & machining time.
- Estimate process parameters affecting the product quality in various advanced machining of metals/ non-metals, ceramics and composites.

COURSE CONTENT:

MODULE – I

Advanced machining processes: Introduction, micro machining process, principle, material removal mechanism, parametric analysis and applications of processes such as ultrasonic machining (USM), abrasive jet machining (AJM), water jet machining (WJM), abrasive water jet machining (AWJM), electrochemical machining (ECM), electro discharge machining (EDM), electron beam machining (EBM), laser beam machining (LBM) processes, working principle of plasma arc machining.

MODULE – II

Advanced machining theory & practices: Mechanisms of chip formation, shear angle relations, and theoretical determination of cutting forces in orthogonal cutting, analysis of turning, drilling and

milling operations, mechanics of grinding, dynamometry, thermal aspects of machining, tool wear, economics of machining, processing of polymers, ceramics, and composites.

MODULE – III

Advanced metal forming processes: Details of high energy rate forming (HERF) process, electro-magnetic forming, explosive forming electro-hydraulic forming, stretch forming, contour roll forming.

MODULE – IV

Advanced welding processes: Details of electron beam welding (EBW), laser beam welding (LBW), ultrasonic welding (USW), cold welding, diffusion welding, forge welding, friction welding, explosive welding, hard vacuum welding, soft vacuum welding, underwater welding processes, concept of robotized welding and welding automation.

MODULE -V

Advanced casting processes: Metal mould casting, continuous casting, squeeze casting, vacuum mould casting, evaporative pattern casting, ceramic shell casting.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for Engineering Materials, Serope Kalpakjian, Steven R. Schemid, Fourth edition, Pearson Education.
2. Manufacturing Engineering and Technology, Serope Kalpakjian, Third Edition, Addison-Wesley Publication Co.,
3. Materials and Processes in Manufacturing, E.P. DeGarmo, J. T Black, R.A. Kohser, 8th Edition, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
4. Manufacturing Science, A. Ghosh & A.K. Mallik, East-West Press Pvt. Ltd. New Delhi.
5. Non-traditional Manufacturing Processes, G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7)
6. Advanced Machining Processes, V.K. Jain, Allied Publishers Pvt. Ltd.
7. Modern Machining Processes, P.C Pandey & H.S. Shan, McGraw Hill Education.
8. Manufacturing Technology, P. N Rao, Tata McGraw Hill Publishing Company.
9. Non-Conventional Machining, P. K Mishra, Narosa Publishers.
10. Unconventional Manufacturing Processes, K. K Singh, Dhanpat Rai & Company, New Delhi.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TOE22	Principles of Management	3	-	-	15	15	70	100	3

The objectives of this course are:

- To help the students gain understanding of the functions and responsibilities of managers.
- To provide them tools and techniques to be used in the performance of the managerial job.
- To enable them to analyse and understand the environment of the organization.
- To help the students to develop cognizance of the importance of management principles.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Discuss and communicate the management evolution and how it will affect future managers.
- Analyse and evaluate the influence of historical forces on the current practice of management.
- Identify and evaluate social responsibility and ethical issues involved in business situations and logically articulate own position on such issues.
- Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment. Practice the process of management's four functions: planning, organizing, leading, and controlling.
- Identify and properly use vocabularies within the field of management to articulate one's own position on a specific management issue and communicate effectively with varied audiences.
- Evaluate leadership styles to anticipate the consequences of each leadership style.
- Analyse and apply both qualitative and quantitative information to isolate issues and formulate best control methods.

COURSE CONTENT:

MODULE - I

Introduction: Definition of management, science or art, manager v/s entrepreneur, types of managers managerial roles and skills, evolution of management- scientific, human relations, system and contingency approaches, types of business organizations, sole proprietorship, partnership, company, public and private enterprises, organization culture and environment, current trends and issues in management.

MODULE - II

Planning: Nature and purpose of planning, types of planning, objectives, setting objectives, policies, strategic management, planning tools and techniques, decision making steps & processes.

MODULE - III

Organization: Nature and purpose of organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, recruitment selection, training & development, performance management, career planning and management.

MODULE - IV

Direction and leadership: Directing, individual and group behaviour, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

MODULE - V

Controlling: System and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

TEXT & REFERENCE BOOKS:

1. Management, S.P. Robins & M. Couiter, 10th Edition, 2009, Prentice Hall India.
2. Management, Jaf Stoner, R.E Freeman and D.R Gilbert, 6th Edition, 2004, Pearson Education.
3. Principles of Management, P.C Tripathy & P.N. Reddy, 1999, Tata McGraw Hill.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TOE23	Maintenance Management	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To develop the skill of maintenance functions in industry.
- To provide the concept of various types of maintenance system used in industries.
- To impart knowledge on reasons for failure and the corrective and preventive measure adopted to reduce them.
- To create the ability of data, analyze failure cause and reliability engineering.
- To develop the new techniques of maintenance for minimizing the cost of maintenance and improving of life of equipment's.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Understand and be able to explain the aim and basics of maintenance activity.
- Use various methods of maintenance and procedures applied to equipment's.
- Be aware of methods of detection for faults and errors in operations.
- Apply the tools and techniques of repairing, faults analysis.

COURSE CONTENT:

MODULE - I

Introduction: Fundamentals of maintenance engineering, maintenance engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. safety regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000.

MODULE - II

Maintenance management: Types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance and their comparison, advantages & disadvantages, limitations of computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department.

MODULE - III

Tribology in maintenance: Friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes.

Lubricants: Types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packing.

MODULE - IV

Machine health monitoring: Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, instrumentation & equipment used in machine health monitoring. instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.

TPM: Introduction, history, components, pillars of TPM, calculation of OEE, Terri technology.

MODULE - V

Reliability, availability & maintainability (RAM) analysis: Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non-repairable systems, improvement in reliability, reliability testing, reliability prediction, utilization factor, system reliability by Monte Carlo simulation technique, FMECA.

TEXT & REFERENCE BOOKS:

1. Maintenance Engineering Hand Book, Higgins.
2. Maintenance & Spare parts Management, Gopal Krishnan.
3. Industrial Maintenance Management, S.K. Shrivastava.
4. Industrial Engineering, Hand book of Condition Monitoring, C.N.R. Rao.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B. Tech. VII Sem.	IP07TMC02	Indian Constitution	3	-	-	-	-	-	-

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To help the students to understand and explain the fundamental rights.
- To describe the uses of directive principle.
- Importance of union executives.
- Describe the composition of legislative assembly, its powers and functions.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Understand the meaning and importance of constitution.
- Identify and explore the basic features and modalities about Indian constitution.
- Realize the state and central policies (union and state executive), fundamental rights & their duties.
- Analyze the salient (outstanding) features of Indian constitution.
- Recognize the importance and significance of preamble with respect to Indian constitution.

MODULE – I

Introduction: Constitution-meaning of the term, sources and constitutional theory, features, citizenship preamble.

MODULE – II

Fundamental rights and duties: Fundamental rights, fundamental duties, directive principles of state policy.

MODULE – III

Union government: Structure of Indian union: federalism, Centre-state relationship President: role. power and position, Prime minister and council of ministers, cabinet and central secretariat, Lok Sabha, Rajya Sabha.

MODULE – IV

State Government: Governor: role and position, chief minister and council of ministers, state secretariat.

MODULE -V

Relationship between Centre and States: Distribution of legislative powers, administrative relations, coordination between states.

TEXT BOOKS:

1. Constitution of India, V.N. Shukla
2. The Constitutional Law of India, J.N. Pandey
3. Indian Constitutional Law. M.P. Jain

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B. Tech. VII Sem.	IP07PPC08	CAD/CAM Lab	-	-	2	30	20	50	1

COURSE LEARNING OBJECTIVES:

- To provide students with the writing and reading principles of "Engineering Drawing", which is a graphical universal language used in technical world for describing the shape and size of an object via supplying orthographic views and/or solid models associated with all the necessary dimensions, associated tolerances and annotations created in a CADD environment.
- To understand 3D drafting and analysis software used for modelling and analysis.

COURSE OUTCOMES:

- Ability to perform both 2D and 3D drafting of component using CAD software.
- Create solid models of objects, objects in basic shapes, composite bodies, custom built machine parts, building modules etc.
- Draw the orthographic views of an object in CAD environment (particularly in Autodesk AutoCAD environment).
- Create the orthographic views of an object from the solid model (particularly in Autodesk Inventor environment).
- Dimension the views, show some annotations, provide the size tolerance of functional features, and general tolerances.
- Explain and interpret the dimensions and the associated tolerances, some annotations.
- Read the given orthographic views; i.e., visualize the 3- Dimensional model of the object shown to its orthographic views and create its CAD model.
- Create auxiliary views, revolved views, sectional views.
- Ability to construct assemblies from the concepts learnt using drafting software.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B. Tech. VII Sem.	IP07PSC02	Seminar on Summer Training	-	-	4	50	-	50	2

COURSE LEARNING OBJECTIVES:

- To provide comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.
- To enhance students' knowledge in one particular technology.
- To increase self-confidence of students and helps in finding their own proficiency.
- To cultivate student's leadership ability and responsibility to perform or execute the given task.
- To provide learners hands on practice within a real job situation.
- Enhance and supplement the knowledge and skills of the students.
- Develop the students in terms of ability, competence and interpersonal relationship.

COURSE OUTCOMES:

- Capability to acquire and apply fundamental principles of engineering.
- Become master in one's specialized technology.
- Become updated with all the latest changes in technological world.
- Develop a skill of a multi-skilled engineer with sound technical knowledge, management, leadership and entrepreneurship skills.
- Ability to identify, formulate and model problems and find engineering solution based on a systems approach.
- Capability and enthusiasm for self-improvement through continuous professional development and life-long learning.
- Awareness of the social, cultural, global and environmental responsibility as an engineer.

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2021-22
B. TECH FOURTH YEAR, VIII SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP08TPC16	Robotics and Robot Applications	3	1	-	30	70	100	4
2.	IP08THS04	Electives from Humanity Science-04	3	-	-	30	70	100	3
3.	IP08TOE03	Open Elective-03	3	-	-	30	70	100	3
4.	IP08TOE04	Open Elective-04	3	-	-	30	70	100	3
5.	IP08TMC03	Essence of Indian Traditional Knowledge	3	-	-	-	-	-	-
Total			**15**	**1**	**-**	**120**	**280**	**400**	**13**
PRACTICALS									
1.	IP08PPR02	Major Project	-	-	12	120	80	200	6
2.	IP08PPC01	Comprehensive Viva	-	-	-	-	50	50	2
Total			**-**	**-**	**12**	**120**	**130**	**250**	**8**

Total Credits: **21**

Total Contact Hour: **28**

Total Marks: **650**

INTERNAL ASSESSMENT: -two class tests of 15 marks each will be conducted.

L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP08THS04 Electives from Humanity Science-04
IP08THS41 Intellectual Property Rights
IP08THS42 Safety Management and Labour Law
IP08TOE03 Open Elective-03
IP08TOE31 Computer Aided Process Planning
IP08TOE32 Microprocessors in Automation
IP08TOE04 Open Elective-04
IP08TOE41 Supply Chain Management
IP08TOE42 Composite Materials Technology

IP08TOE43 Finite Element Method

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TPC16	Robotics and Robot Applications	3	1	-	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To define basic concept about robots, robotics and programming.
- To learn about coordinate frames, mapping and transforms plots.
- To understand kinematic modelling of the manipulators and their working.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Apply knowledge of robotics for understanding, formulating and solving engineering problems.
- Demonstrate creativeness in designing and development of robotics.
- Analyse the kinematic of industrial robot.
- Design control laws for a simple robot.
- Identify, analyse and design of robots useful to the society.

COURSE CONTENT:

MODULE -I

Introduction to robotics: Evolution of robots and robotics, progressive advancement in robots, definitions and classifications, laws of robotics, robot anatomy and related attributes, repeatability, accuracy and precision, human arm characteristics, robot specification and notations, concept of robots programming, the future prospects.

MODULE – II

Coordinate frames, mapping and transforms: Coordinate frames, spatial descriptions and transformations, fundamental of translation, rotations and transformations, inverting a homogeneous transform, fundamental rotation matrices, yaw pitch and roll, yaw pitch and roll transformation, equivalent angle.

MODULE – III

Symbolic modeling of robots, direct kinematic model: Mechanical structure and notations, description of links and joints, kinematic modeling of the manipulator, Denavit-Hartenberg (D- H) representation,

kinematic relationship between adjacent links, manipulator, transformation matrix, arm equations.

MODULE – IV

Robotic sensors and vision: The meaning of sensing, sensors in robotics, kinds of sensors used in robotics, robotic vision, industrial applications of vision-controlled robotic systems, process of imaging, architecture of robotic vision systems, image acquisition, description of other components of vision system, image representation, image processing, artificial intelligence (AI) in robotics.

MODULE – V

Robot controller & applications: Linear control of robot manipulation, feedback and close loop control, second-order linear systems, trajectory following control, modelling and control of single joint, architecture of industrial robotic controllers, artificial intelligence, industrial and non-industrial applications, robotic application for sustainable development & social issues.

TEXT & REFERENCE BOOKS:

1. Robotics & Control, R.K. Mittal & I.J. Nagrath, TMH Publications
2. Robotics for engineers, Yoram Korean, McGrew Hill Co.
3. Industrial Robotics Technology programming and Applications, M.P. Groover, M. Weiss.
4. Robotics Control Sensing, Vision and Intelligence - K.S. Fu, R.C. Gonzalex, C.S.G. Lee, McGrew Hill Book Co.
5. Kinematics and Synthesis of linkages, Hartenberg & Denavit, McGrew Hill Book Co.
6. Kinematics and Linkage Design, A.S. Hall, Prentice Hall.
7. Kinematics and Dynamics of Machinary, J. Hirchhorn, McGrew Hill Book Company.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech VIII Sem.	IP08THS41	Intellectual Property Rights	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Understand, define and differentiate various types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
- Understand the framework of strategic management of Intellectual Property (IP).
- Appreciate and appraise different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs.
- Explain how to derive value from IP and leverage its value in new product and service development.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Identify the different types of Intellectual properties (IPs), the right of ownership and scope of protection.
- Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
- Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
- Analyze ethical and professional issues which arise in the intellectual property right context.
- Apply intellectual property right principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual property rights.
- Demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under

intellectual property law as applicable to information, ideas, new products and product marketing.

COURSE CONTENT:

MODULE - I

Introduction to intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

MODULE - II

Trademarks: Purpose and function of trademarks, acquisition of trademarks rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

MODULE - III

Law of copyrights and law of patents: Fundamentals of copyrights law, originality of material, rights to reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright law, foundation of patent law, patent searching process, ownership rights and transfer.

MODULE - IV

Trade secrets and unfair competition: Trade secrets law, determination of trade secrets status, liability for misappropriations of trade secrets, protection for submission, trade secrets litigation, misappropriation of right of publicity and false advertising.

MODULE - V

New developments of intellectual property: New developments in trade law, copyright law, patent law, intellectual property audits international overview of intellectual property, international-trademark law, copyright law, international patent law, international development in trade secrets law.

TEXT & REFERENCE BOOKS:

1. Intellectual Property Right, Deborah. E. Bouchoux, 4th Edition, 2013, Cengage Learning.
2. Intellectual Property Right: Unleashing the Knowledge Economy, Prabuddha Ganguli, 3 rd Edition, 2005, Tata McGraw Hill Publishing Company Ltd.,

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08THS42	Safety Management & Labour Law	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand roles, responsibilities importance of health safety, and welfare in workplaces.
- To impart knowledge about material handling, air pollution control system, fire prevention and protection.
- To learn about safety audit, disaster control, safety principles.
- To understand the labour laws and various acts applicable to industries.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- To acquire the knowledge of substantive as well as procedural contents of safety management and labour laws.
- To develop an insight into the wages law, factory act etc.
- To gather an understanding of natures of accidents and its effects.
- To gather an understanding of natures of various types of hazards in industry.

COURSE CONTENT:

MODULE -I

Safety management: Concept's evolution of modern safety concept, safety policy, safety in organization, line and staff functions for safety, safety committee, budgeting for safety, techniques incident recall technique (IRT), disaster control, job safety analysis (JSA), safety survey, safety inspection, safety sampling, safety audit.

Safety in material handling: Ergonomic consideration in material handling, design, installation, operation and maintenance of conveying equipment, hoisting, traveling and slewing mechanisms.

MODULE -II

Design of air pollution control system: Industrial sources of air pollution, emission factors, regulations control strategies, policies, gaseous pollutant control: gas absorption in tray and packed towers, absorption with/without chemical reaction, removal of SO_2, absorption in fixed blades-breakthrough, removal of HCs/VOCs, NOx removal, wet scrubbers.

Integrated air pollution control systems: Pollution control in process industries, pollution control in process industries like cement, paper, petroleum, petroleum products, textile, tanneries, thermal power plants dying and pigment industries, eco-friendly energy.

MODULE –III

Safety in metal working machinery and wood working machines: General safety rules, principles, maintenance, inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes, saws, types, hazards.

MODULE -IV

Fire prevention and protection: Sources of ignition, fire triangle, principles of fire extinguishing, active and passive fire protection systems, various classes of fires, A, B, C, D, E, types of fire extinguishers, fire stoppers, hydrant pipes, hoses, monitors, fire watcher's layout of stand pipes, fire station, fire alarms and sirens, maintenance of fire trucks, foam generators, escape from fire rescue operations, fire drills, notice first aid for burns.

MODULE -V

Explosion protecting systems: Principles of explosion, detonation and blast waves, explosion, parameters, explosion protection, containment, flame arrestors, isolation, suppression, venting, explosion relief of large enclosure, explosion venting, inert gases, plant for generation of inert gas rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO_2) and halons-hazards in LPG, ammonia (NH_3), sulphur dioxide (SO_2), chlorine (Cl_2) etc.

TEXT & REFERENCE BOOKS:

1. Accident Prevention Manual for Industrial Operations, N.S.C. Chicago, 1982.
2. Industrial Accident Prevention, H.W Heinrich, 1980, McGraw-Hill Company, New York.
3. Hand Book of Fire Technology, R.S. Gupta, Orient Longman, 1977, Bombay.
4. Accident Prevention manual for industrial operations, N.S.C. Chicago, 1982.
5. Fire and explosion protection, Dinko Tuhtar.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TOE31	Computer Aided Process Planning (CAPP)	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this Course is to:

- Learn the fundamentals of computer aided process planning, group technology and applications.
- Study the simulation of machining processes, importance of design and manufacturing tolerances.
- Understand the role of optimal selection of machining parameters.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Generate the structure of automated process planning system and uses the principle of generative and retrieval CAPP systems for automation.
- Select the manufacturing sequence and explains the reduction of total set up cost for a particular sequence.
- Predict the effect of machining parameters on production rate, cost and surface quality and determines the manufacturing tolerances.
- Explain the generation of tool path and solve optimization models of machining processes.
- Create awareness about the implementation techniques for CAPP.

COURSE CONTENT:

MODULE -I

Introduction to CAPP: Information requirement for process planning system, role of process planning, advantages of conventional process planning over CAPP, structure of automated process planning system, feature recognition, methods.

MODULE – II

Generative CAPP system: Importance, principle of generative CAPP system, automation of logical decisions, knowledge-based systems, inference engine, implementation, benefits.

Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications.

MODULE – III

Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples.

MODULE – IV

Determination of machining parameters: Reasons for optimal selection of machining parameters, effect of parameters on production rate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

MODULE – V

Generation of tool path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods.

TEXT & REFERENCE BOOKS:

1. Automation, Production systems & Computer Integrated Manufacturing System, Mikell P. Groover, PHI Publication.
2. Computer Aided Engineering, David Bedworth, TMH Publishers
3. Computer Aided Design and Manufacturing, Sadhu Singh, Khanna Publisher.
4. Computer Aided Process Planning, H.P. Wang and J.K. Li, Elsevier Science and Technology Publishers, 1st edition, 1991.
5. Computer Aided Process Planning, Joseph Tulkoff, SME Publications.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TOE32	Microprocessors in Automation	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the fundamentals of PIC microcontroller.
- Understand the working of microcontroller systems and able to determine its hardware and software.
- Interface with real time systems.
- Understand the design application based on microprocessors systems.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Learn embedded system and its applications in industry.
- Recognise working of microcontroller architecture and programming model.
- Identify the concept of timer, interrupt, I/O port interfacing with microcontroller.
- Study the concept of interfacing with real time system.

COURSE CONTENT:

MODULE - I

Number Systems: Codes, digital electronics, logic gates, combinational circuits design, flip-flops, sequential logic circuits design, counters, shift registers.

Introduction to 8085 functional block diagram, registers, ALU, bus systems, timing and control signals.

MODULE - II

Machine cycles: Instruction cycle and timing states, instruction timing diagrams, memory interfacing.

MODULE - III

Assembly language programming: Addressing modes, instruction set, simple programs in 8085, concept of interrupt, need for interrupts, interrupt structure, multiple interrupt requests and their handling, programmable interrupt controller, interfacing peripherals, programmable peripheral interface (8255).

MODULE - IV

Interfacing analog to digital converter & digital to analog converter, multiplexed seven segments LED display systems, stepper motor control, data communication: serial data communication (8251),

programmable timers (8253), 8086/8088 microprocessor and its advanced features.

MODULE - V

Introduction to digital control: Sampling theorem, signal conversion and processing, Z-transform, digital filters, implementation of digital algorithm.

TEXT & REFERENCE BOOKS:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited.
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, Tata McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TOE41	Supply Chain Management	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand supply chain activities, process planning, decision phases, importance and management of supply chains.
- To examine various drivers of supply chain for acquiring effectual performance, ease distribution and acquisition of production resources & Inventories.
- To understand about uncertainty, risk management, distribution network, role of location, capacity and forecasting in SC.
- To adapt drivers of supply chain, related framework and to appraise supply chain performance, pricing and sourcing decisions.

COURSE OUTCOMES

At the end of the course, the student will be able to:

- Demonstrate basic understanding about competition, logistics network, capable factors for supply chain designs and supply chain strategies.
- Acquire knowledge about distribution network, e-business, forecasting, network design and time-series analysis.
- Decide technical understanding about demand, inventory, safety, pricing and information technology
- Manage and measure sourcing decisions in supply chain, product availability under capacity constraints, optimal levels of product, services and resources.

COURSE CONTENT:

MODULE - I

Building a strategic framework to analyze supply chains: Supply chain, its objective and the importance of supply chain decisions, decision phases in a supply chain, process view of a supply chain, examples of supply chains, supply chain performance, achieving strategic fit and scope, competitive and supply chain strategies, achieving strategic fit, expanding strategic scope, supply chain drivers and metrics, drivers of supply chain performance, framework for structuring drivers,

facilities, inventory, transportation, information, sourcing, pricing.

MODULE - II

Designing the supply chain network: Designing distribution networks and applications to e-business the role of distribution in the supply chain, factors influencing distribution network design, design options for a distribution network, e-business and the distribution network, distribution networks in practice.

Network design in the supply chain: The role of network design in the supply chain, factors influencing network design decisions framework for network design decisions, models for facility location and capacity allocation, role of IT in network design, making network design decisions in practice.

Network design in an uncertain environment: The impact of uncertainty on network design, discounted cash flow analysis, representations of uncertainty, evaluating network design decisions using decision trees, AM tires: evaluation of supply, chain design decisions under uncertainty, risk management and network design 175, making supply chain decisions under uncertainty in practice.

MODULE - III

Planning demand and supply in a supply chain: Demand forecasting in a supply chain**,** the role of forecasting in a supply chain, characteristics of forecasts, components of a forecast and forecasting methods, basic approach to demand forecasting, time-series forecasting methods, measures of forecast error, forecasting demand at Tahoe salt, role of IT in forecasting, risk management in forecasting, forecasting in practice.

Aggregate planning in a supply chain: Role of aggregate planning in a supply chain, the aggregate planning problem, aggregate planning strategies, aggregate planning using linear programming, aggregate planning in excel, role of IT in aggregate planning, implementing aggregate planning in practice.

Planning supply and demand in a supply chain: Managing predictable variability**,** responding to predictable variability in a supply chain, managing supply, managing demand, implementing solutions to predictable variability in practice.

MODULE - IV

Planning and managing inventories in a supply chain: Managing economies of scale in a supply chain, cycle inventory, the role of cycle inventory in a supply chain, economies of scale to exploit fixed costs, economies of scale to exploit quantity discounts, short-term discounting, trade promotions, managing multiechelon cycle inventory, estimating cycle inventory-related costs in practice.

Managing uncertainty in a supply chain: Safety inventory**,** the role of safety inventory in a supply

chain, determining appropriate level of safety inventory, impact of supply uncertainty on safety inventory, impact of aggregation on safety inventory, impact of replenishment policies on safety inventory, managing safety, inventory in a multiechelon supply chain, role of IT in inventory management, estimating and managing safety inventory in practice.

Determining the optimal level of product availability: The importance of the level of product availability, factors affecting optimal level of product availability. managerial levers to improve supply chain profitability, setting product availability for multiple products under capacity constraints, setting optimal levels of product, availability in practice.

MODULE - V

Designing and planning transportation networks: Transportation in a supply chain**,** the role of transportation in a supply chain, modes of transportation and their performance characteristics, transportation infrastructure and policies, design options for a transportation network trade-off in transportation design, tailored transportation, role of IT in transportation risk management in transportation, making transportation decisions in practice.

Managing cross-functional drivers in a supply chain: Sourcing decisions in a supply chain**,** the role of sourcing in a supply chain, in-house or outsource, third-party and fourth-party logistics providers, supplier scoring and assessment, supplier selection-auctions and negotiations contracts and supply chain performance, design collaboration, the procurement process, sourcing planning and analysis, role of IT in sourcing, risk management in sourcing, making sourcing decisions in practice.

TEXT & REFERENCE BOOKS:

1. Supply Chain Management, Janat Shah, 2010, Pearson Publications.
2. Supply Chain Management, Sunil Chopra & Mein del, Fourth Edition, 2010, PHI.
3. Supply Chain Management, A.S. Altekar, Second Edition, 2006, PHI.
4. Logistics Management, James Stock & Douglas Lambert, Edition, 2006, McGraw Hill International.
5. Supply Chain Management for Global Competitiveness, B.S. Sahay, 2000, McMillan Publication.
6. Emerging Trends in Supply Chain Management, B.S. Sahay 2000, McMillan Publication.
7. Logistics Management, Bowersox, 2004, TMH.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TOE42	Composite Materials Technology	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Analyze the basic concepts of composite materials and application of composite material in various engineering fields.
- Apply the requirements for production and application of composite materials.
- Explain students to various techniques used for composite manufacturing.
- Describe concepts of nano-materials, nano technology and use of nano materials.
- Analyze micro mechanical properties of lamina using various approaches.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Identify and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.
- Apply competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.
- Analyse the elastic properties and simulate the mechanical performance of composite laminates; and understand and predict the failure behaviour of fibre-reinforced composites.
- Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project.
- Critique and select literature and apply the knowledge gained from the course in the design and application of fibre-reinforced composites.

COURSE CONTENT:

MODULE – I

Introduction to composites: Definitions. typical reinforcements and matrices, properties of fiber composites: mechanical, weight, chemical resistance, etc., compared with standard materials, particular composites, quality assurance, outline of manufacturing methods, economic aspects, dependence of properties on manufacturing route, typical manufacturing defects, applications fiber strengthening, fiber flaws, critical length, critical volume fraction, natural composites (wood, bone,

etc.)

MODULE – II

Fiber manufacturing methods: Physical and chemical characteristics, mechanical and other properties of commonly used fibers: carbon, glass, aramid and other organics, ceramics, fiber coating to achieve compatibility with matrix, use of statistical methods to characterize fiber behavior. naturally-occurring (cellulose) fibers, whisker, typical properties, manufacturing methods.

MODULE – III

Manufacture of polymer matrix composites Principles of manufacturing processes (open and closed mould), including: hand and spray lay-up, press moulding, injection moulding, resin injection, RRIM, filament winding, pultrusion, centrifugal casting, autoclave, prepreg and other starting materials, etc., machine methods for manufacture of composites, cutting, drilling and other finishing operations.

MODULE – IV

Engineering properties stiffness and strength: Geometrical aspects, volume and weight fraction, unidirectional continuous fiber systems, stiffness and strength, discontinuous fibers, short fiber systems, length and orientation distributions, woven reinforcements hybrids, failure theories for unidirectional lamina, micro mechanics theories.

MODULE – V

Mechanical testing: Determination of stiffness and strengths of unidirectional composites, tension, compression, flexure and shear, typical standard methods, use of photo elastic, holographic and other methods of strain measurement.

Metal matrix systems: Metals and alloys, solidification processes, diffusion bonding, mechanical properties, boron fibre reinforced aluminium and titanium alloys, alumina fibre reinforced aluminium alloys, silicon carbide fibre reinforced aluminium alloy, particulate systems.

TEXT & REFERENCE BOOKS:

1. Introduction to Composite Materials Design, Ever J. Barbero, Taylor & Francis.
2. Mechanics of Composite Materials, Robert Jones, Second Edition 1999, Taylor & Francis.
3. Composites and Processing Methods, Venkatesan, Narosa Publications.
4. Composite Material Science and Engineering Krishan K. Chawla Springer Third Edition First Indian Reprint 2015
5. Fibre-Reinforced Composites, Materials, Manufacturing, and Design P.K. Mallick, CRC Press, Taylor & Francis Group Third Edition
6. Mechanics of Composite Materials & Structures, Madhijit Mukhopadhay Universities Press 2004

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TOE43	Finite Element Method	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Analyze the basic concept about principle of finite element method.
- Determine the coordinate system and shape function for various element.
- Learn plotting governing equations of linear and higher order.
- Define basic concept of matrix formulation.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Apply concept of shape functions for optimizing decision problem.
- Understand the concepts behind formulation methods in FEM.
- Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
- Develop element characteristic equation and generation of global equation.
- Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.
- Identify boundary conditions to solve dynamic problems under thermal aspects and related to torsion of non-circular shafts.

COURSE CONTENT:

MODULE -I

Basic concept of FEM: Historical background, basic concept and steps in fem, mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, one dimensional second order equation, discretization, linear and higher order elements, introduction of FEM software and steps.

Matrix displacement formulation: Matrix displacement equations, solution of matrix displacement

equations, techniques of saving computer memory requirements, finite element formulation.

MODULE -II

Natural coordinate systems and shape function: Basic concept of natural coordinate, 1-D & 2- D natural coordinate, concept of shape functions, convergence requirements, pascal triangle, shape function for linear and plain elements, shape functions using Lagrange polynomials, shape functions for serendipity family elements, degrading technique for nodes.

MODULE - III

Strain displacement matrix: Strain displacement matrix for linear and plain element, strain displacement matrix for beam, linear and plain elements.

Stiffness matrix: Concept of element stiffness matrix for linear and plain elements. stiffness matrix for bar & trusses, stiffness matrix for linear and plain elements, force vectors, body forces and thermal loads, plate and shell elements, finite representation of infinite bodies, element aspect ratio, quadrilateral and higher order element vs mesh refinement.

MODULE - IV

Assembling of stiffness matrix: Assembly of elemental matrices, boundary conditions and solution, direct approach, strain energy, Castigliano's first theorem, minimum potential energy, Galerkin's method, Galerkin's method applied to elasticity problems, weighted residual methods, variational formulation of boundary value problems, Ritz technique, isoparametric formulations.

MODULE - V

Finite element solutions: Numerical integration and application to plane stress problems, solid mechanics and heat transfer, longitudinal vibration and mode shapes, fourth order beam equation, transverse deflections and natural frequencies, bar, trusses & beams, plane stress and plane strain problems, use of higher order elements, solution of dynamic problems application to thermal problems, torsion of non-circular shafts.

TEXT & REFERENCE BOOKS:

1. The Finite Element Methods for Engineers, K.H. Huebner & E.A., Thorton, John Wiley & Sons.
2. Concepts and Applications of Finite Element Analysis, R.D. Cook, D.S. Malkus & M.E. Plesha, Third Edition, John Wiley & Sons.
3. Finite Element Method in Engineering, S.S. Rao, Butterworth Heinemann.
4. Finite Element Procedures, K.J. Bathe, Prentice Hall of India, New Delhi.
5. The Finite Element Methods, O.C. Zienewiccz & R.L Taylor, Vol.1 & Vol.2, McGraw Hill.
6. Finite element analysis, S.S. Bhavikatti, New Age Pub.
7. An Introduction to Finite Element Method, J.N., Reddy, Tata McGraw Hill.
8. Text Book of Finite Element Analysis, P. Seshu, Prentice Hall, New Delhi.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TMC03	Essence of Traditional Knowledge	3	-	-	-	-	-	-	-

COURSE LEARNING OBJECTIVES:

- The course aims at imparting basic principles of thought process, reasoning and inferencing. sustainability is at the core of Indian traditional knowledge systems connecting society and nature.
- Holistic life style of yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian knowledge system, Indian perspective of modern scientific world-view and basic principles of yoga and holistic health care system.

COURSE OUTCOMES:

- Ability to understand, connect up and explain basics of Indian traditional knowledge modern scientific perspective.

COURSE CONTENT:

- Basic structure of Indian knowledge system: अष्टादशविद्या -४वेद, ४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि) ६वेदांग (शिक्षा, कल्प, निरुक्त, ज्योतिष, छंद) ४उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र).
- Modern science and Indian knowledge system.
- Yoga and holistic health care.
- Case studies.

TEXT & REFERENCE BOOKS:

1. Cultural Heritage of India-course material, V. Sivaramakrishnan (Ed.), Bharatiya Vidya Bhavan, Mumbai 5th Edition, 2014.
2. Modern Physics and Vedant, Swami Jitatmanand, Bharatiya Vidya Bhavan.
3. Tao of Physics, Fritz of Capra.
4. Tarkasangraha of Annam Bhatta, V.N. Jha (Eng. Trans.), International Chinmay Foundation, Velliarnad, Arnakulam.
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Yoga-darshanam with Vyasa Bhashya, G.N. Jha (Eng. Trans.), Ed. R.N. Jha, Vidyanidhi Prakashan, Delhi 2016.