SYLLABI BOOK

BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING

Department of Mechanical Engineering

Faculty of Technology

Dharmsinh Desai University

Nadiad – 387 001, Gujarat, India.

TEACHING SCHEME FOR THE COURSE
B. TECH., MECHANICAL ENGINEERING
(Admission Year_2021)

SEMESTER I

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
BS102	MATHEMATICS -I	3	1	0	60	40	0	0	100	4.0
BS103	MECHANICS	3	0	2	60	40	0	0	100	4.0
ES111	THERMODYNAMICS	3	0	2	60	40	50	0	150	4.0
ES112	BASIC ELECTRICAL ENGG.	3	0	2	60	40	50	0	150	4.0
ES113	COMPUTER PROGRAMMING	2	0	3	40	0	0	50	90	3.5
ES114	WORKSHOP PRACTICE - I	0	0	2	0	0	50	0	50	1.0
SM101	ENVIRONMENTAL STUDIES	2	0	0	40	0	0	0	40	0.0
									680	20.5

SEMESTER II

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
BS203	MATHEMATICS-II	3	1	0	60	40	0	0	100	4.0
BS204	CHEMISTRY	3	0	0	60	0	0	0	60	3.0
ES203	ENGINEERING GRAPHICS	3	0	3	60	40	50	0	150	4.5
ES204	BASIC ELECTRONICS	3	0	2	60	40	50	0	150	4.0
ES205	MECHANICS OF SOLIDS	3	0	2	60	40	50	0	150	4.0
ES206	WORKSHOP PRACTICE - II	0	0	3	0	0	0	50	50	1.5
									660	21

SEMESTER III

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
BS308	NUMERICAL TECHNIQUES	3	0	2	60	40	25	25	150	4.0
ES301	ELECTRICAL MACHINES AND DRIVES	3	0	2	60	40	25	25	150	4.0
MH309	FLUID MECHANICS	3	0	2	60	40	25	25	150	4.0
MH310	KINEMATICS OF MACHINES	3	1	2	60	40	25	25	150	5.0
MH311	MATERIAL SCIENCE AND METALLURGY	3	0	2	60	40	25	25	150	4.0
HS302	ENGLISH	2	0	2	40	0	0	50	90	3.0
									840	24.0

SEMESTER IV

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
MH413	DYNAMICS OF MACHINES	3	1	2	60	40	25	25	150	5.0
MH414	ADVANCE SOLID MECHANICS	3	0	2	60	40	25	25	150	4.0
MH415	MANUFACTURING TECHNOLOGY - I	3	0	4	60	40	25	25	150	5.0
MH416	APPLIED THERMODYNAMICS	3	0	2	60	40	25	25	150	4.0
MH417	MACHINE DRAWING & INDUSTRIAL DRAFTING	0	0	4	0	0	25	25	50	2.0
MH418	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	1	0	2	0	0	0	100	100	2.0
HS401	UNIVERSAL HUMAN VALUES	3	0	0	60	0	0	0	60	3.0
									810	25.0

SEMESTER V

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MEASUREMENT AND METROLOGY	3	0	2	60	40	25	25	150	4.0
2	HEAT AND MASS TRANSFER	3	0	2	60	40	25	25	150	4.0
3	MANUFACTURING TECHNOLOGY - II	3	0	2	60	40	25	25	150	4.0
4	MACHINE DESIGN - I	3	1	2	60	40	25	25	150	5.0
5	OPEN ELECTIVE – I (RENEWABLE ENERGY)	3	0	0	60	0	0	0	60	3.0
6	INDUSTRIAL MANAGEMENT & ECONOMICS	2	0	0	40	0	0	0	40	2.0
7	MANDATORY COURSE - 2 (INNOVATION AND ENTREPRENEURSHIP)	2	0	0	40	0	0	0	40	0.0
									740	22.0

SEMESTER VI

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MACHINE DESIGN - II	3	1	2	60	40	25	25	150	5.0
2	FLUID MACHINES	3	0	2	60	40	25	25	150	4.0
3	COMPUTER-AIDED DESIGN & MANUFACTURING	3	0	2	60	40	25	25	150	4.0
4	PROFESSIONAL ELECTIVE – I REFRIGERATION & AIR-CONDITIONING MECHANICAL VIBRATIONS & NOISE PRODUCTION TECHNOLOGY AUTOMOBILE SYSTEMS	3	0	2	60	40	25	25	150	4.0
5	PROFESSIONAL ELECTIVE – II QUALITY ENGINEERING & RELIABILITY PRESSURE VESSELS & PIPING ADDITIVE MANUF. & REVERSE ENGG. SUPPLY CHAIN MANAGEMENT	3	0	0	60	40	25	25	150	3.0

			Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
6	OPEN ELECTIVE – II (INDUSTRIAL ENGINEERING)		3	0	0	60	0	0	0	60	3.0
7	SUMMER INTERNSHIP		0	0	4	0	0	0	50	50	2.0
										720	25.0

SEMESTER VII

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	FINITE ELEMENT METHODS	3	0	2	40	0	0	50	90	4.0
2	PROFESSIONAL ELECTIVE - III	3	0	2	60	40	25	25	150	4.0
3	PROFESSIONAL ELECTIVE - IV	3	0	2	60	40	25	25	150	4.0
4	OPEN ELECTIVE - III	3	0	0	60	0	0	0	60	3.0
5	OPERATION RESEARCH	3	0	2	60	40	25	25	150	4.0
6	EFFECTIVE TECHNICAL COMMUNICATION	3	0	0	60	0	0	0	60	3.0
7	SEMINAR	0	0	2	0	0	0	100	100	1.0
									760	23.0

SEMESTER VIII

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	PROFESSIONAL ELECTIVE - V	2	0	3	40	0	25	25	90	3.5
2	PROFESSIONAL ELECTIVE - VI	2	0	3	40	0	25	25	90	3.5
3	PROFESSIONAL ELECTIVE - VII	2	0	3	40	0	25	25	90	3.5
4	PROJECT	0	0	4	0	0	0	100	100	2.0
5	INDUSTRIAL TRAINING (8 Weeks)	0	3	12	0	0	150	100	250	9.0
									620	21.5

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: MATHEMATICS - I (BS102)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	1	0	4	4	60	40	0	0	100

DETAILED SYLLABUS

1   CALCULUS: INTEGRAL CALCULUS

Evolutes and involutes, Applications of definite integrals to evaluate surface areas and volumes of revolutions.

2   LINEAR ALGEBRA: MATRICES, VECTORS, DETERMINANTS, LINEAR SYSTEMS:

Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Rank of a matrix, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Inverse of a matrix, Eigen values, Eigenvectors, Symmetric, Skew-symmetric, Linear Independence of vectors, Diagonalization.

3   SEQUENCES AND SERIES:

Convergence of sequence and series, Introduction to tests for convergence; Power series, Series for exponential, Trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

4   MULTIVARIABLE CALCULUS (DIFFERENTIATION)

Partial derivatives, Total derivative; Tangent plane and normal line; Taylor series expansion for function of two variables, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers, Introduction to Vector Differential Calculus; Directional derivatives, Gradient, Curl and divergence.

LEARNING OUTCOMES:

The students will learn:
- To apply differential and integral calculus to notions of curvature and applications of definite integrals.
- Convergence, divergence, and analysis of sequences and infinite series.
- To develop functions as a Fourier series.
- The essential tools of matrices and linear algebra including linear transformations, eigen values, diagonalization.

TEXT/REFERENCE BOOKS:

1.   B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

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

3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

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

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

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

8. V. Krishnamurthy, V.P. Mainra and J. L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: THERMODYNAMICS (ES111)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50*	--	150

* TW marks include Viva based on TW

DETAILED SYLLABUS

1   INTRODUCTION:

Macroscopic versus microscopic view point, thermodynamic systems and control volume, thermodynamic properties, processes and cycles, homogeneous and heterogeneous systems, thermodynamic equilibrium, quasi-static process, pure substance, concept of continuum, temperature and zeroth law of thermodynamics, ideal gas and gas laws

2   ENERGY AND ENERGY TRANSFER:

Forms of energy, energy transfer by heat and work, mechanical forms of work, first law of thermodynamics, energy conversion efficiencies

3   PROPERTIES OF PURE SUBSTANCES:

Pure substance, phases and phase change process, thermodynamic properties, property diagrams, ideal gas equation of state, van der waal equation, virial equation of state

4   ENERGY ANALYSIS OF A CLOSED SYSTEM:

PdV work in various quasi-static processes, energy balance, specific heats, internal energy, enthalpy and specific heats of solids, liquids and ideal gases.

5   ENERGY ANALYSIS OF A OPEN SYSTEM:

Conservation of mass, flow work and energy of a flowing fluid, energy analysis of steady and unteady flow systems.

6   SECOND LAW OF THERMODYNAMICS:

Introduction to second law, thermal energy reservoir, heat engine, refrigerator and heat pump, Clausis and Kelvin-Plank statement, perpetual motion machines, reversible and irreversible processes, Carnot and reversed Carnot cycle, , entropy principle and isentropic process, Tds and Maxwell relation.

7   SEAM BOILERS:

Introduction, classification, mountings and accessories, classification and comparison of boiler draught systems.

8   APPLICATIONS OF THERMODYNAMICS:

Construction and working of pumps, compressors, IC engine- Otto and Diesel engines, vapour compression refrigeration system, vapour absorption refrigeration system.

TEXT/REFERENCE BOOKS:

1. Yunus A. Cengel, Michael A. Boles., "Thermodynamics- An engineering approach", Tata McGraw Hill publishing co. ltd.

2. Nag P.K., "Engineering Thermodynamics", Tata McGraw Hill publishing co. ltd.

3. Smith J.M., Van Ness H.C., Abbott M.M, "Introduction to chemical engineering thermodynamics", McGraw Hill publishing co. Ltd.

4. Sonntag. R.E., Borgnakke, C. and Van Wylen G.J.,"Fundamental of thermodynamics", John Wiley and Sons.

5. Moran M.J. and Shapiro H.N., "Fundamentals of engineering thermodynamics", John Wiley and Sons.

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: ELEMENTS OF ELECTRICAL ENGINEERING (ES112)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50*	--	150

* TW marks include Viva based on TW

DETAILED SYLLABUS

1   D.C. CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff 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.

2   A.C. CIRCUITS

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.

3   TRANSFORMERS

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

4   ELECTRICAL MACHINES

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.

5   ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthling. Elementary calculations for energy consumption, power factor improvement. DC-DC buck and boost converters. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

6   SEMICONDUCTORS, DIODES AND APPLICATIONS

Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and

Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) in brief.

TEXT/REFERENCE BOOKS:

1. R. Muthu Subramanian, S. Salivahanan, and K. A. Muraleedharan, Basic Electrical, Electronics and Computer Engineering, 2nd Edition, Tata McGraw Hill
2. V. K. Mehta & Rohit Mehta, Principles of Electronics, 11thEdition, S. Chand & Company
3. B. L. Theraja , A. K. Theraja, Electrical Technology (Vol: II), 23rdEdition, S. Chand & Company
4. D.P. Kothari and I. J. Nagrath, Basic Electrical Engineering, 3rd Edition, Tata McGraw Hill

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: MECHANICS (BS103)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50*	--	150

* TW marks include Viva based on TW

DETAILED SYLLABUS

1 STATICS

Resultant force for 2D and 3D force system, concept of free body diagrams, equilibrium equations for particles and rigid body subjected to 2D and 3D force system, centroid and center of gravity, moment of inertia, Friction

2 DYNAMICS AND VIBRATIONS

Rotational Transformation of scalers and vectors, Newton's Laws for particle motion, Potential Energy function F= - Grad V, conservative and non-conservative forces, Conservation of momentum, angular momentum, collision, energy equation, free harmonic motion, damped harmonic motion, forced oscillation and resonance, kinematics in a coordinate system rotating and translating in a plane.

TEXT/REFERENCE BOOKS:

1. Engineering Mechanics, M. K. Harbola, 2nd Edition, Cengage Learning, 2013.

2. Mechanics – J P Den Hartog, Dover Publications, 2003.

3. Mechanical Vibrations - J P Den Hartog, Dover Publications, 1985.

4. Theory of Vibrations with Applications – W. T. Thomson, 5th Edition, Pearson Education, 2008.

5. Engineering Mechanics: Statics (V.1), Dynamics (V.2), J. L. Meriam and L. G. Kraige, 5th edition, Wiley, 2017.

6. Engineering Mechanics: Statics & Dynamics, Irving H. Shames, 4th edition, Pearson Education, 2005.

7. Vector Mechanics for Engineers: Statics (V.1), Dynamics (V.2), F. P. Beer and E. R. Johnston, 10th SI edition, McGraw Hill Education, 2017

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: COMPUTER PROGRAMMING (ES113)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	40	0	50*	--	90

* TW marks include Viva based on TW

DETAILED SYLLABUS

1   INTRODUCTION:

Introduction to components of computer system, Idea of algorithm, Introduction to C, Constants, Variables & Data types in C, Managing input and Output operators.

2   OPERATORS AND EXPRESSIONS:

C Operators: Arithmetic, relational, logical, increment &decrement, assignment and conditional, Arithmetic Expressions & Precedence Rule, Type conversion in C, Mathematical Functions.

3   DECISION MAKING AND BRANCHING:

Decision making with If & If...else statements, goto statements.

4   DECISION MAKING AND LOOPING:

The while statement, the break statement & the do... while loop, the for loop, Jump within loops - Programs.

5   ARRAYS:

Array 1D, 2D, Character Array as String

6   USER DEFINED FUNCTIONS:

Categories of Functions (Including using built in library), Call by Value, Parameter passing to function, Recursion.

7   STRUCTURE:

Defining structure, Assigning value to the structure members, Array of structure

8   POINTER:

Idea of pointer, declaration and Initialization of pointer, passing address as function argument, passing array to function using pointer.

9   FILE HANDLING

(only if time is available, otherwise should be done as part of the lab)

TEXT/REFERENCE BOOKS:

1.   E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

2.   Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

3.   Yashvant Kanetkar, Let Us C, 12th Edition, BPB Publication.

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

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: ENVIRONMENTAL STUDIES (SM101)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
2	0	0	2	0	50	0	0	0	50

DETAILED SYLLABUS:

1 **THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES**

Definition, scope and importance & Need for public awareness

2 **NATURAL RESOURCES**

Renewable and non-renewable resource: Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, and their effects on forests and tribal people, Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefit and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Role of an individual in conservation of natural resources. Equitable use of resources of sustainable lifestyles

3 **ECOSYSTEMS**

Concept of an ecosystem, Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

4 **BIODIVERSITY AND ITS CONSERVATION**

Introduction definition: Genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

5 **ENVIRONMENTAL POLLUTION**

Definition, Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards Solid waste management, causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

6   **SOCIAL ISSUES AND THE ENVIRONMENT**

From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management**,** Resettlement and rehabilitation of people: its problems and concerns. Case studies**,** Environmental ethics: Issues and possible solutions**,** Climate change: Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland reclamation, Consumerism and waste products, Environment Protection Act: Air (Prevention and Control of Pollution) Act, Water (Prevention &Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation**,** Public awareness

7   **HUMAN POPULATION AND THE ENVIRONMENT**
(Population growth, variation among nations, population explosion, Family Welfare Program, environment and human health, human rights, Value education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environmental and human health, Case studies.

8   **FIELD WORK**

Visit to a local area to document environmental assets (river/forest/grassland/hill/mountain) Visit to a local polluted site - Urban/Rural/Industrial/Agricultural, Study of common plants, insects, birds, Study of simple ecosystems – pond, river, hill, slopes etc.

TEXT BOOKS/ REFERENCE BOOKS

1.   Erach Bharucha Textbook of Environmental Studies; Second Edition, Universities Press: Hyderabad, 2013.

2.   Poonia, M. P.; Sharma, S. C. Environmental studies; Khanna Publishing House: New Delhi, 2017.

3.   Rajagopalan, R. Environmental Studies; Oxford University Press: India, 2015.

4.   Varandani, N. S. Basics of Environmental studies; Lambert Academic Publishing: Germany, 2013.

5.   Basak, A. Environmental Studies; Dorling Kindersley: India, 2009.

6.   Dhameja, S. K. Environmental studies; S. K. Kataria and Sons: New Delhi, 2007.

7.   Rao, C. S. Environmental Pollution Control Engineering; Wiley publishers: New Delhi, 2006.

8.   Brunner, R. C. Hazardous Waste Incineration; McGraw Hill: Michigan, 1989.

9.   Clark, R. S. Marine Pollution; Clanderson Press Oxford: Bath, 2001.

10. Trivedy, R. K. Handbook of Environmental Laws, Acts, Guidelines, Compliances & standards; B. S. publications: Hyderabad, 2005.

11. Jadhav, H.; Bhosale, V. M. Environmental Protection and Laws; Himalaya Pub. House: Delhi, 1995.

12. Agarwal, K. C. Environmental Biology; Nidi Publ.: Bikaner, 2001.

13. Bharucha, E. The Biodiversity of India; Mapin Publishing: Ahmedabad, India, 2002.

14. Cunningham, W.P.; Cooper; Gorhani, T. H. E.; Hepworth, M.T., Environmental Encyclopedia; Jaico Publ. House: Mumbai, 2001.

15. De, A. K. Environmental Chemistry; Wiley Eastern: New Delhi, 2006.

16. Gleick, H. P. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security; Stockholm Env. Institute Oxford Univ. Press: New York, 1993.

17. Hawkins, R.E., Encyclopedia of Indian Natural History; Bombay Natural History Society: Bombay, 1987.

18. Heywood, V. H.; Waston, R. T. Global Biodiversity Assessment; Cambridge Univ. Press: Cambridge, 1995.

19. Mckinney, M.L.; School, R.M. Environmental Science systems & Solutions; Web enhanced edition: USA, 1996.

20. Miller, T.G. Jr.; Spoolman, S. E. Environmental Science; Cengage learning: Wadsworth, 2014.

21. Odum, E.P. Fundamentals of Ecology; W.B. Saunders: USA, 1971.

22. Rao, M. N.; Datta, A.K. Waste Water treatment; Oxford & IBH Publ.: New Delhi, 1987.

23. Sharma, B. K., Environmental Chemistry; Goel Publ. House: Meerut, 2001.

24. Townsend, C., Harper, J.; Michael, B. Essentials of Ecology; Blackwell: Oxford, 2008.

25. Trivedi, R. K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II; B. S. Publications, Hyderabad, 2010.

26. Trivedi, R. K.; Goel, P. K. Introduction to air pollution; ABD Publishers: Jaipur, 2003.

27. Wanger, K. D., Environmental Management; W.B. Saunders Co. Philadelphia, USA, 1998

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: WORKSHOP PRACTISE - I (ES114)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
0	0	0	2	1	0	0	50*	0	50

LABORTORY WORKS/SCHEDULE:

Lab	Workshop-I
1	Introduction to Workshop, Basic Workshop types
2	Safety requirement in workshop, Safety rules
3	To Understand "5S" Concept for Workplace
4	Demonstration of Tin smithy Tools and it's exercise
5	To make job for Tin smithy shop
6	Demonstration of Plumbing tools, It's accessories.
7	To make job for Plumbing shop
8	Introduction to Fabrication shop, Welding Equipment
9	To make job for Fabrication shop
10	Introduction of Machine shop
11	Introduction and Demonstration of Lathe machine.
12	Introduction and Demonstration of Milling and Radial Drilling m/c

TEXT/ REFERENCE BOOKS

1. Work shop technology, A. K. Hajrachaudhari & S. K. Hajrachaudhari
2. ITB Hand book, Engineering industry training board
3. Work shop Technology Vol. I & II, Gupta & Kaushik

B. TECH. SEMESTER – II (CH/CL/IC/MH)
SUBJECT: MATHEMATICS – II (BS203)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	1	0	4	4	60	40	0	0	100

DETAILED SYLLABUS

1   SERIES SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS BY POWER SERIES METHOD:

Introduction, Validity of series solution of the equation, General Method, Forms of series solution.

2   PARTIAL DIFFERENTIAL EQUATIONS:

Basic Concepts, Classification and Solutions of partial differential equations: Lagrange's linear equation of first order, Non-linear equations of first order-Charpit's method, Homogenous linear equations with constant coefficient to find the complementary functions and the particular integral, Introduction to non-homogenous linear equations with constant coefficients, Method of separation of variables.

3   MULTIVARIABLE CALCULUS (INTEGRATION

Multiple Integration: Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Introduction to Triple integrals (Cartesian), Vector line integrals, Vector surface integrals, Theorems of Green, Gauss and Stoke's.

4   LAPLACE TRANSFORM:

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, Evaluation of integrals by Laplace transform, Solving ODE by Laplace Transform method.

TEXT/REFERENCE BOOKS:

1.   B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

2.   G. B. Thomas and R. L. Finney, Calculus and Analytic geometry,9thEdition, Pearson, Reprint,2002.

3.   Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4.   W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India,2009.

5. S. L. Ross, Differential Equations, 3rd Ed., Wiley India,1984.

6. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.

7. E. L. Ince, Ordinary Differential Equations, Dover Publications,1958.

8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill,2004.

9. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2008.

B. TECH. SEMESTER – II (CH/CL/IC/MH)
SUBJECT: ENGINEERING GRAPHICS (ES203)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	3	6	4.5	60	40	50	0	150

Reference Code ESC102
* TW marks include Viva based on TW

DETAILED SYLLABUS

1 INTRODUCTION TO ENGINEERING DRAWING

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic section curves (Ellipse, Parabola, Hyperbola), Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid), Involutes; Archimedean Spiral

2 SOLID GEOMETRY

Projection of points, projection of lines and their applications. Projection of regular planes such as square, rectangle, triangle, circle, pentagon, hexagon, rhombus. Projection of right and regular solids inclined to both the planes (prisms, pyramids, cylinder and cone)

3 ORTHOGRAPHIC PROJECTIONS

First angle and third angle projection methods, conversion of pictorial views into Orthographic projections with dimensioning, sectional orthographic projection, special sections

4 SECTION OF SOLIDS AND DEVELOPMENT OF SOLIDS

Sections and Sectional Views of Right Angular Solids Covering, Prism, Cylinder, Pyramid, Cone

5 DEVELOPMENT OF SURFACES

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

6 ISOMETRIC PROJECTIONS

Principles of Isometric projection – Isometric Scale, Isometric projection and view, Conversion of orthographic views to isometric projections and views

7 WORKING ENVIRONMENT OF CAD SOFTWARE

Menu bar, Quick access toolbar, Dashboard/Ribbon, Toolbars, drawing space, Navigation bar (View controls: zoom, pan, orbit,), Command prompt, Status bar, Drawing Area (Background, Crosshairs, Coordinate System), Shortcut Menu, Properties manager.

8   DRAWING CUSTOMIZATION

Setting up the drawing sheet (drawing sheet templates, drawing limits, drawing units etc.), Coordinate system (User coordinate system, Absolute and relative coordinates, Cartesian and Polar coordinates), Modes of drawing (Grid, Snap, Ortho, Osnap, Otrack, Polar tracking, Iso draft, etc.) Formatting (colours, line type, line weight, point style etc.).

9   PREPARING COMPUTER AIDED DRAWING

Exploring various commands with exercises of Orthographic drawing views and Isometric drawing views using different drawing tools, modifying tools, dimensioning tools etc.

10   PLOTTING AND EXCHANGING DRAWING

Printing/Plotting the drawing (page setup, plot area, plot scale, drawing orientation, plot options etc.), Drawing standard (DXF), Generating PDF drawing documents, file management.

TEXT/REFERENCE BOOKS:

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

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

3.   Shah P. J., (2014) Engineering Graphics, S. Chand Publishing

4.   Luzadder W., Duff J., (1992), Fundamentals of Engineering Drawing, Peachpit Press

5.   Gill P. S., (2009), Engineering Drawing, S. K. Kataria & Sons

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

B. TECH. SEMESTER – II (CH/CL/IC/MH)
SUBJECT: BASIC ELECTRONICS (ES204)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50	0	150

* TW marks include Viva based on TW

DETAILED SYLLABUS

1   TRANSISTOR & CHARACTERISTICS

Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration

2   FIELD EFFECT TRANSISTOR (FET)

Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits

3   TRANSISTOR AMPLIFIERS AND OSCILLATORS

 Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift

4   OPERATIONAL AMPLIFIERS AND APPLICATIONS

Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, and inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator, wein bride oscillator.

5   DIGITAL ELECTRONICS FUNDAMENTALS

Difference between analogy and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification, Logic ICs, Implementation of combinational logic - half and full adder/subtractor, multiplexers, de-multiplexers.

6   SENSORS & SIGNAL CONDITIONING CIRCUITS

Types of sensors – pneumatic, electromagnetic, electronic, smart sensors. Diaphragm, bellows and bourdon tube, Resistive, Capacitive, Inductive, ultrasonic, LVDT, piezoelectric, optoelectronic transducers, thermocouple, RTD and thermistors, Application of sensors for flow, level, temperature and stress measurement, Bridge Circuit, Differential Amplifier, Instrumentation Amplifier

TEXT/REFERENCE BOOKS:

1. Principles of Electronics, 11thEdition By: V. K. Mehta & Rohit Mehta Publisher: S. Chand & Company

2. Electrical & Electronic Measurement & Measuring Instruments, 17th Edition By: A.K. Sawhney Publisher: Dhanpat rai

3. M. M. Mano, "Digital logic and Computer design", Publisher : Pearson Education India.

B. TECH. SEMESTER – II (CH/CL/IC/MH)
SUBJECT: MECHANICS OF SOLIDS (ES205)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50	0	150

DETAILED SYLLABUS

1 Concept of stress and strain, elasticity, generalized Hooke's law for 3D, concept of isotropy and homogeneity, plane stress and plane strain idealization, axial, volumetric and thermal stresses and strains

2 Transformation of stress and strain at a point, Principal stresses and strains, Mohr's Circle, strain rossete

3 Mechanical properties of metals – elasticity, plasticity, strain hardening, hardness, toughness, fatigue, strain energy

4 Force-strain-deformation analysis for axial load, flexure, shear and torsion

TEXT/REFERENCE BOOKS:

1. Strength of Materials: Part– I and II, Stephen Timoshenko, 3rd Edition, CBS Publisher, 2002.

2. Strength of Materials, Sadhu Singh, 1st Edition, Khanna Book Publishing Company, 2016.

3. Advanced Mechanics of Solid, L. S. Srinath, 3rd Edition, McGraw Hill Publication, 2017.

4. Engineering Mechanics of Solids, E P Popov, 2nd Edition, Prentice Hall India Learning Pvt. Ltd, 2002.

B. TECH. SEMESTER – II (CH/CL/IC/MH)
SUBJECT: CHEMISTRY (BS204)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	0	3	3	100	0	0	0	100

DETAILED SYLLABUS:

1   ATOMIC AND MOLECULAR STRUCTURE

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

2   SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

3   INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

4   USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

5   PERIODIC PROPERTIES

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

6   STEREOCHEMISTRY

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers,

diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

7   ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecules.

TEXT/REFERENCE BOOKS

1.   University chemistry, by B. H. Mahan

2.   Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

3.   Fundamentals of Molecular Spectroscopy, by C. N. Banwell

4.   Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

5.   Physical Chemistry, by P. W. Atkins (vi)Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

B. TECH. SEMESTER – II (CH/CL/IC/MH)
SUBJECT: WORKSHOP PRACTISE – II (ES206)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
0	0	3	3	1.5	0	0	50*	0	150

LABORTORY WORKS/SCHEDULE:

Lab	Workshop-II
1	Introduction to Carpentry Shop, application of various carpentry tools
2	Demonstration of Carpentry Job 1 & 2
3	To make Job 1 for Carpentry shop
4	To make Job 2 for Carpentry shop
5	Introduction to Black smithy shop and Demonstration of it's job
6	To make Job for Black smithy shop
7	Introduction to Fitting shop, to understand application of various tools of this shop
8	Demonstration of Fitting Job
9	To make job for Fitting shop
10	To make job for Fitting shop
11	Assignment for Carpentry shop
12	Assignment for Fitting shop

TEXT/ REFERENCE BOOKS

1. Work shop technology, A. K. Hajrachaudhari & S. K. Hajrachaudhari
2. ITB Hand book, Engineering industry training board
3. Work shop Technology Vol. I & II, Gupta & Kaushik

B. TECH. SEMESTER – III
SUBJECT: NUMERICAL TECHNIQUES (BS308)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

DETAILED SYLLABUS:

1   ERROR ANALYSIS

Significant figures, accuracy and precision, error definitions, round-off errors, truncation errors, Taylor series, total numerical error, blunders, formulation errors, and data uncertainty

2   ROOTS OF EQUATIONS

Introduction, bracketing methods: bisection method and false-position method, open methods: Newton-Raphson method, Secant and Modified Secant method, roots of polynomials

3   ALGEBRAIC EQUATIONS

Introduction, numerical solutions of linear algebraic equations: Cramer's rule, Gauss elimination method, numerical solution of nonlinear equations: Gauss-Jordan method, LU decomposition, special matrices: tridiagonal matrices analysis, Cholesky decomposition, Iterative methods: Gauss-Seidel method and Jacobi's method

4   CURVE FITTING AND INTERPOLATION

Introduction, least square regression: linear regression, polynomial regression
Introduction, Newton's forward and backward difference interpolation, Lagrange interpolation, inverse interpolation, spline interpolation

5   NUMERICAL DIFFERENTIATION AND INTEGRATION

Introduction, high accuracy differentiation formulas: forward, backward and central difference method, Richardson extrapolation, Newton-Cotes integration formulas: trapezoidal and Simpson's rule.

6   NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS

Introduction, initial value problems: Euler's method, Heun's method, fourth order Runge-Kutta method, multistep methods: Milne's method and Adam's method
Elliptic equations: Laplace difference equation, Liebmann's iterative method, boundary conditions, parabolic equations: implicit method, explicit method, the Crank Nicolson method

TEXT/REFERENCE BOOKS

1. Numerical Methods for Engineers, Steven C. Chapra, Raymond P. Canale, Tata McGraw Hill
2. Numerical Methods, E Balagurusamy, Tata McGraw Hill
3. Applied Numerical Analysis, Curtis F. Gerald, Patrick O. Wheatley, Addison Wesley, Pearson
4. Numerical Methods in Engineering and Science, Grewal. B.S. and Grewal. J.S., Khanna Publishers, New Delhi
5. Applied Numerical Methods Using MATLAB, W.Y. Yang, W. Cao, T.S. Chung and J. Morris, Wiley India Edition
6. Numerical Methods for Engineers, S. K. Gupta, New Age International Publishers

B. TECH. SEMESTER – III
SUBJECT: ELECTRICAL MACHINES AND DRIVES (ES301)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

DETAILED SYLLABUS:

1   TRANSFORMERS & ITS SWITCHGEARS

General aspects, basic definition, working principle of transformer, types of transformers, transformer construction: core/shell/spiral transformers, transformers on no load & on load, vector diagrams, equivalent circuit, losses and condition for maximum efficiency, all day efficiency, Sumpner's test, conditions for parallel operation, introduction to 3-phase transformer, construction, instrument transformers, Relay, circuit breaker and isolator, fuses

2   ALTERNATOR

Introduction, constructional details, types, armature winding, EMF equation, factor affecting size of alternator, alternator operation on load, voltage regulation, losses and efficiency, parallel operation of alternators, armature reaction, damper winding

3   DC GENERATOR

Classification, working principle of generator, construction of DC Machines, types of DC generator, open circuit characteristic, external characteristic and internal characteristic of DC generator, efficiency and power stages with example, condition for maximum efficiency

4   DC MOTORS

Construction, types, principle of operation, torque equation, losses and efficiency, speed torque characteristics of shunt, series and compound motor, D.C. shunt motor 3–point starter, speed control of D.C. shunt and series motors, Stepper motor, Single line diagrams of DC motors

5   SINGLE PHASE, THREE-PHASE INDUCTION MOTOR & ITS SWITCHGEARS

Construction, principle of operation, production of magnetic field, comparison between three phase and single-phase induction motors, speed and slip, rotor current, relation between rotor copper loss and rotor input, torque of an induction motor, torque slip curve, losses and efficiency, starters for three phase induction motor, speed control of three phase induction motor, single line diagram of induction motor

6   INTRODUCTION TO DRIVES

Introduction to Thyristor, Insulated Gate Bipolar transistors (IGBTs), Power MOSFET, general configuration of a motor drive, matching power electronic converter and motor, thyristor controlled single phase and three phase converter drive, modes of operation, block diagram and DC drive examples

TEXT/REFERENCE BOOKS

1. Power systems, V. K. Mehta, S. Chand publication
2. Principles of power systems, V.K. Mehta, S. Chand publication
3. Electrical Technology- Vol. II, B. L. Theraja, S. Chand publication
4. A course in power systems, J. B. Gupta, S. K. Kataria Publication
5. Electrical power systems, S. L. Upal, Khanna Publishers
6. A course in Electrical Power, P. V. Gupta, M. L. Soni, U. S. Bhatnagar, Dhanpat Rai & Co.
7. Theory & Performance of Electrical Machines, J. B. Gupta, Katson books
8. Power Electronics, P.S. Bimbhra, Khanna Publishers

B. TECH. SEMESTER – III
SUBJECT: FLUID MECHANICS (MH309)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

Reference Code ME203A

DETAILED SYLLABUS:

1 FLUID PROPERTIES AND PRESSURE MEASUREMENT

Properties of fluid: Mass Density, specific weight, specific gravity and specific volume, Types of fluid, Newton's law of viscosity, continuum concept of a fluid, viscosity, surface tension and capillarity, vapor pressure, cavitation, compressibility, Pressure, Pascal's law, hydrostatic law, hydrostatic paradox, absolute and gauge pressures, measurement of pressure, manometers: simple and differential manometers

2 FLUID STATICS

Total pressure force and center of pressure, hydrostatic force on submerged surfaces -horizontal, inclined, vertical and curved surfaces, buoyancy, stability of floating body and submerged body, metacenter, analytical method to determine meta-centric height

3 FLUID KINEMATICS

Langrangian approach and Eulerian approach, types of flow, streamline, stream tube, path line and streak line, continuity equation, continuity equation in differential form for cartesian coordinate system, local and convective acceleration, translation, rotation and deformation of fluid element, rotation and vorticity, stream function and velocity potential function, stream lines and equipotential lines, relation between stream function and velocity potential, flow nets

4 FLUID DYNAMICS

Newton's Laws of Motion, Euler's Equation, Bernoulli's Equation, venturimeter, orifice meter and pitot tube, impulse-momentum equation and its application, moment of momentum equation, vortex flow, forced and free vortex flow, equation of motion for vortex flow, equation of forced and free vortex flow, dimensionless parameters and their significance, Dimensional analysis.

5 VISCOUS FLOW

Concepts of laminar and turbulent flows, Reynolds number and Reynold's experiment, exact solution of Navier -Stokes equation for simple flows, relation between shear stress and pressure gradient, concept of developing and fully developed flow, Flow of viscous fluid in circular pipes - Hagen-Poiseuille law, laminar flow between parallel plates for moving and stationary plates

6   FLOW THROUGH PIPES

Loss of energy in pipes, friction factor, Moody's Chart, Darcy Weisbach Equation, major and minor losses in pipes, hydraulic gradient lines and total energy line, pipes connected in series and parallel, equivalent pipe, branched pipes, flow through orifices and mouthpieces

TEXT / REFERENCE BOOKS

1. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Prakashan
2. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S. K. Kataria & Sons
3. Fluid Mechanics, Yunus A. Cengel, McGraw Hill Publication
4. Fluids Mechanics, F.M. White, McGraw-Hill Inc
5. Fluid Mechanics and Hydraulic Machines, Sukumar Pati, McGraw-Hill Inc
6. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som., G. Biswas, Tata McGraw Hill Co. Pvt. Ltd

B. TECH. SEMESTER – III
SUBJECT: MATERIAL SCIENCE AND METALLURGY (MH311)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

DETAILED SYLLABUS:

1   STRUCTURE OF MATERIALS

Crystalline structure of solids, crystalline materials vs amorphous materials, concept of unit cell and space lattice, lattice parameters, Miller indices, crystal structure of ferrous and non-ferrous metals, crystal imperfections, atomic packing factors for various cubic systems, Bragg's law

2   MECHANICAL PROPERTY AND MEASUREMENTS

Tensile, compression and torsion test, Young's modulus, relations between true and engineering stress-strain curves, generalized Hook's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery, Hardness: Rockwell, Brinell and Vickers and their relation to strength

3   PHASE DIAGRAM AND IRON-CARBON EQUILIBRIUM DIAGRAM

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

4   STEELS AND HEAT TREATMENTS

Introduction and purpose of heat treatments, classification of heat treatment processes, annealing, tempering, normalising and spheroidising, isothermal transformation diagram for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructure and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening. Property variation with microstructure, classification and application of steels, transformation product of austenite, TTT and CCT curves, critical cooling rate. Introduction and applications of various case hardening and surface hardening treatments

5   FERROUS-NON-FERROUS ALLOYS, COMPOSITES & OTHER NON-METALS

Classification of steels, alloying of steels, properties of various stainless steels and tool steels, designation of steels. Cast irons; grey, white, malleable and spheroidal cast irons. Copper and copper alloys, brasses, equivalent zinc in brasses, season cracking of brasses, aluminium bronzes, tin bronzes, beryllium bronzes, silicon bronzes, copper nickel alloys, aluminium and aluminium alloys, nickel and nickel alloys, bearing materials, Ceramic materials, polymers, composites, particles-

reinforced composites, fiber reinforced composites, Material standards and its equivalency (ISO, ASTM, DIN, JIS).

6 NON-DESTRUCTIVE TESTING

Introduction to non-destructive testing, radiography testing, dye penetration testing, magnetic particle testing, ultrasonic testing, Jominy end quench test, macro-examination, spark test, macro-etching, microscopic examinations, electron microscopy, magnetic testing, chemical analysis of steel and iron, NDT certification and its applicability to industry.

TEXT / REFERENCE BOOKS

1. Material Science & Engineering, V. Raghvan, PHI Learning Pvt Ltd.
2. Introduction to Physical Metallurgy, Sidney H Avner, Tata Mcgraw-Hill
3. Material Science and Engineering, W. Callister, Willey Publication
4. The science and engineering of Materials, Donald Askland and Pradeep Phule, Wadsworth Publishing.
5. Material Science and Metallurgy for Engineers, V.D. Kodgire, Everest Publishing House
6. Elements of Material Science and Engineering, Lawrence Vlack, PEARSON
7. Physical Metallurgy for Engineers, Donald S Clark & Wilbur R Varney, East-west press pvt Ltd.

B. TECH. SEMESTER – III
SUBJECT: KINEMATICS OF MACHINES (MH310)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	1	2	7	5	60	40	25	25	150

DETAILED SYLLABUS:

1   MECHANISM AND MACHINES

Terminology and definitions, mechanism & machines. rigid and resistance body, link, kinematic pair types of motion, degrees of freedom, classification of Kinematic pairs, kinematic chain, linkage, kinematic inversions of single and double slider crank chain, four bar chain mechanism with lower pairs, straight line mechanism and approximate straight-line mechanism, quick return mechanisms, Steering gear mechanisms

2   VELOCITY ANALYSIS

Vectors, displacement of a rigid body, relative displacement, definition of velocity, angular velocity, rotation of a rigid body, translation and rotation of a rigid body, relative velocity method, instantaneous axes of motion, properties of instantaneous centers, the Aronhold Kennedy theorem of three centers, velocity analysis by instantaneous centers.

3   ACCELERATION ANALYSIS

Definition of acceleration, angular acceleration, a general case of acceleration, radial and transverse components of acceleration, the Coriolis component of acceleration, examples of Acceleration analysis, acceleration diagrams

4   BELTS, ROPES & CHAIN DRIVES

Introduction, belt and rope drives, open and crossed belt drives, velocity ratio, slip, materials for belt and ropes, law of belting, length of belt, ratio of friction tensions, power transmitted, centrifugal effect on belts, maximum power transmitted by a belt, initial tension, creep, chain drive-chain length, angular speed ratio, classification of chains

5   GEARS & GEAR TRAINS

Introduction, classification of gears, gear terminology, law of gearing, velocity of sliding, forms of teeth, cycloidal profile teeth, involute profile teeth, comparison of cycloidal and involute tooth forms, birth of contact, arc of contact, number of pairs of teeth in contact, interference in involute gears, minimum number of teeth, interference between rack and pinion, undercutting, introduction to helical, spiral, worm and bevel gears

6   CAMS

Introduction, types of cams, types of followers, cam terminology, displacement diagrams, motions of the follower, graphical construction of cam profile

TEXT / REFERENCE BOOKS

1. Theory of Machines, S. S. Rattan, Tata McGraw-Hill Publishing Co. Ltd New Delhi
2. Theory of Machines, P. L. Ballaney, Khanna Publishers, New Delhi
3. Theory of Machines and Mechanisms, Joseph Shigley and John Uicker, Jr., McGraw Hill
4. Theory of Mechanisms & Machines, Amitabha Ghosh & Ashok Mallik, Affiliated East-West Press Pvt. Ltd
5. Theory of Machines, Thomas Bevan, CBS publishers and distributors
6. Theory of Machines, Sadhu Singh, Pearson Education
7. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age International Publisher
8. Kinematics & Dynamics of Machinery, Charles Wilson & J. Peter Sadler, Pearson Education

B. TECH. SEMESTER – III
SUBJECT: ENGLISH (HS302)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
2	0	2	4	3	40	0	50*	0	90

DETAILED SYLLABUS:

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

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

TEXT / REFERENCE BOOKS

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

B. TECH. SEMESTER – IV
SUBJECT: APPLIED THERMODYNAMICS (MH416)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

DETAILED SYLLABUS:

1   EXERGY: WORK POTENTIAL OF ENERGY

Overview of laws of thermodynamics, exergy associated with kinetic and potential energy, reversible work and irreversibility, second law efficiency

THERMODYNAMIC RELATIONS

Maxwell relations, Clapeyron equation, Clausius-Clapeyron equation

2   GAS POWER CYCLE

Basic considerations in the analysis of power cycles, air-standard cycles: assumptions, Otto cycle, diesel cycle, dual cycle and their comparison, simple Brayton cycle and its modification-intercooling, reheating and regeneration

3   VAPOUR POWER CYCLES

The Carnot vapour power cycle, simple Rankine cycle and its energy analysis, modified Rankine cycle: superheating, reheating and regeneration

4   FUELS AND COMBUSTIONS

Calorific values of fuel, requirements of good fuel, proximate and ultimate analysis of fuel, theoretical determination of calorific value using Dulong's formula, air requirement for combustion, boiler performance

5   REFRIGERATION CYCLE

Reversed Carnot cycle, Joule-Thompson effect, analysis of ideal vapour compression refrigeration cycle, actual vapour Compression refrigeration cycle, refrigerants and its properties, selection, air refrigeration (Bell-Coleman) cycle

6   PSYCHROMETRY AND AIR-CONDITIONING

Psychrometric properties and processes, adiabatic saturation temperature, psychrometric chart, human comfort and industrial air-conditioning

TEXT / REFERENCE BOOKS

1. Thermodynamics- An engineering approach, Yunus A. Cengel, Michael A. Boles., Tata McGraw Hill publishing co. ltd.

2. Engineering Thermodynamics, P.K. Nag, Tata McGraw Hill publishing co. ltd.

3. Fundamental of thermodynamics, Sonntag. R.E., Borgnakke C. and Van Wylen G.J, John Wiley and Sons.

4. Fundamentals of engineering thermodynamics, Moran M.J. and Shapiro H.N., John Wiley and Sons.

B. TECH. SEMESTER – IV
SUBJECT: ADVANCE SOLID MECHANICS (MH414)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

DETAILED SYLLABUS:

1 **STRESSES AND STRAINS IN THREE DIMENSIONS**

Solid mechanics approaches, concept of continuum, homogeneity and isotropy, types of forces on a body, state of stress at a point, rectangular stress components, stress sign convention, equality of cross shear, traction on an arbitrary surface, principal stresses and planes, stress invariants, hydrostatic and deviatoric stress tensor, Mohr's circle for general state of stress, octahedral planes and stresses, differential equation of equilibrium

Difference between displacement and deformation, strain at a point, strain displacement relationship, engineers and mathematician's strain tensors, rigid body rotation, cubical dilatation, principal axes of strain and principal strain, strain deviator, strain invariants, compatibility conditions, stress-strain relationship and elastic constants required for different types of materials, stress strain relationship for isotropic material, plane stress and plane strain

2 **THEORIES OF ELASTIC FAILURE UNDER STATIC LOADING**

Concept of factor of safety, factors affecting factor of safety, maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear strain energy theory, region of safety for all theories

3 **THICK CYLINDERS AND BENDING OF CURVED BARS**
Cylinder Classification, design of thick cylinders, Lame's theory, Design based on various failure theories, cylinders subjected to external pressure, Methods of prestressing of cylinders
Introduction, Stresses in curved bars (Winkler-Bach theory) (Rectangular section, Circular section, Triangular section, Trapezoidal section, T-Section)

4 **COLUMNS AND STRUTS**

Classification of columns, strength of columns, end conditions and equivalent length, Euler's formula, Rankine's hypothesis

5 **SLOPE AND DEFLECTION OF BEAMS**
Introduction, Beam deflection, relation between slope, deflection and radius of curvature, slope and deflection at a section by various methods

6 **STRESSES DUE TO ROTATION**
Stresses in rotating ring, stresses in rotating thin solid and hollow disc, stresses in thin disc with a pin hole, disc of uniform strength

TEXT / REFERENCE BOOKS

1. Advanced Mechanics of Solids, L. S. Srinath, Tata McGraw Hill
2. Strength of Materials, R. K. Rajput, S. Chand & Co. Ltd.
3. Solid Mechanics, S. M. A. Kazimi, Tata McGraw Hill
4. Strength of Materials, D. S. Bedi, Khanna book publishing co. Pvt ltd.
5. Elements of Strength of Materials, Timoshenko S. P. and Young D.H., East-West Press Pvt. Ltd.
6. Mechanics of Materials, Timoshenko and Gere, CBS Publishers
7. Mechanics of Structures, S. B. Junarkar, Charotar Publishers

B. TECH. SEMESTER – IV
SUBJECT: MANUFACTURING TECHNOLOGY-I (MH415)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	4	7	5	60	40	25	25	150

DETAILED SYLLABUS:

1   SAND CASTING PROCESS

Principal of casting process, different types of patterns, pattern materials, pattern allowances, pattern colours, types of sand, moulding materials and core, moulding processes, melting practice and metal pouring, gating system design, fettling process and casting defects

2   SPECIAL CASTING PROCESSES

Gravity die casting, pressure die casting, centrifugal casting, investment casting, continuous casting, vacuum casting, squeeze casting, comparison with conventional sand casting process

3   LATHE MACHINE

Function, working principle, classification, specifications, main parts, feed mechanism, lathe accessories, lathe operations, cutting tool materials, tool geometry of single point cutting tool, cutting Parameters: speed, feed and depth of cut, machining time, material removal rate, specification of lathe machine, capstan and turret lathe, working principle, parts

4   MILLING, SHAPER AND PLANNER MACHINE

Working principle, main parts, classification of milling machines, specification, milling machine mechanism, work holding devices, cutter holding devices, different milling cutters, tool geometry of plain milling cutter, milling operations, cutting parameters, machining time, milling attachments, principle of indexing, types of indexing

Function of shaper, working principle, classification, main parts, driving mechanism of shaper, feed mechanism of shaper, different operations on shaper machine, cutting parameters: speed, feed and depth of cut, machining time, specification of shaper machine

Working principle of planer, classification, difference between shaper and planer, planner operations, specification of planner machine

5   DRILLING, BORING AND GRINDING MACHINE

Working principle of drilling, classification, main parts, specification, different operations on drilling, machining time

Working principle & types of boring machines, boring tools

Working principle, main parts, classification of grinding machines, specification, Grinding operations, types of grinding wheels, wheel marking, truing, glazing, loading

6   INTRODUCTION TO ADDITIVE MANUFACTURING

Additive manufacturing – basics, processes and applications

TEXT / REFERENCE BOOKS

1. Element of Workshop Technology, S. K. Hajra Choudhury,Vol. 1, Media Promoters and publishers Pvt.

2. Element of Workshop Technology, S. K. Hajra Choudhury,Vol. 2, Media Promoters and publishers Pvt.

3. Foundary Technology, O. P. Khanna, Dhanpat Rai Publication

4. A course in Workshop Technology, B.S.Raghuwanshi, Dhanpat Rai & Sons, Delhi

5. Elements of Lathe work, B.Brushtein and V.Dementyev, Peace Publishers, Moscow

6. Manufacturing Engg. And Technology, S. Kalpakajain, PHI/Pearson

7. H.M.T, "Production Technology", Tata McGraw Hill

8. Manufacturing Processes for Engineering Materials, Kalpakjain S. and Schmid Steven R., Pearson Publication

9. Workshop Technology Vol. I, II & III, Chapman

10. Manufacturing Technology – 1 Foundary, Forming and Welding, P. N. Rao

B. TECH. SEMESTER – IV
SUBJECT: DYNAMICS OF MACHINE (MH413)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	1	2	5	5	60	40	25	25	150

DETAILED SYLLABUS:

[1] STATIC FORCE ANALYSIS

Introduction, conditions of static equilibrium, equilibrium of different members, free body diagrams, principle of super position, static force analysis of various mechanism, principle of virtual work, static force analysis with friction

[2] DYNAMIC FORCE ANALYSIS

Introduction, D–Alembert's principle, equivalent offset inertia force, dynamic analysis of simple mechanisms, combined static and inertia force analysis of different mechanisms, dynamic force analysis of reciprocating engine: inertia of reciprocating mass and connecting rod, dynamically equivalent system

[3] FLYWHEEL

Introduction, function, turning-moment diagrams, fluctuation of energy, dimensions of flywheel rims

[4] BALANCING

Introduction, static balancing, dynamic balancing of several masses in different planes, balancing of reciprocating and rotary masses

[5] GOVERNORS

Introduction, different types of governors, various terminologies, effort and power of a governor, controlling force

[6] GYROSCOPE

Concept of gyroscope, angular velocity, angular acceleration, gyroscopic couple, gyroscopic effect on aviation, marine and automobiles

TEXT / REFERENCE BOOK

1. Theory of Machines, S S Rattan, Tata McGraw Hill.

2. Theory of Machines, R. S. Khurmi and J. K. Gupta, S. Chand and Company Ltd.

3. Theory of Machines and Mechanisms, Joseph Shigley and John Uicker, Jr., McGraw Hill.

4. Theory of Mechanisms & Machines, Amitabha Ghosh & Ashok Mallik, Affiliated East-West Press Pvt. Ltd.

5. Kinematics & Dynamics of Machinery, Charles Wilson & J. Peter Sadler, Pearson Education.

6. Dynamics of Machinery, Farazdak Haideri, Nirali Publication.
7. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age International Publisher

B. TECH. SEMESTER – IV
SUBJECT: MACHINE DRAWING AND INDUSTRIAL DRAFTING

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
0	0	4	4	2	0	0	25	25	50

DETAILED SYLLABUS:

PART A: MACHINE DRAWING

1   FUNDAMENTALS OF MACHINE DRAWING

Introduction to Machine drawing, conventional representations of various machine elements such as threaded parts, bearing, gears, spring, etc. conventional representation of part materials, standard abbreviations.

2   DETACHABLE FASTNERS

Introduction, screw thread nomenclature, forms of thread, thread designation, drawing representations of threads: normal, schematic and conventional. part drawing exercises of threaded fasteners such as bolts, nuts, screws, studs, nut locking arrangements

3   PERMANENT FASTNERS

Rivets and riveted joints, BIS symbols for riveted joints. types of welded joints, BIS symbols for welded joints. drawing exercises for representation of riveted joints and welded joints

4   ASSEMBLY DRAWING

Detail drawing of machine components. assembly drawings of various machines, mechanisms and equipment such as cotter joint, knuckle joint, flange coupling, universal coupling, screw jack etc. from detail drawings, sketches and actual machine components

5   PRODUCTION DRAWING

Introduction to limits, fits, dimensional tolerance, surface roughness and their drawing representation. Geometric dimensioning and tolerancing: basic terminology, indication of geometric tolerance in drawing

PART B: COMPUTER AIDED DRAFTING

1   DRAWING OBJECTS

Starting with AutoCAD, AutoCAD dialog boxes, co-ordinate Systems, drawing line, circle, arc, rectangle, ellipse, polygons

2   EDITING SKETCHED OBJECTS

Editing sketches, moving, copying, pasting, offsetting, scaling, chamfering, trimming, mirroring. filleting, sketched objects

3   DIMENSIONING

Giving dimensions and annotations to drawings, creating linear, rotated, angular, aligned, base line dimensions, modifying dimensions, showing surface roughness symbols, weld symbols, dimensional tolerances, geometric tolerances

4 PLOTTING

Plotting the drawings in AutoCAD, plotting drawing using the plot dialog box, adding plotters and using plot styles, plotting sheets

5 DRAWING EXERCISES WITH AUTOCAD

Orthographic drawing and Isometric drawing of objects, drawing of machine parts, detail and assembly drawing of machines

6 3D MODELING

Creating a 3D model of any object using AutoCAD, generating drawings from the 3D model.

TEXT / REFERENCE BOOK

1. Machine Drawing, K. L. Narayana, P. Kannaiah, K. Venkata Reddy, 3rd edition, New age international (P) Ltd.

2. Machine Drawing, Basudeb Bhattacharyya, Oxford University Press

3. Machine Drawing, N. D. Junnarkar, Pearson Education Pvt. Ltd

4. Machine Drawing - P.S. Gill, S.K. Kataria & Sons New Delhi.

5. Machine Drawing - N. Sidheshwar, P. Kannaiah. McGraw-Hill India.

6. Engineering Drawing Practice for Schools and Colleges SP 46: 2003- BIS (Bureau of Indian Standards).

7. AutoCAD 2017 for Engineers & Designers- Prof. Sham Tickoo. Dreamtech Press.

8. Design of Machine Elements - V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd.

9. A text book of Machine Design - P. C. Sharma, D. K. Aggarwal, S. K. Kataria & Sons.

10. PSG Design data book.

B. TECH. SEMESTER – IV
SUBJECT: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
1	0	2	3	2	0	0	100*	0	100

DETAILED SYLLABUS:

1 **INTRODUCTION TO ARTIFICIAL INTELLIGENCE**

Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search.

2 **KNOWLEDGE REPRESENTATION**

Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction.

3 **NATURAL LANGUAGE PROCESSING & VISUAL PERCEPTION**

Language & its comprehension, reading, understanding conversation and essays. Language context, language in a social context, Introduction to problem solving, decision making and reasoning, Visual perception from sensation to representation, approaches to perception, perception of object sand forms, role of environment in seeing, deficits in perception, and perception in practice. Automatic and controlled processes in attention.

4 **INTRODUCTION TO MACHINE LEARNING**

Preliminaries, what is machine learning; varieties of machine learning, learning input/output functions, sample application. Boolean functions and their classes, CNF, DNF, decision lists. Version spaces for learning, version graphs, learning search of a version space, candidate elimination methods

TEXT / REFERENCE BOOK

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill
2. Introduction to AI & Expert System: Dan W.Patterson, PHI
3. Introduction to Machine learning, Nils J.Nilsson
4. Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O'Reilly
5. Artificial Intelligence by Luger (Pearson Education)
6. Machine learning for dummies, IBM Limited ed, by Judith Hurwitz and Daniel Kirsch
7. Russel & Norvig, Artificial Intelligence: A Modern Approach, Pearson Education.

B. TECH. SEMESTER – IV
SUBJECT: UNIVERSAL HUMAN VALUES (HS401)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	0	3	3	60	0	0	0	60

DETAILED SYLLABUS:

1 COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

Purpose and motivation for the course, recapitulation from Universal Human Values-I, self-Exploration–what is it?-Its content and process; 'Natural Acceptance' and experiential validation-as the process for self-exploration, continuous happiness and prosperity-A look at basic human aspirations, right understanding, relationship and physical facility-the basic requirements for fulfillment of aspirations of every human being with their correct priority, understanding happiness and prosperity correctly-a critical appraisal of the current scenario, method to fulfill the above human aspirations: understanding and living in harmony at various levels

2 UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', understanding the needs of Self ('I') and 'Body'- happiness and physical facility, understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer), understanding the characteristics and activities of 'I' and harmony in 'I' , understanding the harmony of I with the body: sanyam and health; correct appraisal of physical needs, meaning of prosperity in detail, programs to ensure sanyam and health

3 UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN- HUMAN RELATIONSHIP

Understanding values in human-human relationship; meaning of justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; trust and respect as the foundational values of relationship, understanding the meaning of trust; difference between intention and competence, understanding the meaning of respect, difference between respect and differentiation; the other salient values in relationship, understanding the harmony in the society (society being an extension of family): resolution, prosperity, fearlessness (trust) and co-existence as comprehensive human goals, visualizing a universal harmonious order in society- undivided society, universal order- from family to world family

4 UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

Understanding the harmony in the nature, interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in

nature, understanding existence as co-existence of mutually interacting units in all pervasive space, holistic perception of harmony at all levels of existence, include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

Natural acceptance of human values, definitiveness of ethical human conduct, basis for humanistic education, humanistic constitution and humanistic universal order, competence in professional ethics: a. ability to utilize the professional competence for augmenting universal human order b. ability to identify the scope and characteristics of people friendly and eco-friendly production systems c. ability to identify and develop appropriate technologies and management patterns for above production systems, case studies of typical holistic technologies, management models and production systems, strategy for transition from the present state to universal human order: a. at the level of individual: as socially and ecologically responsible engineers, technologists and managers b. at the level of society: as mutually enriching institutions and organizations

TEXT / REFERENCE BOOK

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books

2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan

3. Human Values, A.N. Tripathi, New Age Intl. Publishers

SUBJECT: MEASUREMENT AND METROLOGY

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

DETAILED SYLLABUS

1 **BASIC CONCEPT OF MEASUREMENT**
Introduction, Methods of measurement, Standards, Calibration, General measurement system, Operational description of a measurement system, Accuracy and Precision, Types of errors, Sources of errors, Statistical analysis of data, Static performance characteristics, Dynamic performance characteristics, transducers

2 **MEASUREMENT OF PRESSURE AND TEMPERATURE**
Measurement of Pressure: Introduction, Methods of measuring pressure, Dead weight gauge tester, McLeod gauge, Pressure measurement with elastic transducers, Manometers, Measurement of Vacuum.
Measurement of Temperature: Introduction, Thermometer, Resistance temperature detector, thermocouple, thermistor, Optical pyrometer

3 **FLOW MEASURMENT TECHNIQUES AND MISCELLANEOUS MEASUREMENT**
Flow measurement: Introduction, Types of flow measuring instruments, Quantity meter, Ultrasonic flow meter, Flow measurement by drag effect (Rotameter), Hot wire anemometers.
Miscellaneous measurements: Basic methods of force measurements, Torque measurement on rotating shaft, Prony brake and eddy current dynamometers, Strain measurements, Types of strain gauges, Electrical resistant strain gauges, Gauge factor of strain gauge, Rosettes.

4 **LINEAR AND ANGULAR MEASUREMENT**
Introduction, Need of inspection, Standards of Measurements, Steel Rule, Calipers, Surface plate, V block, Radius gauges, Feeler gauges, Screw pitch gauges, Angle gauges, Vernier Caliper, Vernier height gauge, Vernier depth gauge, Outside micrometer, Inside micrometer, Micrometer with interchangeable anvils, Vernier micrometer, Slip gauges, Universal Bevel Protector, Sine Principle and Sine Bars, Dial gauges, Comparators.

5 **LIMITS, FITS, GAUGE DESIGN AND MEASUREMENT OF GEOMETRIC SHAPES**
Introduction, Tolerances, Types of fits, Types of gauges, Taylor's principle of gauge design, Gauge tolerance, Allocation of gauge tolerance, Wear allowance, Straightness, Test for straightness by using Spirit level and Auto- collimator, Flatness Testing, Parallelism, Squareness, Measurement of circularity, Surface roughness measurement.

6 **METROLOGY OF GEAR AND SCREW THREAD AND MODERN MEASUREMENT TECHNIQUES**

Introduction, Screw thread terminology, Measurement of various elements of screw thread, Basic elements of gear, Measurement of various elements of spur gear.

Modern Measurement Techniques: Coordinate measuring machine, Machine vision, Universal measuring machine.

TEXTBOOKS/ REFERENCE BOOKS

1. Mechanical Measurement and Control by D. S. Kumar, Metropolitan, New Delhi
2. Metrology by M. Mahajan, Dhanpat Rai & Co.
3. Mechanical Measurements and Instrumentation and Control by A. K. Sawhney & Puneet
4. Sawhney, Dhanpat Rai & Co.
5. Engineering Metrology by R. K. Jain, Khanna publisher
6. Mechanical Measurement by R. S. Sirohi & H. C. Raha Krishna, Wiley Eastern Limited
7. Engineering Metrology by D. M. Anthony, Pergamon Press
8. The Metrology Hand Book by J. L. Bucher, American Society for Quality, 2004
9. Measurement Systems: Application and Design by E.O. Doebelin, McGraw Hill

SUBJECT: HEAT AND MASS TRANSFER

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

DETAILED SYLLABUS

1 **BASIC CONCEPTS**

Thermodynamics vs. Heat transfer, Modes of Heat transfer, Basic laws of heat transfer: Fourier's law, Newton's law, Stephen Boltzmann law, Steady and unsteady state of heat transfer, Thermal resistance, Thermal conductivity of material, General heat conduction equation in Cartesian, cylindrical and spherical coordinate system

2 **CONDUCTION**

Steady state one-dimension heat conduction- Heat conduction through plane and composite wall, heat flow between surface and surroundings, overall heat transfer coefficient, heat conduction through hollow and composite cylinders, heat conduction through hollow and composite spheres, Shape Factor, effect of variable conductivity, critical thickness of insulation.

Heat transfer from extended surfaces- Introduction, heat flow through rectangular fin, heat dissipation from, an infinitely long fin, a fin insulated at the tip and fin losing heat at the tip, Fin performance.

Unsteady state heat conduction- Transient conduction in solid with infinite thermal conductivity, Time constant and response of thermocouple, Transient conduction in solid with finite conduction and convection resistance

3 **CONVECTION**

Introduction- Basic law of heat convection, Free and Force convection.

Dimensional analysis- Dimensional homogeneity, Methods of dimensional analysis, Dimensional analysis applied to force and free convection, Dimensional numbers and their physical significance.

Empirical relation for free convection and forced convection- Bulk temperature and mean film temperature, Local and average convection coefficient, Correlations for force convection, Correlations for free convection.

Force convection- Hydrodynamic Boundary layer, thicknesses of boundary layer, and Thermal boundary layer, continuity, momentum and energy equations for force convection. Blasius solution for laminar boundary layer, General solution of Von- Karman integral momentum equation.

Free convection- Introduction, characteristic parameters in free convection, momentum and energy equations for laminar free convection heat transfer.

4   RADIATION

Thermal Radiation Basic relations- Introduction, Surface emission properties, absorptivity, reflectivity and transitivity, black, white and grey body, emissive power and emissivity, laws of radiation: Planck, Stefan-Boltzmann, Wein's displacement, Kirchhoff's law, intensity of radiation and solid angle, Lambert's cosine law

Radiation heat exchange between surfaces- black bodies, shape factor, heat exchange between non-black bodies- infinite parallel planes and infinite long concentric cylinder, small grey surfaces, small body in large enclosure, Electrical network approach for radiation heat exchange. Radiation shield, error in temperature measurement due to radiation.

5   HEAT EXCHANGER

Introduction, Classification of heat exchanger, performance analysis, overall heat transfer coefficient, LMTD, Correction factor for multi-pass arrangement, effectiveness and NTU, Limiting value of capacity ratio, TEMA standards for heat exchanger design

6   CONDENSATION, BOILING AND CONCEPT OF MASS TRANSFER

Condensation- Laminar film condensation on vertical plate, turbulence film condensation, convective coefficient for film condensation on tube.

Boiling- Boiling regimes, Bubble growth and nucleate boiling, Boiling correlation**.**

Mass Transfer- Classification, Concentration, velocity and fluxes. Fick's law, General equation of mass diffusion, Steady state diffusion, Mass transfer coefficient.

TEXTBOOKS/ REFERENCE BOOKS

1. Heat and Mass Transfer, R.K. Rajput, S. Chand Publication
2. Heat and Mass Transfer, D. S. Kumar, S.K. Kataria and sons
3. Cengel Y A, Heat Transfer – A Practical Approach, McGraw Hill
4. Fundamentals of Heat and Mass Transfer, D. P. Incropera, P.P. and Dewitt, Wiley Eastern
5. Convective Heat Transfer, Adrian Bejan, Wiley India.
6. Heat Transfer, J. P. Holman, McGraw Hill
7. Heat and Mass Transfer, Domkundawar Arora, Dhanapat rai & CO.
8. Heat and Mass Transfer, P. K. Nag, McGraw Hill

B. TECH. SEMESTER – V
SUBJECT: MANUFACTURING TECHNOLOGY - II

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

DETAILED SYLLABUS

1   **FUNDAMENTALS OF WELDING AND ARC WELDING PROCESSES**
    Fundamentals of welding system, Advantages & Disadvantages of welding, Classification of welding processes.
    Fundamentals of arc welding, Arc welding processes: Carbon arc welding, Manual metal arc welding, Tungsten inert gas welding, Metal inert gas welding, Metal active gas welding and Submerged arc welding, arc welding power sources, welding consumables: types of electrodes, inert gases, fluxes.

2   **RESISTANCE WELDING PROCESSES AND GAS WELDING PROCESS**
    Fundamentals of electric resistance welding, Spot welding, Projection welding, Seam welding.
    Oxy fuel gas welding process, Oxyacetylene welding: Principle, Methods, Applications, Equipment used in gas welding, Gas cutting, Principles of gas cutting.

3   **ALLIED METAL JOINING PROCESSES AND WELDING DEFECTS**
    Soldering, Brazing, Adhesive Bonding and its application.
    Various types of welding defects, Causes and remedies, Introduction to inspection and testing of welds.

4   **ADVANCED WELDING PROCESSES**
    Introduction to Electron beam welding, Electroslag welding, Underwater welding, Ultrasonic welding, special welding processes: Thermit welding, Friction welding.

5   **HOT WORKING AND COLD WORKING OF METALS**
    Plastic Deformation, Rolling, Extrusion, Pipe & tube manufacture, Merits and demerits of the hot working and cold working process, Wire drawing, Metal spinning.

6   **PRESS WORKING**
    Presses and drive mechanism for presses, Feed mechanism, Clearance and its importance, Press tool operations: Shearing, cutting off, parting, blanking, piercing, notching, slitting, slitting, nibbling trimming, lancing, Different types of dies, die materials, stock layout, construction details of die set.

TEXTBOOKS/ REFERENCE BOOKS

1. Welding technology, O.P. Khanna, Dhanpatrai & Co. (p) ltd, New Delhi
2. Production Technology, O.P. Khanna ,Dhanpatrai & Co.(p) ltd, New Delhi

3. Production Technology, P.C.Sharma, S. Chand
4. Welding processes and technology, R. S. Parmar, Khanna publishers
5. Manufacturing Technology- Foundry, Forming and Welding, P. N. Rao, Tata McGraw Hill
6. Introduction to Manufacturing Processes, Schey J., Tata McGraw Hill
7. Manufacturing Engineering and Technology, S. Kalpakajain, PHI/Pearson
8. Welding Technology, Richard Little, Tata McGraw Hill

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	1	2	60	40	25	25	150	3	1	1	5

DETAILED SYLLABUS

1 INTRODUCTION AND DESIGN CONSIDERATIONS

Design engineering, design engineering phases, basic requirements and procedure of design, design synthesis, use of standards in design, selection of preferred sizes,aesthetic and ergonomic considerations in design, concurrent engineering, design considerations for manufacture and assembly of casting, forging, machining and welding

2 DESIGN AGAINST STATIC LOAD

Design parts subjected to tension, compression, shear, bending, torsion, combinedand eccentric axial static loads such as cotter joint, knuckle joint, levers

3 THREADED FASTENERS, POWER SCREW AND RIVETED JOINTS

Basic design concepts of threaded fasteners, eccentrically loaded threaded joint in shear, eccentric load perpendicular and parallel to axis of threaded fastener, designof power screw and simple screw jack

Riveted joints, Strength Equations, Basic design concepts of riveted joints, Efficiency of joint.

4 SHAFTS, KEYS, COUPLINGS

Types of shafts, material for shaft, shaft design based on strength and rigidity, A.S.M.E. code for shaft design, types of keys, design of sunk, saddle and Kennedykey, design of splines, types of couplings, design of flanged coupling

5 MECHANICAL SPRINGS

Types, applications and materials for springs, stress and deflection equations for closely coiled helical compression springs, Wahl's factor and its use in spring design, end conditions, concentric springs, design of helical torsion, spiral and leafsprings

6 DESIGN OF CLUTCHES AND BRAKES

Clutch: Function, classification and material selection, design of single plate, multiple plate,cone and centrifugal clutches

Brake: Function, classification of brakes, design of band brake, block brake with short shoe,block brake with long shoe, pivoted block brake with long shoe, internal expandingshoe brakes

TEXTBOOKS/ REFERENCE BOOKS

1. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd
2. Machine Design – I & II, Farazdak Haideri, Nirali Prakashan
3. Mechanical System Design, Farazdak Haideri, Nirali Prakashan
4. Machine Design, An integral approach - Robert L. Norton, Pearson Education Inc
5. Mechanical Engineering Design - J. E. Shigley, C. R. Mischke, McGraw-Hill Publishing Co. Ltd
6. A text book of Machine Design - P. C. Sharma, D. K. Aggarwal, S. K. Kataria & Sons
7. Engineering Design, George E. Dieter, McGraw-Hill Publishing Co. Ltd
8. Design Data (PSG College of Engg. & Tech.), DVP Printers

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	0	60	0	0	0	60	3	0	0	3

DETAILED SYLLABUS

1 INTRODUCTION

Present energy scenario in India, need of the non- conventional energy sources, various conventional & non-conventional energy sources and their comparison, energy and environment.

2 SOLAR ENERGY AND ITS APPLICATIONS

Sun-Earth geometry, characteristics & estimation of solar radiation, instruments for solar radiation measurements. Types of solar collector – flat plate & concentrating. Energy calculations for flat plate type, parabolic concentrator type collector, collector efficiency calculation, Selective paints & surfaces for collectors

Active & passive systems, solar pumps, solar refrigeration & air conditioning solar cookers, solar furnaces, photovoltaic systems for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and limitations, thermal storages and solar ponds – principle & its uses.

3 WIND ENERGY

power in wind, power coefficient, different types of wind turbines, design criteria and material selection and economics, site selection, advantages and disadvantages, applications, wind energy development in India

4 TIDAL ENERGY AND OCEAN THERMAL ENERGY

Site selection, different methods of using tidal power, single basin, double basin, advantages and limitations.

Ocean Thermal Energy Conversion-Principle of utilization, open cycle OTEC system, closed cycle, hybrid cycle

5 BIOMASS CONVERSION

Photosynthesis & generation of bio-gas, digesters and their design, selection of material, feed of digester, gasification, types and applications of gasifiers, advantages and limitations of biomass conversion.

6 ENERGY STORAGE

Various energy storage systems: battery storage, types of batteries and their applications, sensible and latent heat storage materials, hydrogen storage, ultra-capacitors, ultra-flywheel.

TEXTBOOKS/ REFERENCE BOOKS

1. Non-conventional Energy Sources – G.D. Rai, Publisher: Khanna publisher
2. Solar Energy - Principles of thermal collection and storage, S. P. Sukhatme, Publisher: Tata McGraw-Hill
3. Solar Energy: Fundamentals, Design, Modelling and Applications - G.N. Tiwari, Narosa publisher.
4. Renewable Energy Sources and Emerging Technologies by: Kothari D. P., Singal K. C., Ranjan Rakesh, Publisher: PHI ISBN
5. Solar Energy, Garg and Prakash
6. Solar Energy Utilization, G.D. Rai

SUBJECT: INDUSTRIAL MANAGEMENT AND ECONOMICS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
2	0	0	40	0	0	0	40	2	0	0	2

DETAILED SYLLABUS

1   INTRODUCTION
Concept of production and service, types of industries, objectives and functions of industrial management

2   FUNCTIONS OF MANAGEMENT
Introduction to term organization, types of ownership, types of organization structure: line, functional, line and staff and matrix. Management: classification and importance, functions of management: planning, organizing, staffing, directing and controlling

3   ELEMENTS OF ECONOMICS
Laws of demand and supply, factors of production, concept of economies of scale, time value of money, inflation, depreciation, gross domestic product, gross national product, productivity.

4   ENGINEERING ECONOMICS
Production cost concept: direct costs, indirect costs and overheads, break even analysis, make or buy decision, value analysis, product life cycle

5   WORK SYSTEM DESIGN
Work study: method study objectives and procedure, time study procedure, performance rating, allowances, principles of motion economy, ergonomics.

6   RECENT TRENDS IN INDUSTRIAL MANAGEMENT
Principles and concepts of quality, continuous improvement techniques, introduction to optimization, supply chain management.

TEXTBOOKS/ REFERENCE BOOKS
1. Industrial Engineering and Production Management, M. Mahajan, Dhanpat Rai Publication
2. Industrial Engineering and Production Management, Martand Telsang, S. Chand Publication
3. Industrial Organization and Engineering Economics, T. R. Banga and S. C. Sharma, Khanna Publisher
4. Production and Operation Management, R. Paneerselvam, PHI Publication

5. Elementary Economic Theory, K. K. Dewitt and J. D. Varma, S. Chand Publication
6. Management, S. Robbins, M. Coulter and A. Randel, Pearson Introduction to Work Study, G. Kanawaty, ILO Geneva

B. TECH. SEMESTER – V
SUBJECT: INNOVATION AND ENTREPRENEURSHIP

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
2	0	0	40	0	0	0	40	2	0	0	2

DETAILED SYLLABUS

1 ENTREPRENEURSHIP

Role of entrepreneurship in economic development; entrepreneurial mindset, motivation and competencies; market pull and technology push factors; new product development lifecycle; technology readiness levels; Product-market fit validation; commercialization pathways; business vision and leadership; team composition and management

2 PRODUCT INNOVATION

Opportunity scanning, market survey, need identification and problem definition; creative design thinking for concept generation; detailed design and prototyping; functionality and manufacturability; bill of materials and components supply chain; manufacturing and assembly plan; product testing and quality assurance; intellectual property rights management

3 VENTURE CREATION

Sustainable business options and pathways; business model and business canvas; startup team and business partners; startup ecosystem and stakeholders; technology business incubators and parks; proposal pitching and agreements; startup company incorporation; social impact and responsibility

TEXTBOOKS/ REFERENCE BOOKS

1. Bill Aulet, Technology Entrepreneurship, 4th ed., Tata McGraw Hill
2. Peter F. Drucker, "Innovation and Entrepreneurship", 1st ed., Harper Business
3. Chelat Bhuvanachandran, Innovision, Khanna Book Publishing
4. Byers, Dorf, and Nelson, Technology Ventures: From Ideas to Enterprise, McGraw Hill
5. Steve Blank, The Startup Owner's Manual"T.V. Rao, Entrepreneurship - A South Asian Perspective

B. TECH. SEMESTER – VI
SUBJECT MACHINE DESIGN-II

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	1	2	60	40	25	25	150	3	1	1	5

DETAILED SYLLABUS

1   DESIGN AGAINST VARYING LOAD
Stress concentration – causes and remedies, Stress concentration factors, Fluctuating stresses, Fatigue failure, S-N curve, Endurance limit, Notch sensitivity, Design for finite and infinite life, Soderberg and Goodman lines, Modified Goodman diagrams, Gerber equation, Fatigue design under combine stresses, Impact stresses.

2   SURFACE FAILURE
Introduction, Surface geometry, Mating surfaces, Friction, Effect of roughness on friction, Effect of velocity on friction, Rolling friction, Effect of lubrication on friction, Adhesive wear, Abrasive wear, Corrosive wear, Surface fatigue, Spherical contact, Cylindrical contact, General contact, Surface fatigue failure models, Surface fatigue strength.

3   BEARINGS
Introduction, Types of rolling contact bearings, Comparison of rolling and sliding contact bearings, Selection of rolling bearing type, Static and dynamic load carrying capacity, Equivalent bearing load, Bearing life, Load factor, Design for cyclic loads and speeds, Probability of survival, Bearing mounting, Failure of rolling contact bearing, Causes and remedies, Lubricants, Viscosity, Basic modes of lubrication, Material combination in sliding bearings, Hydrodynamic lubrication theory, Design of hydrodynamic journal bearings, Journal bearing Failure causes and remedies, Viscous flow through rectangular slot, Design of hydrostatic bearing.

4   SPUR GEAR DESIGN
Overview of gear drive terminology, Standard systems of gear tooth, Gear material selection, Force analysis of spur gear, Minimum no. of teeth, Estimation of module based on beam and wear strength for gears, Design of spur gears, Friction and wear of spur gears, Contact stresses, Lubrication of gears, Surface failures, Offline monitoring of gears, Online monitoring of gears.

5   HELICAL, BEVEL AND WORM & WORM GEAR DESIGN
Virtual number of teeth, Force analysis of helical gears, Design of helical gears, Bevel gear geometry, Force analysis of bevel gears, Design of bevel gears, Worm

& worm gear geometry, Force analysis of worm & worm gear, Design of worm & worm gear.

6 **DESIGN OF GEAR BOXES**

Basic considerations in design of drives, Determination of variable speed range, Preliminary steps in the design of multi speed gear box, Structure diagram, Graphical representation of ray and speed diagram, Rules and guidelines for layout.

TEXTBOOKS/ REFERENCE BOOKS

1. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd.
2. Machine Design- An Integrated Approach, Robert L. Norton, Pearson Education, Inc.
3. Machine Tool Design and Numerical Control, N. K. Mehta, Tata McGraw-Hill Education Pvt. Ltd.
4. Mechanical Engineering Design, Shigley J.E. and Mischke C.R., McGraw Hill Publ. Co. Ltd.
5. Fundamental of Engineering Tribology with Application, Harish Hirani, Cambridge University Press.
6. Design of Machine Elements, M. F. Spott, T. E. Shoup, L. E. Hornberger, S. R. Jayram & C. V. Venkatesh, Pearson Education Inc.
7. Machine Design, Black P.H. and O. Eugene Adams, McGraw Hill Book Co.Ltd.
8. Design Data (PSG College of Engg. & Tech.), DPV Printers.
9. Mechanical Design Data Book, V. S. Konnur & A. A. Memon, New Popular Prakashan, Surat.

B. TECH. SEMESTER – VI
SUBJECT: FLUID MACHINES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

DETAILED SYLLABUS

1 INTRODUCTION

Major applications of hydropower plant, classification of hydropower plant, mini-micro hydro power plant, elements of hydropower plant, advantages and disadvantages of hydropower plant, selection of site for a hydropower plant

2 IMPACT OF JET

Introduction, force exerted by jet on stationary flat, Inclined and curved vanes, force exerted by jet on moving flat, inclined and curved vanes, jet of water striking tangentially to symmetrical and unsymmetrical blades, jet Propulsion

3 HYUDRAULIC TURBINES

Introduction, classification of hydraulic turbines, head and efficiencies of hydraulic turbine, Pelton Wheel turbine-construction and working velocity triangle and work done for Pelton Wheel turbine, design parameters, radial flow reaction turbine-inward radial flow and outward radial flow turbine, Francis Turbine - construction and working, velocity triangle and work done, axial flow reaction turbine-construction and working of Kaplan Turbine, design parameters, draft tube-types, theory and efficiency of draft tube, specific speed of hydraulic turbines, unit quantities and characteristics curves of hydraulic turbines. governing of hydraulic turbines

4 HYDRAULIC PUMPS

Introduction, classification of pumps, centrifugal pump-introduction, main parts of centrifugal pump work done by centrifugal pump, definition of heads and efficiencies of centrifugal pump, minimum starting speed of centrifugal pump, multistage centrifugal pumps, specific speed of centrifugal pump, model testing of centrifugal pump, priming, characteristics curves of centrifugal pump, cavitation, maximum suction lift of centrifugal pump, NPSH, reciprocating pump-introduction, construction and working, indicator diagram, air vessels, comparison of centrifugal pump and reciprocating pump

5   COMPRESSORS

Centrifugal compressor-introduction, principle of operation, components of centrifugal compressor static and stagnation properties, work done by the impeller, pressure rise and temperature rise, degree of reaction, power input factor, slip factor, Stodola formula, enthalpy-entropy diagram, isentropic efficiency

Reciprocating compressor-terminology, classification, single stage reciprocating air compressor without clearance-work done, power required to compress air, condition for minimum work, single stage reciprocating air compressor with clearance-work done, volumetric efficiency, FAD, multistage compression-work done, two stage compressor with intercooler without clearance, condition for minimum work, work done in two stage compressor with intercooler with clearance, optimum intermediate pressure in two stage compressor with incomplete intercooling, actual p-v diagram for reciprocating compressor, mean effective pressure and indicated power, compressor efficiency, heat rejected in compressor and intercooler

6   MISCELLANEOUS HYDRAULIC MACHINES

Hydraulic accumulator, hydraulic intensifier, hydraulic ram, hydraulic lift, hydraulic crane, hydraulic coupling, hydraulic torque converter, airlift pump, gear pump

TEXTBOOKS/ REFERENCE BOOKS

1. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Prakashan
2. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S. K. Kataria & Sons
3. Fluid Mechanics, Yunus A. Cengel, McGraw Hill Publication
4. Fluids Mechanics, F.M. White, McGraw-Hill Inc
5. Fluid Mechanics and Hydraulic Machines, Sukumar Pati, McGraw-Hill Inc
6. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som., G. Biswas, Tata McGraw Hill Co. Pvt. Ltd

B. TECH. SEMESTER – VI
SUBJECT: COMPUTER AIDED DESIGN & MANUFACTURING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

DETAILED SYLLABUS

1 **FUNDAMENTALS OF CAD**
   Introduction to Computer-Aided Design (CAD), Conventional design vs CAD. Advantages of CAD, CAD hardware and software, Architecture of CAD workstation with technical specifications, Interactive Computer Graphics system. Scan conversion, Graphics algorithms (for line, circle etc.), CAD standards

2 **GEOMETRIC TRANSFORMATIONS**
   Geometric transformations: Scaling, Translation, Rotation, Reflection, Shear, Homogeneous coordinate system, Composite transformation

3 **GEOMETRIC MODELING**
   Introduction, Types of geometric modeling: Wire-frame, Surface and Solid modeling. analytical and synthetic curves, non-parametric and parametric representation of curves. analytical and synthetic surfaces. solid modeling representation schemes such as pure primitive instancing, generalized sweeps, hierarchical, octree and cellular decomposition, B-rep, CSG etc. Feature based modelling, Parametric modeling

4 **FUNDAMENTALS OF CAM**
   Introduction to Computer Aided Manufacturing (CAM), role of computers in manufacturing, Numerical Control (NC) and Computerized Numerical Control (CNC), Components of NC/CNC system, specification of CNC system, axis designation, classification of NC/CNC machines, constructional details of CNC machines, NC/CNC tooling

5 **PART PROGRAMMING FOR CNC MACHINES**
   Fundamentals of manual part programming, Manual part Programming for various machining operations on Turning centre and Machining centre, canned cycles

6 **ADVANCES IN CAM**
   Introduction to Group Technology and Flexible Manufacturing System (FMS). Computer aided process planning (CAPP), Computer aided quality control (CAQC)

TEXTBOOKS/ REFERENCE BOOKS

1. CAD-CAM and Automation, Farazdak Haideri, Nirali Prakashan
2. Computer Aided Manufacturing, Rao, Tewari, Kundra, McGraw Hill
3. CNC Machines, Pabla B.S. & Adinathan, New Age publishers
4. Mastering CAD/CAM, Ibrahim Zeid, Mc Graw Hill international
5. Mathematical Elements of Computer Graphics, Roger and Adams, McGraw Hill
6. Computer Aided Design and Manufacturing, Sadhu Singh, Khanna Pub.
7. CAD/CAM, Zimmer & Groover P., Prentice Hall of India
8. CNC Programming, Sinha S. K., Galgotia Publications

B. TECH. SEMESTER – VI
SUBJECT: REFRIGERATION & AIR CONDITIONING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	2	4

DETAILED SYLLABUS

1 FUNDAMENTALS OF REFRIGERATION

Reversed Carnot cycle, maximum coefficient of performance, methods of producing cooling effect

2 REFRIGERATION SYSTEMS

VAPOUR COMPRESSION REFRIGERATION SYSTEM

Factors affecting the performance of the system, actual cycle considering different losses, methods of improving COP.

SINGLE LOAD SYSTEM

Single evaporator with multi expansion valves & flash chambers, compound compression system with flash intercooler with single expansion valve concept of Variable Refrigerant Flow/Volume (VRF or VRV) technology.

VAPOR ABSORPTION REFRIGERATION SYSTEM

Aqua-ammonia system and its analysis, (Li-Br)-Water system, advantages of absorption system over compression refrigeration system, electrolux refrigerator.

AIR-REFRIGERATION SYSTEM

Bell-Coleman refrigeration cycle and its analysis, aircraft refrigeration system and its classification, advantages of air cycle for aircraft refrigeration, DART

3 PSYCHROMETRY & AIR-CONDITIONING

Psychrometric properties, Adiabatic saturation and Thermodynamics wet bulb temperature, psychrometric chart, psychrometer, application of first law to psychrometric process, mixing process, working substance in air-conditioning, basic process in conditioning of air, psychrometric process in air conditioning equipment,

sensible heat factor (SHF) and its use, Grand sensible heat factor (GSHF) and apparatus dew point (ADP), Effective sensible heat factor (ESHF), Cooling towers, Indoor air quality

4 TRANSMISSION AND DISTRIBUTION OF AIR

Introduction, pressure drop in ducts, pressure drop by graphical method, Economic duct dimensions, methods of duct design.

5 AIR-CONDITIONING SYSTEMS
Classification, All year air-conditioning system, Winter air-conditioning, residential, commercial and industrial applications.

6 THERMAL INSULATION & REFRIGERANTS

Insulations: Desired properties and classification, thickness of insulation,

Refrigerants: thermodynamic, chemical & physical requirements, different types of refrigerants, including eco-friendly refrigerants, Refrigerant mixtures

TEXT BOOKS/ REFERENCE BOOKS

1. Refrigeration and Air Conditioning, C. P. Arora, Tata McGraw-Hill New Delhi
2. A course in Refrigeration and Air-Conditioning, S. C. Arora & S. Domkundwar, Dhanpat Rai & Co.
3. Refrigeration and Air Conditioning, Manohar Prasad, Wiley Eastern Ltd.
4. Refrigeration and Air Conditioning, W. F. Stocker and J.W.Jones, McGraw-Hill
5. Principles of Refrigeration, Roy. J Dossat, Pearson Education
6. Refrigeration & air conditioning technology, Whitman, W. C., Johnson, W. M., & Tomczyk, J. Delmar

B. TECH. SEMESTER – VI
SUBJECT: MECHANICAL VIBRATIONS & NOISE

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

DETAILED SYLLABUS

1 **UNDAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS**
   Introduction, Basic terminologies, Simple harmonic motion, Degrees of freedom, Derivations of differential equations, Solution of a differential equation, Rayleigh's energy method, Torsional vibrations, Equivalent stiffness of spring combinations: spring in series, spring in parallel, inclined springs.

2 **DAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS**
   Introduction, Different types of damping, over-damped system, critically-damped system, under-damped system, logarithmic decrement, Viscous dampers: Fluid Dashpot, Eddy current damping, Dry friction damping, Solid damping, Slip damping.

3 **FORCED VIBRATIONS OF SINGLE-DEGREE OF FREEDOM SYSTEMS**
   Introduction, forced vibration with constant harmonic excitation, Force vibration with rotating and reciprocating unbalance, forced vibrations due to excitation of support, Absolute amplitude, Relative amplitude, Energy dissipated by damping, Vibration isolation and transmissibility, Force transmissibility, Motion transmissibility. Vibration measuring instruments: Vibrometer, velocity pick-ups, accelerometer, and frequency measuring instruments, Introduction to proximeter, condition monitoring using vibration meters.

4 **TWO DEGREE OF FREEDOM SYSTEMS**
   Introduction, Principal modes of vibration, Cases of two degrees of freedom undamped free systems, Undamped forced vibration with harmonic excitation, Vibration absorbers, Vibration isolation.

5 **CRITICAL SPEED OF SHAFTS**
   Introduction, Critical speed of a single disc with and without damping, Secondary critical speed.

6 **NOISE AND ITS MEASUREMENT**

Introduction to noise and its causes, Basic terminologies, Decibel scale, Frequency and sound-dependent human response, Sound pressure level, Sound power level, Sound intensity scale, Addition, subtraction, and averaging decibel levels, Loudness, Standard of noise level and exposure limits, Measurement and analysis of noise, Measurement environment, Noise measuring equipment: Sound level meter, Integrating sound level meter, and Noise dosimeter

TEXTBOOKS/ REFERENCE BOOKS

1. Mechanical Vibrations by Grover, G.K., 8th Ed., Nem Chand and Brothers, 2003
2. Mechanical Vibrations and Noise Engineering by A. G. Ambekar, PHI Publication.
3. Mechanical Vibration by Singiresu S. Rao, 5th Ed., Pearson Publication.
4. Mechanical Vibrations by Singh, V.P., Dhanpat Rai & Co.
5. Mechanical Vibrations by Shrikant Bhave, Pearson Publication.
6. Theory of Vibration with Applications by Thomson W.T., 5th Ed., Pearson Publication.
7. Principles of Vibration by Benson H. Tongue, Oxford University Press.
8. Theory of Machines & Mechanisms by P.L.Ballaney, Khanna Publishers, Delhi.
9. Vibrations and noise for engineers by K. Pujara, Dhanpat Rai & Co.

B. TECH. SEMESTER – VI
SUBJECT: PRODUCTION TECHNOLOGY

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

DETAILED SYLLABUS

1 THEORY OF METAL CUTTING
Principles of metal machining, cutting tools and tool materials, tool signature, mechanics of chip removal, cutting forces and parameters effecting it, cutting fluids, tool wear, tool life, economics of machining. Multi point cutting tools, temperature measurement at tool-work interface and its effects

2 GEAR AND THREAD MANUFACTURING
Different types of Threads manufacturing methods, and tools involved, Different gear forming and generating methods with their special features, Gears finishing processes

3 JIGS & FIXTURES
Definition, its usefulness in mass production, design principles, locating systems and types of locators & clamps, jig bushes, design of jigs and fixtures for various machining operations

4 UNCONVENTIONAL MACHININIG
Process principle, process equipment for various unconventional machining processes like - EDM, wire cut EDM, ECM, ECG, CM, AJM, USM, PAM, LBM, WJM

5 DRIVE AND CONTROLS IN MACHINE TOOLS
Introduction to drives in machine tools, classification of machine tool drives, selection of maximum and minimum speeds and feeds, stepped regulators and stepless regulators for spindle drive

6 SEMI AUTOMATS AND AUTOMATS:
Classification of automats, specifications, Capstan and turret lathes, tooling equipment, bar stock feeding methods, tool layout for turret, capstan and automats, single spindle and multi spindle automats

TEXT BOOKS/REFERENCE BOOKS

1. A Textbook of Production Engineering, P. C. Sharma, S. Chand & Company Limited
2. Modern Machining Processes, P. C. Pandey and H. S. Shan, Tata McGraw Hill

3. Production Technology, HMT, Tata McGraw-Hill Education Pvt Limited
4. Production engineering and science, P. C. Pandey and C. K. Singh, Standard Publishers Distributors
5. Jigs and Fixtures, P. H. Joshi, Tata McGraw Hill Education Private Limited
6. A Textbook of Production Technology, P. C. Sharma, S. Chand & Company Limited
7. Manufacturing Science, A. Ghosh and A. K Mallik, East West Press Pvt Ltd
8. Metal Cutting principles, M C Shaw, Oxford University press

B. TECH. SEMESTER – VI
SUBJECT: AUTOMOBILE SYSTEMS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

DETAILED SYLLABUS

1   **VEHICLE PERFORMANCE AND STRUCTURE**
Vehicle motion, Resistances during motion, Power required for acceleration and constant velocity motions, Tractive efforts and draw bar pull, Power required and engine characteristics, Gear ratio requirement. Study various vehicle layouts as front engine and front wheel drive, front engine & rear wheel drive, rear engine & rear wheel drive, Components of transmission system, Four-wheel drives. Types of Chassis frames & body, Material, Frameless construction.

2   **AUTOMATIC TRANSMISSION AND DRIVE LINES**
Requirements, types, Torque converter, Epicyclic gearbox, Continuously variable transmission, Overdrive. Propellers shaft, Types of drive, Final drive types, Type of drive axles & differential.

3   **CLUTCH AND MANUAL TRANSMISSION**
Functions, Type of clutches, Lining material, Release mechanism, Fluid flywheel. Types of gear boxes, Gear ratios, Transfer case.

4   **STEERING AND SUSPENSION SYSTEMS**
Steering requirements, steering system and linkages, steering gears, Steering geometry, Ackermann linkages, Power steering. Purpose, Types of suspension system, Front and rear suspension, Coil spring, Leaf spring, Torsion bars, Shock absorbers, Air and rubber suspension, Plastic suspensions, Independent suspension, Antiroll bar or stabilizer.

5   **BRAKES, WHEELS AND TYRES**
Function, Internal expanding brakes, Brake lining material, Properties, Hydraulic braking system, Pneumatic braking system, Types of wheel rims, Types of tyres, Cross ply, Radial & tubeless tyres, Specifications of tyres, wheel balancing.

6   **HYBRID ELECTRIC VEHICLES AND AUXILLARIES**
Introduction to Hybrid Electric Vehicles, Architecture of hybrid and electric vehicles, Regenerative braking, Control system for hybrid and electric vehicles. Battery: Construction, working, methods of rating, charging methods, test,

generator and cranking motor with drive purpose. Modern technique, Safety provisions, like air bags/ safety belts, Traction control system

TEXT BOOKS/ REFERENCE BOOKS

1. Heinz Heisler, —Vehicle and Engine Technology, Arnold, London
2. Dr. Kirpal Singh, —Automobile Engineering Vol- I & II, Standard Pub & Dist.
3. Dr. N.K.Giri, —Automobile Technology, Khanna Pub
4. R.B.Gupta, —Automobile Engineering, Satya Prakashan, New Delhi
5. Narang G.B.S., —Automobile Engineering, Khanna Publishers, New Delhi.
6. Crause, W.H., —Automobile Mechanics, Tata McGraw Hill, New Delhi.

B. TECH. SEMESTER – VI
SUBJECT: QUALITY ENGINEERING & RELIABILITY

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	0	60	0	0	0	60	3	0	0	3

DETAILED SYLLABUS

1   INTRODUCTION
Quality – Concept, Different Definitions and Dimensions, Inspection, Quality Control, Quality Assurance and Quality Management, Views of different Quality Gurus, 7 basic QC Tools

2   SIX SIGMA AND PROCESS CAPABILITY ANALYSIS
Methodology of Six Sigma DMAIC, Statistics associated with Six Sigma, Determination of Defects per unit (DPU), Defects per million opportunities (DPMO) and calculating of sigma value of the process, Process capability index - Cp, upper and lower capability indices - Cpk.

3   RECENT TRENDS IN QUALITY MANAGEMENT
Seven Industrial wastes, Lean tools – 5S, visual management, Poka-Yoke, Kaizen, Value stream mapping, Cost of quality, TPM, SMED, JIT and Kanban.

4   DESIGNING FOR QUALITY AND QUALITY SYSTEMS
Quality Function Deployment (QFD), Failure Mode and Effect Analysis (FMEA) – Concept, Methodology and Application. Need for ISO 9000, ISO 9000-2015 Quality System – Elements, Documentation, ISO 14000 – Concepts, Requirements and Benefits.

5   DESIGN OF EXPERIMENTS
Introduction, Methods, Taguchi approach, Steps in experimental design, S/N ratio and analysis of results.

6   RELIABILITY
Reliability Engineering Fundamentals, Basic Elements of Reliability, Measurement of Reliability, Maintenance and Reliability, Quality and Reliability, System Reliability

TEXT BOOKS/ REFERENCE BOOKS

1. Statistical Quality Control by M. Mahajan, Dhanpat Rai Publication
2. Total Quality Management by P. M. Charantimath, Pearson Education
3. Total Quality Management by S. Ramasamy, Tata McGraw Hill
4. Quality Management: A process improvement approach by M. A. Fryman, Cengage Learning
5. Total Quality Management by P. N. Mukherjee, Prentice-Hall of India
6. Total Quality Management- Principles and Practices, Tools and Techniques by K. Suri, Katson Books Publication
7. Taguchi Techniques for Quality Engineering by P. J. Ross, Tata McGraw Hill.

B. TECH. SEMESTER – VI
SUBJECT: PRESSURE VESSELS & PIPING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	0	60	0	0	0	60	3	0	0	3

DETAILED SYLLABUS

1 FACTORS INFLUENCING THE DESIGN OF VESSELS
Types of vessels, methods of fabrication, Design Preliminaries like types of stresses, material of vessel, factor of safety, Poisson's ratio, criteria in vessel design like excessive elastic deformation, plastic instability, brittle rupture and creep, corrosion,

2 VESSELS UNDER INTERNAL/EXTERNAL PRESSURES
General theory of membrane stresses in vessels and its applications to shells and end-closures, stress concentration in plate with hole, Design of nozzles, reinforcement pads, flanges and gaskets, design of pressure vessels under external pressure wall in presence and absence of stiffeners, design of closers subjected to external pressure

3 VESSEL SUPPORTS
Selection and design of different types – bracket or lug support, skirt support & saddle support

4 HIGH PRESSURE VESSELS
Types, design procedure, construction features and materials for high pressure shell and closures

5 PIPING ANALYSIS
Flow diagram, piping layout and piping stress analysis, flexibility factor and stress intensification factor; design of piping system as per B31.1 piping code, piping components and their behaviour

6 PRESSURE VESSEL DESIGN
Introduction to vessel and piping codes and standards, design of vessels for various applications using codes and standards

TEXT BOOKS/ REFERENCE BOOKS

1. Mechanical System Design, Farazdak Haideri, Nirali Prakashan
2. Process equipment design, Brownell L. E & Young. E. D, Wiley Eastern Ltd., India
3. Pressure vessel design, Harvey J F, CBS publication
4. Fundamentals of Machine Components Design, Juvinal R.C, Wiley, India
5. ASME Pressure Vessel and Boiler code, Section VIII Div 1, 2, and 3.
6. American standard code for pressure piping, B 31.1
7. Pressure vessel Design Hand book, Henry H Bednar, CBS publishers and distributors
8. Design Data (PSG College of Engg. & Tech.), DVP Printers

B. TECH. SEMESTER – VI
SUBJECT: ADDITIVE MANUFACTURING & REVERSE ENGINEERING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	0	60	0	0	0	60	3	0	0	3

DETAILED SYLLABUS

1   INTRODUCTION TO ADDITIVE MANUFACTURING (AM)
Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Introduction to AM, AM evolution, Distinction between AM & CNC machining, Generic Steps in AM processes, Classification of AM processes

2   VAT PHOTOPOLYMERIZATION AM PROCESS
Stereo lithography Apparatus, Working Principles, details of processes, Products, materials, advantages, limitations and applications - Case studies

3   AM PROCESSES FOR SOLID MATERIALS
Fused deposition Modeling, Laminated object manufacturing Working Principles, details of processes, Products, materials, advantages, limitations and applications - Case studies

4   AM PROCESSES FOR POWDER MATERIALS
Selective Laser Sintering, Direct Metal Laser Sintering, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam melting (EBM): Processes, materials, products, advantages, applications and limitations – Case Studies.

5   DATA PROCESSING AND POST PROCESSING
Additive manufacturing file formats, Defects and Issues in Data Formats; Pre-processing – Part orientation and support structure generation, Model Slicing, Contour Generation, Tool Path Generation, Build File preparation, Machine Set-up; Post Processing – Product quality evaluation, support structure removal, Improvement of finish, geometry and aesthetics.

6   REVERSE ENGINEERING (RE) AND CAD MODELING
Basic concept, Digitization techniques, Model Reconstruction, Data Processing for Rapid Prototyping, Reverse Engineering methodologies and techniques,

Selection of RE systems, RE software, RE hardware, RE in product development.

TEXT BOOKS/ REFERENCE BOOKS

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing by Ian Gibson, David W Rosen, and Brent Stucker, Springer.
2. Rapid Prototyping: Principles and Applications in Manufacturing by Rafiq Noorani John Wiley and Sons.
3. Reverse engineering -An industial perspective by Vinesh Raja, Kiran J Fernandes, Springer.
4. Rapid Prototyping: Laser-based and Other Technologies, Patri K. Venuvinod and Weiyin Ma, Springer.
5. Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling by D.T. Pham, and S.S. Dimov, Springer.
6. 3D Printing and Additive Manufacturing: Principles & Applications, Chua Chee Kai, and Leong Kah Fai, World Scientific, 2015.

B. TECH. SEMESTER – VI
SUBJECT: SUPPLY CHAIN MANAGEMENT

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	0	60	0	0	0	60	3	0	0	3

DETAILED SYLLABUS

1   INTRODUCTION
Introduction of logistics, inbound-outbound logistics, supply chain objectives, importance of supply chain management, process view-push/pull, supply chain drivers and barriers.

2   SUPPLY CHAIN NETWORK

Role of supply chain network, design options for network- drop shipping hub and spoke method, warehouse storage, last- mile delivery, cross-dock, customer pick up points, factors affecting network, design decision.

3   TRANSPORTATION IN SUPPLY CHAIN

Role and importance of transportation in supply chain, modes of transportation, options for design of transportation network.

4   SOURCING AND PRICING

Sourcing strategies and benefits, third party logistics and fourth party logistics, supplier assessment and selection, 4R strategy for revenue management.

5   COORDINATION IN A SUPPLY CHAIN

Bull-whip effect, vendor managed inventory, collaborative planning, forecasting and replenishment, customer relationship management, supplier relationship management, role and benefits of IT in supply chain management, supply resource management, customer relationship management, ERP, E-commerce.

6   STRATEGIC ALLIANCE AND INTEGRATION IN SUPPLY CHAIN

Reasons and purpose of strategic alliance (SA), ways and means of entering into SA, types of SA, concept, types and benefits of supply chain integration.

TEXT BOOKS/ REFERENCE BOOKS

1. Supply Chain Management: Strategy, Planning, and Operation by S. Chopra and P. Meindel, Pearson Education.
2. Industrial Engineering and Production Management by Martang Telsang, S. chand.
3. Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies by D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi, McGraw-Hill Publication.
4. Supply Chain Management- Processes, System and Practice by N. Chandrasekaran, Oxford University Press
5. Operations Management; Contemporary Concepts and Cases by Shroeder, G., McGraw Hill publication

B. TECH. SEMESTER – VI

SUBJECT: INDUSTRIAL ENGINEERING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	0	60	0	0	0	60	3	0	0	3

DETAILED SYLLABUS

1 **INTRODUCTION TO INDUSTRIAL ENGINEERING AND PRODUCTIVITY**

Objectives of industrial engineering, function if an industrial engineer, techniques of industrial engineering, introduction to productivity, difference between production and productivity, productivity measures factors influencing productivity, productivity improvement tools.

2 **PLANT LOCATION SELECTION AND PLANT LAYOUT**

Introduction, system view of location, comparison of location, factor affecting plant location, quantitative methods for evaluation of plant location, principals of plant layout, types of plant layout, factors affecting layout, types of flow patterns.

3 **INSPECTION AND STATISTICAL QUALITY CONTROL**

Introduction, types of inspection, method of inspection, quality control and statistical quality control, tools for SQC, control charts for variables and attribute, acceptance sampling.

4 **ERGONOMICS**

Introduction, Man machine system, Anthropometry, Work place design.

5 **ENTREPRENEURSHIP**

Introduction, concept, functions of an entrepreneur, product identification, sources of industrial finance, resources allocation, government incentives to entrepreneurs.

6 **FUNCTIONAL MANAGEMENT**

Marketing Management, Operations Management, Material management and purchasing, Personnel Management, Financial Management, Maintenance management.

TEXT BOOKS

1. Industrial Engineering and Production Management by Martang Telsang, S. chand.
2. Industrial Engineering and Production Management by M. Mahajan, Dhanpat Rai & Co.

REFERENCE BOOKS

1. Industrial Organisation & Engineering Economics, T. R. Banga & S.C. Shrama,, Khanna Publishers.
2. Industrial Engineering, Vivek Deshpande, Mehul Gor and Jaydeepsinh Ravalji, Ria publishing house.
3. Production and Operations Management, Everett E. Adam, Ronald J. Ebert, Prentice Hall of India