UTTAR PRADESH TECHNICAL UNIVERSITY, LUCKNOW

Syllabus

[Effective from Session 2013-14]

(1st Year)

[Common to all B.Tech. Branch except Agricultural Engineering]

B.Tech. First Year (Common to all B.Tech. Courses except B.Tech. Agricultural Engg.)

(Effective from the session 2013-14)

Semester-I

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assesment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NAS 103	Engg. Mathematics-I	3	1	0	30	20	50	100	150	4
2	NEC-101/ NAS-104	Electronics Engg./ Professional Communication	3	1	0	30	20	50	100	150	4
3	NAS102/ NME102	Engg. Chemistry/Engg. Mechanics	3	1	0	30	20	50	100	150	4
4	NEE-101/ NCS 101	Basic Electrical Engg./Computer System and Programming in C	3	1	0	30	20	50	100	150	4
5	NAS-101	Engg. Physics-I	2	1	0	15	10	25	50	75	3
6	NME-101/ NAS-105	Basic Manufacturing Processes/Environment & Ecology	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NAS-152/ NME-152	Engg. Chemistry Lab/ Engg. Mechanics Lab	0	0	2	10	10	20	30	50	1
8	NEE-151/ NCS-151	Basic Electrical Engg. Lab/ Computer Programming Lab	0	0	2	10	10	20	30	50	1
9	NEW-151/ NCE-151	Workshop Practice/ Computer Aided Engg. Graphics	0	1	3	10	10	20	30	50	2
10	NAS-151/ NAS-154	Engg. Physics Lab/ Professional Communication Lab	0	0	2	10	10	20	30	50	1
11	GP-101	GP						50		50	
		TOTAL	16	6	9					1000	26

L- Lecture

T -Tutorial

P-Practical

CT-Cumulative Test

TA-Teacher's Assessment

ESE-End Semester Examination

Semester-II

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assesment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NAS-203	Engg. Mathematics-II	3	1	0	30	20	50	100	150	4
2	NEC-201/ NAS-204	Electronics Engg./ Professional Communication	3	1	0	30	20	50	100	150	4
3	NAS-202/ NME-202	Engg. Chemistry/ Engg. Mechanics	3	1	0	30	20	50	100	150	4
4	NEE-201/ NCS-201	Basic Electrical Engg./ Computer System and Programming in C	3	1	0	30	20	50	100	150	4
5	NAS-201	Engg. Physics-II	2	1	0	15	10	25	50	75	3
6	NME-201 / NAS-205	Basic Manufacturing Processes / Environment & Ecology	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NAS-252/ NME-252	Engg. Chemistry Lab/ Engg. Mechanics Lab	0	0	2	10	10	20	30	50	1
8	NEE-251/ NCS-251	Basic Electrical Engg. Lab/ Computer Programming Lab	0	0	2	10	10	20	30	50	1
9	NWS-251/ NCE-251	Workshop Practice / Computer Aided Engg. Graphics	0	1	3	10	10	20	30	50	2
10	NAS-251/ NAS-254	Engg. Physics Lab / Professional Communication Lab	0	0	2	10	10	20	30	50	1
11	GP-201	GP						50		50	
		TOTAL	16	6	9					1000	26

Engineering Mathematics - I
(NAS-103)

L	T	P
3	1	0

Unit - 1: Differential Calculus - I

Leibnitz's theorem, Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.

Unit - 2: Differential Calculus - II

Taylor's and Maclaurin's Theorems, Expansion of function of several variables, Jacobian, Approximation of errors, Extrema of functions of several variables, Lagrange's method of multipliers (Simple applications).

Unit - 3: Linear Algebra

Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form), Linear dependence, Consistency of linear system of equations and their solution,. Characteristic equation, Eigen values and eigen vectors, Cayley-Hamilton Theorem,A brief introduction to Vector Spaces,Subspaces. Rank & Nullity. Linear transformations.

Unit - 4: Multiple Integrals

Double and triple integrals, Change of order of integration, Change of variables, Application of integration to lengths, Volumes and Surface areas – Cartesian and Polar coordinates. Beta and Gamma functions, Dirichlet's integral and applications.

Unit - 5: Vector Calculus

Point function, Gradient,Divergence and Curl and their physical interpretations, Vector identities, Directional derivatives. Line,Surface and Volume integrals, Applications of Green's, Stoke's and Gauss divergence theorems (without proofs),

Text Books:

1. **E. Kreyszig :Advanced Engineering Mathematics-Volume-I,JohnWiley & Sons**
2. **B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw- Hill Publishing Company Ltd.**
3. **R.K.Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.**

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Thomas & Finley, Calculus, Narosa Publishing House
4. Rukmangadachari, Engineering Mathematics – I, Pearson Education.

NEC-101/NEC-201: ELECTRONICS ENGINEERING

Chapters/ Books **L T P 3 1 0**

Unit -1	**1st Book**	**10 Lecture**
Semiconductor Diode Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance, Diode Equivalent Circuits, Transition and Diffusion Capacitance, Zener Diodes breakdown mechanism (Zener and avalanche)	**Chapter 1/1**	**2**
Diode Application Series , Parallel and Series, Parallel Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits	**Chapter 2/1**	**6**
Special Purpose two terminal Devices Light-Emitting Diodes, Varactor (Varicap) Diodes, Tunnel Diodes, Liquid-Crystal Displays.	**Chapter 16/1**	**2**
Unit II	**1st Book**	**12 Lecture**
Bipolar Junction Transistor Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration	**Chapter 3/1**	**2**
DC Biasing BJTs Operating Point, Fixed-Bias, Emitter Bias, Voltage-Divider Bias Configuration. Collector Feedback, Emitter-Follower Configuration. Bias Stabilization. CE,CB,CC amplifiers and analysis of single stage CE amplifier	**Chapter 4/1**	**6**
Field Effect Transistor Construction and Characteristic of JFETs. Transfer Characteristic. CS,CD,CG amplifier and analysis of CS amplifier MOSFET (Depletion and Enhancement)Type, Transfer Characteristic,	**Chapter 6/1**	**4**
Unit III	**1st Book**	**6 Lecture**
Operational Amplifiers Introduction, Differential Amplifier Circuits, Op-Amp Basic, Practical Op-Amp Circuits (Inverting Amplifier, Noninverting Amplifier, Unit Follower, Summing Amplifier, Integrator, Differentiator). Differential and Common-Mode Operation	**Chapter 10 10.1,10.4, 10.5, 10.9 1st Book**	**6**
Unit IV	**2nd Book**	**4 Lecture**
Digital Voltmeter : Introduction, RAMP Techniques **Digital Multimeters**: **Oscilloscope**: Introduction, Basic Principle, CRT , Block Diagram of Oscilloscope, Simple CRO, Measurement of voltage , current phase and frequency using CRO	**5.1, 5.2 2rd Book 6.2 2nd Book 7.1,7.2,7.3, 7.4,7.5,7.20 2nd Books**	**4**
Unit V	**3rd Book**	**8 Lecture**
Fundamentals of Communication Engineering : Elements of a Communication System, Need of modulation, electromagnetic spectrum and typical applications, terminologies in communication systems, Basics of signal representation and analysis, Fundamentals of amplitude and angle modulation, modulation and demodulation techniques.	**Chapter 1, 2 3rd Book**	**8**

Text Books

1. Robert L. Boylestad &Louis Nashelsky "**Electronic Devices and Circuit Theory**" , Tenth Edition, Pearson Education, 2013
2. H S Kalsi, "**Electronics Instrumentation**," Third Edition, TMH Publication 2012

3. George Kennedy, "**Electronic Communication System**", Fifth Edition , TMH Publication, 2012

Reference Books

4. Devid A. Bell " **Electronics Devices and Circuits**", 5th Edition, OXFORD University Press 2008
5. Jacob Millman/ Christos C. Halkias/ Satyabrata Jit "**Electronics Devices and Circuits**", 3rd Edition , TMH 2008

NAS-104/NAS-204 : PROFESSIONAL COMMUNICATION

L T P
3 1 2

Unit-1 Fundamentals of Communication

Technical Communication: features: Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communications; The flow of Communication: Downward, Upward, Lateral of Horizontal (Peer group): Importance of technical communication; Barriers to Communication.

Unit-II Constituents of Technical Written Communication

Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; **Correct Usage**: all Parts of Speech; Modals; Concord; Articles; Infinitives; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation-various steps.

Unit-III Business Communication

Principles, Sales & Credit letters;
Claim and Adjustment Letters; Job application and Resumes**.**
Reports: Types; Significance; Structure, Style & Writing of Reports.
Technical Proposal; Parts; Types; Writing of Proposal; Significance.
Negotiation & Business Presentation skills.

Unit-IV Presentation Strategies and Listening Skills.

Defining Purpose; Audience & Local; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Listening Skills: Active Listening, Passive Listening. methods for improving Listening Skills.

Unit-V Value-Based Text Readings

Following essays form the suggested text book with emphasis on Mechanics of writing.
(i) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
(ii) The Language of Literature and Science by A. Huxley
(iii) Man and Nature by J.Bronowski
(iv) The Social Function of Literature by Ian Watt
(v) Science and Survival by Barry Commoner
(vi) The Mother of the Sciences by A.J.Bahm
(vii) The Effect of Scientific Temper on Man by Bertrand Russell.

Text Book

1. Improve Your Writing ed. V.N.Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi..
2. Technical Communication: A Practical Approach: Madhu Rani and Seema Verma- Acme Learning, New Delhi-2011
3. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press,2007, New Delhi.

Reference Books

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt.Ltd,2011, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C.Sharma & Krishna Mohan, Tata McGraw Hill & Co.Ltd.,2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. &Distributors, 2009,Delhi.
4. Developing Communication Skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd. 1990, Delhi.
5. Manual of Practical Communication by L.U.B.Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
6. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
7. Spoken English- A manual of Speech and Phonetics by R.K.Bansal & J.B.Harrison, Orient Blackswan, 2013, New Delhi.
8. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi.

NAS 102/ NAS 202

ENGINEERING CHEMISTRY

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UNIT-I

Molecular orbital theory and its applications in diatomic molecules. Band theory of solids. Lequid crystals. Application of liquid crystals. Types of unit cell, space lattice (only cubes), Bragg's equation. Calculation of density of unit cell. One and two dimensional imperfections in solids. Structure and applications of Graphite and Fullerenes.

UNIT-II

Polymers, its classification and their applications. Chain and Step growth polymerization. Thermoplastic and Thermosetting resins. Elastomers and synthetic fibres. Conducting and biodegradable polymers. General methods of synthesis of organometallic compound (Grignard Reagent) and their applications in polymerization and catalysis.

UNIT-III

Stereochemistry with special reference to optical isomerism. Types of organic reactions with special reference to elimination and substitution reaction. Elementary ideas and simple applications of UV, Visible, IR and ^{1H}NMR spectral Techniques.

UNIT-IV

Hardness of water. Disadvantage of hard water. Techniques for water softening; Calgon, Zeolite, Lime-Soda, Ion exchange resin, Reverse osmosis. Water treatment method for boiler feed by internal process. Phase Rule and its application to one component system (water and sulphur).

UNIT-V

Fuels; Classification of fuels. Analysis of Coal. Determination of Calorific values. Biogas and Biomass. Cement and its application. Plaster of paris. Lubricant. Corrosion; causes and prevention.

Textbook

1. Chemistry for Engineers, by S. Vairam and Suba Ramesh; Wiley India

Reference Books

1. Textbook of Engineering Chemistry by Dr. Gopal Krishna Bhatt, Acme Publishers
2. Chemistry (9th ed), by Raymond Chang, Tata McGraw-Hill
3. Chemistry Concepts and Applications by Steven S. Zumdahl; Cengage Learning
4. Engineering Chemistry, Wiley India
5. Engineering Chemistry Author: Abhijit Mallick, Viva Books
6. Text Book of Engineering Chemistry by Harsh Malhotra; Sonali Publications
7. Concise Inorganic Chemistry by J.D. Lee; Wiley India
8. Organic Chemistry (6 ed) by Morrison & Boyd; Pearson Education
9. Physical Chemistry by Gordon M. Barrow; Mc-Graw Hill
10. Organic Chemistry, Volume 1(6 ed)& 2 (5ed) by I. L. Finar; Pearson Education
11. Atkins' Physical Chemistry by Peter Atkins & Julio De Paula; Oxford University Press

NME-102/202: Engineering Mechanics: L T P [3 1 0]

Unit	Topic	Contact Hours
I	**Force Systems:** • Basic concepts: Definitions, Basic assumptions, Scalar & Vector quantities, Free, Forced and fixed vectors. • Force System: Force, Classification & Representation, Force as a Vector, Composition of forces, Parallelogram Law, Resolution, Principle of Transmissibility of forces • Moment of a force, Vector representation, Moment for coplanar force system, Varignon's theorem • Couple, Vector representation, Resolution of a force into a force and a couple. • Force Systems: Coplanar Concurrent Force system and Coplanar Non Concurrent force systems, Resultant of coplanar force system. • Equilibrium of coplanar force system, Free body diagrams, Determination of reactions, Equilibrium of a body under three forces, Lami's theorem. **Friction:** • Introduction, Wet and Dry friction, Theory of Dry friction, Angle of friction, Angle of Repose, Cone of friction, Coulomb's laws of friction.	8
II	**Basic Structural Analysis:** • **Plane Truss**, Difference between truss and frame, Perfect and imperfect truss, Assumptions and Analysis of Plane Truss , Method of joints, Method of section, Zero force members. • Beams, Types of beams, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear and bending moment.	8
III	**Centroid and Moment of Inertia:** • Center of Gravity, Center of Mass and Centroid of curves, areas, volumes, Determination of centroid by integration, Centroid of composite bodies. • Definition of Moment of inertia of area, Perpendicular axis theorem and Polar moment of Inertia, Parallel axis theorem, Moment of inertia of simple areas by integration, Moment of Inertia of Composite Areas. • Moment of Inertia of masses, Parallel axis theorem for mass moment of inertia, Mass moment of inertia of simple bodies by integration, Mass moment of inertia of composite bodies.	8
IV	**Kinematics of Rigid Body:** • Introduction, Absolute motion, Plane rectilinear motion of rigid body, Plane curvilinear Motion of rigid body, x-y and n-t components, Rotation of rigid bodies, Relative Motion, Plane Motion of rigid bodies, Instantaneous center of zero velocity **Kinetics of Rigid Body:** • Introduction, Force, Mass and Acceleration, Newton's law of	9

	motion, D'Alembert's Principles and Dynamic Equilibrium, Laws of motion applied to planar translation, rotation and plane motion. • Work and Energy, Kinetic energy, Principle of work and energy, Conservative forces, Law of conservation of energy, • Linear Impulse and Momentum, Conservation of linear momentum.	
V	**Mechanics of Deformable Solids:** • **Simple stress and strain**: Normal and shear stresses. One Dimensional Loading; members of varying cross section, bars in series. Tensile Test diagram for ductile and brittle materials, Elastic constants, Strain energy. • **Bending of Beams**: theory of pure bending, neutral surface and neutral axis, stresses in beams of different cross sections. • **Theory of Torsion**, Torque and twist, Shear stress due to torsion circular sections.	**08**

References:

1. "Engineering Mechanics: Statics" , J.L Meriam , Wiley
2. "Engineering Mechanics: Dynamics" , J.L Meriam , Wiley
3. "Engineering Mechanics " , F L Singer
4. "Engineering Mechanics : Statics and Dynamics", R. C. Hibbler, Pearson
5. "Engineering Mechanics " , Thimoshenko & Young , 4ed, Tata McGraw Hill
6. "Engineering Mechanics: Statics and Dynamics", A. Nelason, McGraw-Hill
7. "Engineering Mechanics : Statics and Dynamics", Shames and Rao, Pearson
8. "Engineering Mechanics : Statics and Dynamics", S. Rajasekaran and G. Sankarasubramanian, Vikas
9. "Engineering Mechanics", V. Jayakumar and M. Kumar, PHI
10. "Engineering Mechanics", D. P. Sharma, PHI
11. "Engineering Mechanics", M. V. Sheshagiri Rao, and D. Rama Durgaiah, University Press.
12. "Engineering Mechanics" , K L Kumar and V. Kumar, McGraw Hill
13. "Engineering Mechanics" , Bhattacharya , Oxford Press
14. "Engineering Mechanics " , Dr Sadhu Singh , Umesh Publications
15. "Engineering Mechanics " , Bhavikatti , New Age
16. "Strength of Materials" F. L.Singer
17. "Strength of Materials" Thimoshenko & Young
18. "Mechanics of Solids", R. C. Hibbler, Pearson
19. "Mechanics of Solids", A. Mubeen, Pearson

NEE101/NEE201: ELECTRICAL ENGINEERING

L T P 3 1 0

Unit-I

1. D C Circuit Analysis and Network Theorems:

Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation

Kirchhoff's laws; Loop and nodal methods of analysis; Star-delta transformation

Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem (Simple numerical problems) 9

Unit-II

2. Steady- State Analysis of Single Phase AC Circuits:

AC fundamentals: Sinusoidal, square and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC Circuits, Resonance in series and parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers, Power factor, Causes and problems of low power factor, Concept of power factor improvement (Simple numerical problems) 8

Unit-III

3. Three Phase AC Circuits:

Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power and its measurement (simple numerical problems). 3

4. Measuring Instruments:

Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers) 4

Unit-IV

5. Introduction to Earthing and Electrical Safety:

Need of Earthing of equipment and devices, important electrical safety issues. 2

6. Magnetic Circuit:

Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Mutual coupling with dot convention, Magnetic circuit calculations. 3

7. Single Phase Transformer:

Principle of operation, Construction, EMF equation, Equivalent circuit, Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer. 3

Unit-V

8. Electrical Machines:

Concept of electro mechanical energy conversion

DC machines: Types, EMF equation of generator and torque equation of motor, Characteristics and applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Types, Principle of operation, Slip-torque characteristics, Applications

(Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications. 8

Text Books:

1. "Principles of Electrical Engineering", V. Del Toro,; Prentice Hall International
2. "Basic Electrical Engineering", D P Kothari, I.J. Nagarath; Tata McGraw Hill
3. "Basic Electrical Engineering", S N Singh; Prentice Hall International
4. "Fundamentals of Electrical Engineering", B Dwivedi, A Tripathi; Wiley India
5. "Basic Electrical Engineering", Kuldeep Sahay, New Age International Publishers

Reference Books:

1. "Electrical and Electronics Technology", Edward Hughes; Pearson
2. "Engineering Circuit Analysis", W.H. Hayt & J.E. Kimerly; Mc Graw Hill
3. "Basic Electrical Engineering", C L Wadhwa; New Age International
4. "Basic Electrical Engineering", T.K. Nagsarkar,M.S. Shukhija; Oxford University Press

NCS-101/NCS-201 Computer System and Programming in C

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Unit1 (10 Lectures)

Basics of Computer: Introduction to digital computer, basic operations of computer, functional components of computer, Classification of computers.

Introduction to operating system: [DOS, Windows, Linux and Android] purpose, function, services and types.

Number system : Binary, octal and hexadecimal number systems, their mutual conversions, Binary arithmetic.

Basics of programming: Approaches to Problem Solving, Concept of algorithm and flow charts, Types of computer languages:- Machine Language, Assembly Language and High Level Language, Concept of Assembler, Compiler, Loader and Linker.

Unit2 (8 Lectures)

Standard I/O in C, Fundamental data types- Character type, integer, short, long, unsigned, single and double floating point, Storage classes- automatic, register, static and external**,** Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associativity.

Fundamentals of C programming: Structure of C program**,** writing and executing the first C program, components of C language. Standard I/O in C.

Unit3 (10 Lectures)

Conditional program execution: Applying if and switch statements, nesting if and else, use of break and default with switch**,** program loops and iterations: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing values to functions, recursive functions.

Unit 4 (6 Lectures)

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Structure, union, enumerated data types

Unit 5 (8 Lectures)

Pointers: Introduction, declaration, applications

File handling**,** standard C preprocessors**,** defining and calling macros, conditional compilation, passing values to the compiler.

NAS-101: ENGINEERING PHYSICS-I

Unit - I

Relativistic Mechanics **06 Hrs**.

Inertial & non-inertial frames, Michelson- Morley experiment, Einsteins postulates, Lorentz transformation equations, Length contraction & Time dilation, Addition of velocities; Variation of mass with velocity, Mass energy equivalence.

Unit - II **06 Hrs.**

Modern Physics

Wave Mechanics: Wave- particle duality, de-Broglie matter waves, Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications, Wave function and its significance, Schrödinger's wave equation – particle in one dimensional potential box, Eigen values and Eigen function.

Unit - III **10 Hrs.**

Wave Optics

Interference: Interference of light, Interference in thin films (parallel and wedge shaped film), Newton's rings.

Diffraction: Single, double and N- Slit Diffraction, Diffraction grating, Grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating.

Polarization: Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Retardation Plate.

Unit - IV **08 Hrs.**

Modern Optics

Laser: Spontaneous and stimulated emission of radiation, population inversion, concept of 3 and 4 level Laser, construction and working of Ruby, He-Ne lasers and laser applications.

Fiber Optics: Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and cone, Numerical aperture, Single and Multi Mode Fibers

Holography: Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

Reference Books:

1. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)
2. Introduction to Special theory of - Robert Resnick - Wielly
3. Optical Fibre & Laser - Anuradha De. (New Age)
4. Optics –Aloy Ghatak (Tata McGraw Hill Education Private Ltd. New Delhi)
5. Optics - Brijlal & Subramanian (S. Chand)
6. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New Delhi)

NME-101/201: Basic Manufacturing Processes L T P [2 0 0]

Unit-I Engineering Materials

Materials and Civilization, their socio economic impact. Engineering Materials their classification and applications. **1**

Metals & Alloys: Properties and Applications

Mechanical Properties of Materials: Strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, malleability, toughness, hardness, resilience, hardness, machine ability, formability, weld ability. Elementary ideas of fracture fatigue & creep. **2**

Steels and Cast Irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications. Wrought iron. Cast iron. Alloy steels: stainless steel, tool steel. **2**

Alloys of Non Ferrous Metals: Common uses of various non-ferrous metals (Copper, Zink, Tin, Magnesium, Lead, Aluminum etc.) & alloys and its composition such as Cu-alloys: Brass, Bronze, Al-alloys. **2**

Unit-II Basic Metal Forming & Casting Processes.

Forming Processes: Basic metal forming operations & uses of such as: Forging, Rolling, Wire & Tube-drawing/making and Extrusion, and their uses.

Press-work: Die & Punch assembly, cutting and forming, its applications.

Hot-working versus cold-working **4**

Casting: Pattern: Materials, types and allowances. Type and composition of Molding sands and their desirable properties. Mould making with the use of a core. Gating system. Casting defects & remedies. Cupola Furnace. Die-casting and its uses. **3**

Unit-III Machining and Welding Operations and their Applications

Machining: Basic principles of Lathe-machine and operations performed on it. Basic description of machines and operations of Shaper-Planer, Drilling, Milling & Grinding. **4**

Welding: Introduction, classification of welding processes. Gas-welding, types of flames and their applications. Electric-Arc welding. Resistance welding. Soldering & Brazing processes and their uses. **3**

Unit-IV Misc. Topics/ Processes

Heat Treatment Processes: Introduction to Heat- treatment of carbon steels: annealing, normalizing, quenching, tempering and case-hardening.

Manufacturing Establishment: Plant location. Plant layout–its types. Types of Production. Production versus Productivity. **1**

Non-Metallic Materials: Common types & uses of Wood, Cement-concrete, Ceramics, Rubber, Plastics and Composite-materials. **3**

Misc. Processes: Introduction to Galvanizing and Electroplating. **1**

Reference Books:

1. "Processes and Materials of Manufacture", Lindberg, PHI
2. "Manufacturing Engineering And Technology", Kalpakjian and Schmid, Pearson
3. "Manufacturing Processes", Kalpakjian and Schmid, Pearson
4. "Manufacturing Processes", H. N .Gupta, R. C. Gupta, Arun Mital, New Age

NAS 105/ NAS 205 : ENVIRONMENT AND ECOLOGY

2 0 0

UNIT-I: Nature of Environment

Introduction to Environmental Science - Definition and scope and need for public awareness Ecosystems Concept, structure and functions, restoration of damaged ecosystems

Biodiversity – Definition, description at national and global level, threats and conservation Natural Resources - Renewable and non-renewable and their equitable use for sustainability, Material cycles – carbon, nitrogen and sulphur cycle.

Conventional and Non-conventional Energy Sources – fossil fuel-based, hydroelectric, wind, -nuclear and solar energy, biomass, biodiesel, hydrogen as an alternative fuel

UNIT-II: Impact of Human Activity on Environment

Human Population and Environment – Population growth, population explosion and migration; Impact of farming, housing, mining, transportation and industrial growth

Social Issues Related to Environment– Sustainable development, urban problems (related to water and energy conservation and waste management), resettlement and rehabilitation Environmental ethics

UNIT-III: Environmental Changes and Human Health

Environmental Pollution–Definition, causes and effects, control measures for water, air, soil, marine, land, noise, thermal pollution,

Climate change– Greenhouse effect and global warming**,** acid rain**,** ozone layer formation and depletion Impact on human health – water and air borne diseases, diseases induced by residual impurities in drinking water (fluoride and arsenic); Toxic wastes and carcinogens; Nuclear hazards

UNIT- IV: Environmental Protection through Assessment and Education

Indicators and Impact Assessment **–** Bio-indicators, Natural disasters and disaster management, Impact assessment through inventorying and monitoring

Environmental Protection– Role of individuals, organizations and government in pollution control

Laws, Conventions and Treaties–National legislation, issues in the enforcement of environmental legislation, initiatives by non- governmental organizations, global efforts in environmental protection Environmental education–women and value education

Recommended Textbook:

Environmental Studies, J Krishnawamy , R J Ranjit Daniels, Wiley India.

Recommended Reference Books:

1. Environmental Science, Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall Professional 1993.
2. Environment and Ecology, R K Khandal, 978-81-265-4277-2, Wiley India.
3. Environmental Science, 8th Ed ISV, Botkin and Keller, 9788126534142, Wiley India.
4. Environmental Studies, R Rajagopalan, 978-0195673937, Oxford University Press
5. Textbook of Environmental Science and Technology, M.Anjireddy, BS Publications
6. Environmental Studies, Soli. J Arceivala, Shyam, R Asolekar, 9781259006050, McGrawHill India, 2012.
7. Environmental Studies, D.L. Manjunath, 9788131709122 Pearson Education India, 2007
8. Textbook of Environment Ecology , Singh, Acme Learning
9. Perspective in Environmental Studies, Kaushik, New Age International
10. Environmental Studies, B. Joseph, 2nd Ed, 978-0070648134, Tata McGraw Hill

NAS-203 : Engineering Mathematics - II

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Unit - 1: Differential Equations

Linear differential equations of n^{th} order with constant coefficients, Complementary function and Particular integral, Simultaneous linear differential equations, Solution of second order differential equations by changing dependent & independent variables, Normal form, Method of variation of parameters, Applications to engineering problems (without derivation).

Unit - 2: Series Solution and Special Functions

Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

Unit - 3: Laplace Transform

Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

Unit - 4: Fourier Series and Partial Differential Equations

Periodic functions, Fourier series of period 2π, Euler's Formulae, Functions having arbitrary periods, Change of interval, Even and odd functions, Half range sine and cosine series, Harmonic analysis.
Solution of first order partial differential equations by Lagrange's method, Solution of second order linear partial differential equations with constant coefficients.

Unit - 5: Applications of Partial Differential Equations

Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.

Text Books:

1. **E. Kreyszig, : Advanced Enginnering Mathematics,Volume-II,John Wiley&Sons**
2. **B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw- Hill Publishing Company Ltd.**
3. **R.K.Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing Hous**e.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudranalaya
4. A. C. Srivastava & P. K. Srivastava, Engineering Mathematics, Vol. – II, PHI Learning Pvt. Ltd.
5. Rukmangadachari, Engineering Mathematics – II, Pearson Education.

NAS-202: ENGINEERING PHYSICS- II

Unit - I **07 Hrs**

Crystal Structures and X-ray Diffraction:

Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Crystal structure of NaCl and diamond, Lattice planes and Miller Indices, Reciprocal Lattice, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer.

Unit - II **08 Hrs**

Dielectric and Magnetic Properties of Materials:

Dielectric Properties: Dielectric constant and Polarization of dielectric materials, Types of Polarization (Polarizability). Equation of internal fields in liquid and solid (One- Dimensional), Claussius Mussoti-Equation, Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material,

Magnetic Properties: Magnetization, Origin of magnetic moment, Dia, para and ferro magnetism, Langevin's theory for diamagnetic material, Phenomena of hysteresis and its applications.

Unit - III **06 Hrs.**

Electromagnetic Theory Displacement Current, Equation of continuity, Maxwell's Equations (Integral and Differential Forms), Poynting theorem and Poynting vectors, EM - Wave equation and its propagation characteristics in free space, non-conducting and in conducting media, Skin depth.

Unit - IV **09 Hrs**

Physics of some Technologically important Materials

Semiconductors: Band Theory of Solids, density of states, Fermi-Dirac distribution, free carrier density(electrons and holes), conductivity of semiconductors, Position of Fermi level in intrinsic and in extrinsic semiconductors.

Superconductors: Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Super-conductors.

Nano-Materials: Basic principle of nanoscience and technology, structure, properties and uses of Fullerene and Carbon nanotubes, Applications of nanotechnology.

Reference books:

1. Concept of Modern Physics - by Beiser (Tata Mc-Graw Hill)
2. Solid State Physics - by C. Kittel, 7th edition (Wiley Eastern)
3. Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
4. Solid State Physics - by S.O. Pillai, 5th edition (New Age International)
5. Introduction to Electrodynamics - by David J. Griffith (PH I)
6. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New Delhi)

NAS 152/ NAS 252 : ENGINEERING CHEMISTRY PRACTICALS

LIST OF EXPERIMENTS

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample usind EDTA as standard solution.
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in water sample.
5. Determination of iron content in the given water sample by Mohr's method.
6. pH- metric titration.
7. Viscosity of an addition polymer like polyester by viscometer.
8. Determination of iron concentration in sample of water by calorimetric method. The method involves the use of KCN as a colour developing agent and the measurements are carried out at λ_{max} 480nm.
9. Element detection and functional group identification in organic compounds.
10. Preparation of Bakelite and Urea formaldehyde resin.

NME-152/NME/252 : Engineering Mechanics Lab

L T P [0 0 2]

(Any 10 experiments of the following or similar experiments suitably designed)

1. To verify the law of parallelogram of forces.
2. To study the equilibrium of a body under three forces.
3. To determine the coefficient of friction of a flat surface.
4. Friction experiment on screw-jack.
5. Experiment based on analysis of truss.
6. To determine the mass moment of inertia of a rotating disc.
7. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a mild steel specimen.
8. To conduct the Impact-tests (Izod / Charpy) on Impact-testing machine to find the Impact Strength of the specimen.
9. To determine the hardness of the given specimen using Vicker/Brinell/Rockwell hardness testing machine.
10. Simple & compound gear-train experiment.
11. Worm & worm-wheel experiment for load lifting.
12. Belt-Pulley experiment.
13. Bending of simply-supported and cantilever beams for theoretical & experimental deflection.
14. Dynamics experiment on momentum conservation
15. Dynamics experiment on collision for determining coefficient of restitution.
16. Experiment on Torsion of Rod/wire

NEE151/NEE251 : ELECTRICAL ENGINEERING LABORATORY

L T P
0 0 2

List of Experiments

Note : A minimum of 10 experiments from the following should be performed

1. Verification of Kirchhoff's laws
2. Verification of (i) Superposition theorem (ii) Thevenin's Theorem (iii) Maximum Power Transfer Theorem.
3. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor.
6. Determination of parameters of ac single phase series RLC circuit
7. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
8. To study speed control of dc shunt motor using (i) armature voltage control (ii) field flux control.
9. Determination of efficiency of a dc shunt motor by load test \
10. To study running and speed reversal of a three phase induction motor and record speed in both directions.
11. To measure energy by a single phase energy meter and determine error.
12. To study P-N diode characteristics
13. To study full wave and half wave rectifier circuits with and without capacitor and determine ripple factors.
14. To study various logic gates (TTL)
15. To study Operational Amplifier as Adder and Subtractor
16. To study transistor as a switch

NCS-151/NCS-252 : Computer Programming Lab

7-5-13

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal , Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:

    Between 90-100%----------Print 'A'
    80-90%----------Print 'B'
    60-80%----------Print 'C'
    Below 60%----------Print 'D'
11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.
26. WAP to add and multiply two matrices of order nxn.
27. WAP that finds the sum of diagonal elements of a mxn matrix.
28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.

29. Define a structure data type TRAIN_INFO. The type contain

    Train No.: *integer type*
    Train name: *string*
    Departure Time: aggregate type TIME
    Arrival Time : aggregate type TIME
    Start station: string
    End station : string

    The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:

    (i) List all the trains (sorted according to train number) that depart from a particular section.
    (ii) List all the trains that depart from a particular station at a particular time.
    (iii) List all he trains that depart from a particular station within the next one hour of a given time.
    (iv) List all the trains between a pair of start station and end station.

30. WAP to swap two elements using the concept of pointers.
31. WAP to compare the contents of two files and determine whether they are same or not.
32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

NEW-151/251 : WORKSHOP PRACTICE

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[0 1 3]

1. Carpentry Shop: 1. Study of tools & operations and carpentry joints. 2. Simple exercise using jack plane. 3. To prepare half-lap corner joint, mortise & tennon joints. 4. Simple exercise on woodworking lathe.

2. Fitting (Bench Working) Shop: 1. Study of tools & operations 2. Simple exercises involving fitting work. 3. Make perfect male-female joint. 4. Simple exercises involving drilling/tapping/dieing.

3. Black Smithy Shop: 1. Study of tools & operations 2. Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.

4. Welding Shop: 1.Study of tools & operations of Gas welding & Arc welding 2. Simple butt and Lap welded joints. 3. Oxy-acetylene flame cutting.

5. Sheet-metal Shop: 1. Study of tools & operations. 2. Making Funnel complete with 'soldering'. 3. Fabrication of tool-box, tray, electric panel box etc.

6. Machine Shop: 1. Study of Single point cutting tool, machine tools and operations. 2. Plane turning. 3. Step turning 4. Taper turning. 5. Threading

7. Foundry Shop: 1. Study of tools & operations 2. Pattern making. 3. Mould making with the use of a core. 4. Casting

NCE-151/251 : Computer Aided Engineering Graphics

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0 1 3

Introduction Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning line conventions and free hand practicing,

AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints. **2 - Sheets**

Orthographic Projections

Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes **2 - Sheets**

Orthographic Projections of Plane Surfaces (First Angle Projection Only)

Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only. **1 - Sheet**

Projections of Solids (First Angle Projection Only)

Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. **2-Sheets**

Sections And Development of Lateral Surfaces of Solids

Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. **1 - Sheet**

Isometric Projection (Using Isometric Scale Only)

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres. **1-Sheet**

Text Books

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48th edition, 2005-Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition- 2006.

Reference Books

1. Engineering Graphics - K.R. Gopalakrishna, 32nd edition, 2005- Subash Publishers Bangalore.
2. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005-Prentice-Hall of India Pvt. Ltd., New Delhi.

Engineering Drawing – M.B. Shah, B.C.Rana, 2nd Edition,2

NAS-151/NAS-251: PHYSICS LAB

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0 0 2

List of Experiments

Any ten experiments, at least four from each group.

Group -A

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To study the polarization of light by simple reflection using laser.
7. Measurement of Wavelength of a laser (He- Ne) light using single slit diffraction.

Group – B

8. To determine the specific resistance of a given wire using Carey Foster's bridge.
9. To study the variation of magnetic field along the axis of current carrying - Circular coil and then to estimate the radius of the coil.
10. To verify Stefan's Law by electrical method.
11. To calibrate the given ammeter and voltmeter by potentiometer.
12. To study the Hall effect and determine Hall coefficient, carrier density and - mobility of a given semiconductor using Hall effect set up.
13. To determine the energy band gap of a given semiconductor material.
14 To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
15. To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen.
16. To determine the ballistic constant of a ballistic galvanometer.
17. To determine the coefficient of viscosity of a liquid.
18. Measurement of fiber attenuation and aperture of fiber.
19. High resistance by leakage method.
20. Magnetic Susceptibility of paramagnetic solution.

NAS-154/NAS-254 : PROFESSIONAL COMMUNICATION LABORATORY PRACTICALS

L T P
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Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (I.P.A.)

LIST OF PRACTICALS

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics/ Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme- Presentation/ Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practicals on a model Audio-Visual Usage.

Reference Books

1. Bansal R.K. & Harrison: Phonetics in English, Orient Longman, New Delhi.
2. Sethi & Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, New Delhi.
3. L.U.B.Pandey & R.P.Singh, A Manual of Practical Communication, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press.

UTTAR PRADESH TECHNICAL UNIVERSITY
LUCKNOW

SYLLABUS

B. Tech. (2nd Year)

1. **Mechanical Engineering**
2. **Production Engineering**
3. **Industrial & Production Engineering**
4. **Mechanical & Industrial Engineering**
5. **Manufacturing Technology**
6. **Automobile Engineering**
7. **Aeronautical Engineering**

[Effective Form session 2014-15]

STUDY & EVALUATION SCHEME
B. Tech. Mechanical Engineering / Production Engineering / Industrial & Production Engineering / Mechanical & Industrial Engineering / Manufacturing Technology / Automobile Engineering / *Aeronautical Engineering*
[Effective Form session 2014-15]

YEAR II, SEMESTER-III

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NAS-301/ NOE-031 to NOE-039	Engg Mathematics-III/ Science Based Elective	3	1	0	30	20	50	100	150	4
2	NCE-301	Fluid Mechanics	3	1	0	30	20	50	100	150	4
3	NME-301	Material Science	3	1	0	30	20	50	100	150	4
4	NME-302	Mechanics of Solids	3	1	0	30	20	50	100	150	4
5	NHU-301/ NHU-302	Industrial Psychology/ Industrial Sociology	2	0	0	15	10	25	50	75	2
6	NME-303	Thermodynamics	2	1	0	15	10	25	50	75	3
7	AUC-001/ AUC-002	*Human Value & Professional Ethics/Cyber Security*	2	0	0	15	10	25	50	75*	
PRACTICAL/DESIGN/DRAWING SUBJECTS											
8	NCE-351	Fluid Mechanics Lab.	0	0	3	10	10	20	30	50	1
9	NME-351	Material Science & Testing Lab.	0	0	2	10	10	20	30	50	1
10	NME-352	Machine Drawing I	0	0	3	10	10	20	30	50	1
11	NME-353	Thermodynamics Lab.	0	0	2	10	10	20	30	50	1
12	NGP-301	GP						50		50	
		TOTAL	18	5	10					1000	25

NOTE: *Up to IV semesters – common to Mechanical and related branches (such as Production, Industrial, Manufacturing, Automobile, Aeronautical etc.).*

The details of Science Based Electives are to be provided by The Boards of Studies of Science Subjects; these are common to all branches.

*Human values & Professional Ethics /Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.

STUDY & EVALUATION SCHEME
B. Tech. Mechanical Engineering / Production Engineering / Industrial & Production Engineering / Mechanical & Industrial Engineering / Manufacturing Technology / Automobile Engineering / *Aeronautical Engineering*
[Effective Form session 2014-15]

YEAR II, SEMESTER-IV

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NOE-041 to NOE-049/ NAS-401	Science Based Elective/ Engg Mathematics-III	3	1	0	30	20	50	100	150	4
2	NEE-409	Electrical Machines & Controls	3	1	0	30	20	50	100	150	4
3	NME-401	Applied Thermodynamics	3	1	0	30	20	50	100	150	4
4	NME-402	Manufacturing Science & Technology I	3	1	0	30	20	50	100	150	4
5	NHU-402/ NHU-401	Industrial Sociology/Industrial Psychology	2	0	0	15	10	25	50	75	2
6	NME-403	Measurement and Metrology	2	1	0	15	10	25	50	75	3
7	AUC-002/ AUC-001	*Cyber Security/Human Value & Professional Ethics*	2	0	0	15	10	25	50	75*	
PRACTICAL/DESIGN/DRAWING SUBJECT											
8	NEE-459	Electrical Machines & Controls Lab.	0	0	3	10	10	20	30	50	1
9	NME-451	Machine Drawing II	0	0	3	10	10	20	30	50	1
10	NME-452	Manufacturing Technology I Lab.	0	0	2	10	10	20	30	50	1
11	NME-453	Measurement and Metrology Lab.	0	0	2	10	10	20	30	50	1
12	NGP-401	GP						50		50	
		TOTAL	18	5	10					1000	25
		Industrial Training-I of 4 weeks after IV semester or Minor fabrication project involving work for nearly 4 weeks , which will be evaluated in VII semester									

NOTE: Practical summer training-I of 4-weeks after IV –semester or Minor fabrication project will be evaluated in VII semester

The details of Science Based Electives are to be provided by The Boards of Studies of Science Subjects; these are common to all branches.

*Human values & Professional Ethics /Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.

NCE- 301: FLUID MECHANICS **L T P**
3 1 0

Unit - I

Fluid and continuum, Physical properties of fluids, Rheology of fluids.

Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Unit - II

Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential.

Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance,

Unit - III

Potential Flow: source, sink, doublet and half-body.

Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, notches and weirs, momentum equation and its application to pipe bends.

Similarity Laws: geometric, kinematics and dynamic similarity, undistorted and distorted model studies.

Unit - IV

Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks.

Unit - V

Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect.

Introduction to compressible flow

References :

1. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley &Sons Pvt Ltd,
2. Cengel & Cimbala, "Fluid Mechanics" TMH, New Delhi.
3. White,F.M. "Fluid Mechanics" TMH, New Delhi.
4. Munsen et al ,"Fundamental of Fluid Mechanics" Wiley Newyork Ltd
5. Garde, R.J., " Fluid Mechanics", SciTech Publications Pvt. Ltd
6. I.H. Shames, "Mechanics of Fluids", McGraw Hill, Int. Student, Education

NME- 301: MATERIAL SCIENCE **L T P**
3 1 0

Unit-I

Introduction : Importance of materials. historical perspective, Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bondings.

4

Crystallography and Imperfections : Concept of unit cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. Xray crystallography techniques. Imperfections, Defects & Dislocations in solids.

3

Unit-II

Mechanical properties and Testing : Stress strain diagram, Ductile & brittle material, Stress vs strength. Toughness, Hardness, Fracture, Fatigue and Creep. Testing of material such as Strength tests, Hardness tests, Impact tests, Fatigue tests, Creep tests, and Non-destructive testing (NDT).

4

Microstructural Exam : Microscope principle and methods. Preparation of samples and Microstructure exam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass.

2

Phase Diagram and Equilibrium Diagram : Uniary and Binary diagrams, Phase rules. Types of equilibrium diagrams: Solid solution type, eutectic type and combination type. Iron-carbon equilibrium diagram.

3

Unit-III

Ferrous materials : Various types of carbon steels, alloy steels and cast irons, its properties and uses.

2

Heat Treatment : Various types of heat treatment such as Annealing, Normalizing, Quenching, Tempering (Austempering, Martempering), and various case hardening processes. Time Temperature Transformation (TTT) diagrams.

2

Diffusion: Diffusion of Solids, Ficks I and II law.

1

Non-Ferrous metals and alloys : Non-ferrrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various type of Brass and Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys.

3

Unit-IV

Dielectric Materials: Dielectric Materials and their applications.

1

Magnetic properties : Concept of magnetism - Dia, para, ferro Hysteresis. Soft and hard magnetic materials, Magnetic storages.

2

Electric properties, Semi conductors and Super conductors: Energy band concept of conductor, insulator and semi-conductor. Intrinsic & extrinsic semi-conductors. P-n junction and transistors. Basic devices and its application. Super conductivity and its applications. Messier effect. Type I & II superconductors. High Tc superconductors.

5

Unit-V

Ceramics : Structure types and properties and applications of ceramics. Mechanical/Electrical behavior and processing of Ceramics.

2

Plastics : Various types of polymers/plastics and its applications. Mechanical behaviour and processing of plastics. Future of plastics.

2

Other materials : Brief description of other material such as optical and thermal materials, Composite Materials and its uses. Introduction to Smart materials & Nano-materials and their potential applications

3

Performance of materials in service: Brief theoretical consideration of Fracture, Fatigue, and Corrosion and its control.

2

Books and References:

1. Callisters Materials Science and Engineering, by William D. Callister, Jr, (Adopted by R. Balasubramaniam), Wiley India Pvt. Ltd.
2. Elements of Material Science & Engineering by Van Vlack, Pearson
3. Materials Science and Engineering - A First Course by Raghavan, PHI
4. Material Science and Engineering by Smith, Hashemi and Prakash, TMH
5. Introduction to Materials Science for Engineers by Shackelford, Pearson
6. Material Science by Narula , TMH.
7. Material Science for Engineering Students by Fischer, Academic Press
8. Technology of Engineering materials by Philip and Bolton, Butterworth-Heinamann

NME-302: MECHANICS OF SOLIDS **L T P**

3 1 0

UNIT-I

Compound stress and strains: Introduction, normal stress and strain, shear stress and strain, stresses on inclines sections, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr's stress circle, three dimensional state of stress & strain, equilibrium equations, generalized Hook's law, theories of failure

8

UNIT –II

Stresses in Beams: Pure Bending**,** normal stresses in beams, shear stresses in beams due to transverse and axial loads, composite beams.

2

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams

4

Torsion: Torsion, combined bending & torsion of solid & hollow shafts, torsion of thin walled tubes

2

UNIT-III

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

4

Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin ended

columns, effect of end conditions on column buckling, Ranking Gordon formulae, examples of columns in mechanical equipments and machines.

4

UNIT-IV

Thin cylinders & spheres: Introduction, difference between thin walled and thick walled pressure vessels, Thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.

2

Thick cylinders:
Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders, stresses in rotating shaft and cylinders, stresses due to interference fits.

4

UNIT-V

Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

4

Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel section.

4

Books and References :

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of Materials by.Beer, Jhonston, DEwolf and Mazurek, TMH
3. Strength of Materials by Pytel and Singer, Harper Collins
4. Strength of Materials by Ryder, Macmillan.
5. Strength of Materials by Timoshenko and & Yơungs, East West Press.
6. Introduction to Solid Mechanics by Shames, PHI
7. Strength of Materials by Nag and Chandra, Wiley India.
8. Strength of Materials by Nash (Sp Indian Edition), TMH
9. Strength of Materials by Jindal, Pearson Education
10. Strength of Material by Bhavikatti, Vikas Publishing.
11. Fundamentals of Solid Mechanics by Gambhir, PHI
12. Strength of Materials by Basavajaiah and Mahadevappa, University Press.

NME-303 : THERMODYNAMICS **L T P**
2 1 0

Unit – I:

Fundamental Concepts and Definitions: Introduction- Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Causes of Irreversibility Energy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases.

3

Zeroth law of thermodynamics: Concept of Temperature and its' measurement, Temperature scales.

1

First law of thermodynamics: Thermodynamic definition of work, Displacement work and flow work, , Displacement work for various non flow processes, Joules' experiment, First law analysis for closed system (non flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I.

3

Unit – II:

First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer.

2

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, Thermodynamic Temperature Scale, PMM-II.

4

Unit – III

Entropy : Clausius inequality, Concept of Entropy, Entropy change of pure substance in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

4

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function.

3

Unit – IV

Properties of steam and Rankine cycle: Pure substance, Property of Pure Substance (steam), Triple point, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables & Mollier chart, Dryness factor and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

5

Introduction to IC engines: Compression Ignition engines, Spark Ignition engines, 2 stroke and 4 stroke engines, Performance parameters of IC engine, Heat balance sheet.

2

Books and References:

1. Engineering Thermodynamics by P.K.Nag, TMH
2. Thermodynamics by Shavit and Gutfinger, CRC Press.
3. Thermodynamics- An Engineering Approach by Cengel & Boles, TMH.
4. Basic Engineering Thermodynamics, Joel, Pearson.
5. Fundamentals of Engineering Thermodynamics by Rathakrishnan, PHI.
6. Engineering Thermodynamics by Dhar, Elsevier.
7. Engineering Thermodynamics by Onkar Singh, New Age International.
8. Thermodynamics by Prasanna Kumar Pearson
9. Engineering Thermodynamics by C.P. Arora.
10. Engineering Thermodynamics by Rogers and Mayhew, Pearson.
11. Fundamentals of Engineering Thermodynamics by Moran, Shapiro, Boettner, & Bailey, John Wiley.
12. Fundamentals of Thermodynamics - Sonntag, Borgnakke and Van Wylen , John Wiley
13. Engineering Thermodynamics by Jones and Dugans, PHI

14. Modern Engineering Thermodynamics by Balmer, Academic Press.
15. An Introduction to Thermodynamics, By Rao, University Press.

NME- 351: FLUID MECHANICS LAB. **L T P**
0 0 3

Note: Ensure to conduct at least 10 experiments from the list:

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
6. To draw a flow-net using Electrical Analogy Method.
7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement
13. To determine the head loss for a sudden Contraction.

NME- 351: MATERIALS SCIENCE AND TESTING LAB. **L T P**
0 0 2

In this lab Experiments on Material Science and Experiments on Material Testing are to be conducted as given below:

(A). Experiments on Material Science (at least 5 of the following):
1. Preparation of a plastic mould for small metallic specimen.
2. Preparation of specimen for micro structural examination-cutting, grinding, polishing, etching.
3. Determination of grain size for a given specimen.
4. Comparative study of microstructures of different specimens of different materials (mild steel, gray C.I., brass, copper etc.)
5. Experiments on heat treatment such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after heat treatment.
6. Material identification of, say, 50 common items kept in a box.
7. Experiment on Faraday's law of electrolysis.
8. Study of corrosion and its effects.
9. Study of microstructure of welded component and HAZ. Macro & micro examination of the welded specimen.
10. Study of Magnetic/ Electrical/Electronic materials.

(B). Experiments on Material Testing (at least 5 of the following):

1. Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot on the machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact test on impact testing machine like Charpy, Izod or both.
4. Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index test on spring testing machine.
6. Fatigue test on fatigue testing machine.
7. Creep test on creep testing machine.
8. Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion test of a rod using torsion testing machine.
10. Study of NDT (non-destructive testing) methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.

NME-352: MACHINE DRAWING -I LAB

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Introduction (1 drawing sheets)

Introduction, classification of machine drawings, principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, lines and rules of dimensioning.

2

Orthographic Projections (3 drawing sheets)

Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing line problems, principle of visualization of objects, sectional views, full and half sectional views, auxiliary views.

3

Fasteners (2 drawing sheets)

Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints.

2

Riveted joints (1 drawing sheet)

Introduction, rivets and riveting, types of rivets, types of riveted joints, drawing of boiler joints etc.

1

Assembly drawing (2 drawing sheets)

Introduction to assembly drawing, drawing assembly drawing of simple machine elements like rigid or flexible coupling, muff coupling, plummer block, footstep bearing, bracket etc.

2

Free hand sketching (1 drawing sheet**)**

Introduction, Need for free hand sketching, Free hand sketching of foundation bolts, studs, pulleys, couplings etc.

1

Computer aided drafting (1 drawing**)**

Introduction to computer aided drafting; advantages and applications of CAD, concepts of computer aided 2D drafting using any drafting software like AutoCAD, Solid Edge, Draft Sight etc., basic draw and modify commands, making 2D drawings of simple machine parts

1

Books and References:

1. Fundamentals of Machine Drawing by Sadhu Singh & Shah, PHI
2. Engineering Drawing by Bhat, & Panchal, Charotar Publishing House
3. Machine Drawing with AutoCAD by Pohit and Ghosh, Pearson
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy, New Age
5. Machine Drawing, N. Siddeshswar, P Kannaiah, VVS Shastry, Tata McGraw Hill
6. Engineering Drawing, Pathak, Wiley
7. Textbook of Machine Drawing, K C John, PHI
8. AutoCAD 2014 for Engineers & Designers, Bhatt, WILEY
9. Engineering Graphics with AutoCAD, Bethune, PHI

NME-353 : THERMODYNAMICS LAB **L T P**
0 0 2

Minimum 10 experiments out of following;

1. Study of Fire Tube boiler
2. Study of Water Tube boiler
3. Study and working of Two stroke petrol Engine
4. Study and working of Four stroke petrol Engine
5. Determination of Indicated H.P. of I.C. Engine by Morse Test
6. Prepare the heat balance sheet for Diesel Engine test rig
7. Prepare the heat balance sheet for Petrol Engine test rig
8. Study and working of two stroke Diesel Engine
9. Study and working of four stroke Diesel Engine.
10. Study of Velocity compounded steam turbine
11. Study of Pressure compounded steam turbine
12. Study of Impulse & Reaction turbine
13. Study of steam Engine model.
14. Study of Gas Turbine Model
15. Any other suitable experiment(s) on thermodynamics

NEE 409 ELECTRICAL MACHINES & CONTROL **L T P**
0 0 2

UNIT I

Single phase Transformer: Efficiency Voltage regulation, O.C.& S.C. Tests.

Three Phase Transformer: Three phase transformer connections, Auto Transformer: Volt- Amp relations, Efficiency, Advantages & Disadvantages, Applications.

D.C. Motors: Concept of starting, Speed control, Losses and Efficiency *(simple numericals only)*

UNIT II

Three phase Induction Motor: Construction, Equivalent circuit, Torque equation and torque- slip characteristics, Speed control *(simple numericals only).*

Alternator: Construction, e.m.f. equation, Voltage regulation and its determination by synchronous impedance method. *(simple numericals only)*

Synchronous Motor *(conceptual treatment only)*: Starting, Effect of excitation on line current (V-curves), Synchronous condenser.

Servo Motor: Two phase AC and DC servo motors & their applications.

UNIT III

Modeling of Mechanical System: Linear mechanical elements, Force-voltage and force- current analogy, Electrical analog of simple mechanical systems; Concept of transfer function & its determination for simple systems.

Control System: Open loop & closed loop controls systems; advantages and disadvantages.

Signals: Unit step, Unit ramp, Unit impulse and Periodic signals with their mathematical representation and characteristics.

UNIT IV

Time Response Analysis: Time response of a standard second order system and response specifications.

Stability: Concept and types of stability, Routh Hurwitz Criterion and its application for determination of stability, Limitations (*simple numerical only*); *Only conceptual treatment of* Polar plot, Nyquist stability criterion and assessment of stability.

UNIT V

Root Locus Techniques: Concept of root locus, construction of root loci. Bode plot, Gain margin and Phase margin and their determination.

Process control: Introduction to P, PI and PID controllers their characteristics, representation and applications.

Books and References:

1. I. J. Nagrath & D. P. Kothari, “Electrical machines”, Tata McGraw Hill.
2. P.S.Bimbhra, “Electrical Machinery”, Khanna Publishers
3. K. Ogata, “Modern Control Engineering”, Prentice Hall of India.
4. Ghosh, “Control Systems: Theory and Applications”, Pearson
5. B.C. Kuo, “Automatic Control systems”, Wiley India Ltd.
6. D. Roy Choudhary, “Modern Control Engineering” Prentice Hall of India.
7. M. Gopal, “Control Systems: Principles and Design” Tata McGraw Hill.

EME-401: APPLIED THERMODYNAMICS **L T P**
3 1 0

Unit-I

Thermodynamic relations: Conditions for exact differentials. Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic and Isothermal compressibility.

3

Fuels and Combustion: Combustion analysis, heating values, air requirement, Air/Fuel ratio, standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Adiabatic flame temperature.

4

Unit-II

Boilers: Classifications and working of boilers, boiler mountings and accessories, Draught and its calculations, air pre heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance.

6

Condenser: Classification of condenser, air leakage, condenser performance parameters.

2

Unit-III

Vapour Power cycles: Carnot vapour power cycle, Rankine cycle, effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration.

4

Steam Engines: Modified Rankine cycles, working and classification of steam engines, Indicator diagram, Saturation curve, Missing quantity, Heat balance.

3

Unit-IV

Steam and Gas Nozzles: Flow through Convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, Choked flow, throat area, Nozzle efficiency, Off design operation of nozzle, Effect of friction on nozzle, Super saturated flow.

3

Steam Turbines : Classification of steam turbine, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple and compound multistage impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine.

4

Unit-V

Gas Turbine: Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles.

4

Jet Propulsion: Introduction to the principles of jet propulsion, Turbojet and turboprop engines and their processes, Principle of rocket propulsion, Introduction to Rocket Engine.

3

Books and References:

1. Basic and Applied Thermodynamics by P.K. Nag, TMH
2. Applied thermodynamics by Onkar Singh, New Age International
3. Applied Thermodynamics for Engineering Technologists by Eastop, Pearson Education
4. Applied Thermodynamics by Venkanna And Swati, PHI

5. Theory of Stream Turbine by W.J. Kearton
6. Gas turbine Theory & Practice, by Cohen & Rogers, Addison Weslay Long man
7. Gas Turbine, by V. Ganeshan, Tata Mc Graw Hill Publishers.
8. Steam & Gas Turbine by R.Yadav, CPH Allahabad
9. Thermodynamics and Energy Systems Analysis, Borel and Favrat, CRC Press
10. Mechanics and Thermodynamics of Propulsion, Hill and Peterson, Pearson
11. Thermal Engineering by Kulshrestha, Vikas Publishing.
12. Thermal Engg. By P.L. Ballaney, Khanna Publisher
13. Thermal Engg. By R.K. Rajput, Laxmi Publication

NME- 402 : MANUFACTURING SCIENCE & TECHNOLOGY-I **L T P**
3 1 0

Unit-I

Introduction :
Importance of manufacturing. Economic & technological considerations in manufacturing. Classification of manufacturing processes. Materials & manufacturing processes for common items.
2

Metal Forming Processes :
Elastic & plastic deformation, yield criteria(Mises' and Tresca's). Hot working versus cold working.
2

Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction, sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging.
5

Unit-II

Metal Forming Processes (continued):
Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application.
3

Condition for Rolling force and power in rolling. Rolling mills & rolled-sections.
2

Design, lubrication and defects in metal forming processes.
2

Unit-III

Sheet Metal working :
Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs. Piercing. Compound vs. Progressive die. Flat-face vs Inclined-face punch and Load(capacity) needed.
4

Analysis of forming process like cup/deep drawing. Bending & spring-back.
3

Unit-IV

Casting (Foundry)
Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand, sand testing. Elements of mould and design considerations, Gating, Riser, Runnes, Core. Solidification of casting,. Sand casting, defects & remedies and inspection. Cupola furnace.
7

Die Casting, Centrifugal casting, Investment casting, Continuous casting, CO_2 casting and Stir casting etc.
3

Unit-V

Unconventional Metal forming processes :
Unconventional metal forming or High Energy Rate Forming (HERF) processes such as explosive forming, electromagnetic, electro-hydraulic forming.

2

Powder Metallurgy :
Introduction to Powder metallurgy manufacturing process. Application and, advantages.

1

Jigs & Fixtures :
Locating & Clamping devices & principles. Jigs and Fixtures and its applications.

2

Manufacturing of Plastic components :
Review of plastics, and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic & its applications. Resins & Adhesives.

2

Books and References :

1. Manufacturing Science by Ghosh and Mallik
2. Production Engg. Science by P.C. Pandey
3. Manufacturing Engineering & Technology by Kalpakjian, Pearson
4. Manufacturing Technology by P.N. Rao., TMH
5. Manufacturing Processes by Shan, Pearson.
6. Manufacturing Processes foe Engineering materials by Kalpakjian, Pearson
7. Materials and Manufacturing by Paul Degarmo.
8. Manufacturing Processes by Kaushish , PHI
9. Principles of Foundry Technology, Jain, TMH
10. Production Technology by R.K. Jain

EME -403 : MEASUREMENT AND METROLOGY **L T P**
3 1 0

Unit-I

MECHANICAL MEASUREMENTS
Introduction: Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static performance characteristics and elementary idea of dynamic performance characteristics of measurement devices, calibration, concept of error (systematic and random), sources of error, statistical analysis of errors.

4

Sensors and Transducers:
Types of sensors, types of transducers and their characteristics.

2

Signal Transmission and Processing:
Signal transmission and processing devices and systems. Signal display & recording devices

2

Unit-II

Time Related Measurements:
Stroboscope, frequency measurement by direct comparison. Measurement of displacement

2

Measurement of Pressure:
Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures (high vacuum).

1

Strain Measurement:
Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.

2

Temperature Measurement:
Thermometers, bimetallic thermocouples, thermistors and pyrometers.

2

Measurements of Force, Torque, Acceleration, and Vibration:
Different types of load cells, elastic transducers, pneumatic & hydraulic systems. Seismic instruments, accelerometers vibration pick ups and decibel meters, vibrometers.

3

Unit-III:

Measurement of Fluid Velocity and Flow rate:
Measurement of fluid velocity, Hot Wire Anemometry, Laser Doppler Velocimetry. Flow measuring devices, Rotameter.

2

METROLOGY
Metrology and Inspection :
Standards of linear measurement, line and end standards. Limit fits and tolerances. Interchangeability and standardisation.

2

Linear and angular measurements devices and systems Comparators: Sigma, Johansson's Microkrator.

2

Limit gauges classification, Taylor's Principle of Gauge Design.

1

Unit-IV
Measurement of geometric forms like straightness, flatness, roundness.

2

Tool makers microscope, profile project autocollimator.

1

Interferometry: principle and use of interferometry, optical flat.

2

Measurement of screw threads and gears.

1

Surface texture: quantitative evaluation of surface roughness and its measurement.

1

Books and References:

1. Experimental Methods for Engineers by Holman, TMH
2. Mechanical Measurements by Beckwith, Pearson
3. Principles of Measurement Systems by Bentley, Pearson
4. Metrology of Measurements by Bewoor and Kulkarni, TMH
5. Measurement Systems, Application Design by Doeblein, TMH
6. Hume K.J., "Engineering Metrology", MacDonald and Co
7. Jain, R.K., "Engineering Metrology" Khanna Publishers
8. Jain, R.K., "Mechanical Measurement" Khanna Publishers

NME-451: MACHINE DRAWING -II LAB **L T P**
0 0 3

Review of Orthographic Projections (2 drawing sheets)
Orthographic projection of solids in first angle of projection, missing lines views, interpretation of views

2

Part and Assembly Drawing (4 drawing sheets)
Introduction to assembly drawing, steps in making of assembly drawing, assembly drawing of footstep bearing, lathe tool post, lathe tool post, tail stock stuffing box, connecting rod, gate valve, screw jack, Ramsbottom's safety valve etc.

4

Production drawing: (2 drawing sheet)
Limits, fits and tolerances, types of tolerances and fits, hole basis and shaft basis of fits, and geometric dimensioning and tolerance, surface texture, indication of surface roughness, methods of placing machining symbols on orthographic views

2

Computer Based Solid Modeling (4 computer based drawing assignments)
Introduction, input, output devices, introduction to any 3D modeling software like AutoCAD, Solidworks, Creo Parametric, Autodesk Inventor etc., basic commands and development of 3D drawings of simple machine parts and assemblies.

4

Books and References:

1. Textbook of Machine Drawing, K C John, PHI
2. Machine Drawing, N. Siddeshswar, P Kannaiah, VVS Shastry, Tata McGraw Hill
3. Fundamentals of Machine Drawing, Dr Sadhu Singh & P L Shah, Prantice Hall India
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy-New Age
5. Autodesk Inventor by Examples, Sam Tikoo, Wiley

NME-452 : MANUFACTURING TECHNOLOGY-1 LAB **L T P**
0 0 3

Minimum 8 experiments out of following (or such experiment) are to be performed:

1. Design of pattern for a desired casting (containing hole).
2. Pattern making with proper allowance.
3. Making a mould (with core) and casting.
4. Sand testing methods (at least one, such as grain fineness number determination)
5. Injection moulding with plastics
6. Forging - hand forging processes
7. Forging - power hammer study & operation
8. Tube bending with the use of sand and on tube bending m/c.
9. Press work experiment such as blanking/piercing, washer, making etc.
10. Wire drawing/extrusion on soft material.
11. Rolling-experiment.
12. Bending & spring back.
13. Powder metallurgy experiment.
14. Jigs & Fixture experiment.
15. Any other suitable experiment on manufacturing science / process / technique.

NME 453: MEASUREMENT & METROLOGY LAB **L T P**
0 0 2

Minimum 8 experiments out of following (or such experiment) are to be performed:

1. Study the working of simple measuring instruments- Vernier calipers, micrometer, tachometer.
2. Measurement of effective diameter of a screw thread using 3 wire method.
3. Measurement of angle using sinebar & slip gauges. Study of limit gauges.
4. Study & angular measurement using level protector.
5. Adjustment of spark plug gap using feeler gauges.
6. Study of dial indicator & its constructional details.
7. Use of dial indicator to check a shape run use.
8. Use of dial indicator and V Block to check the circularity and plot the polar Graph.
9. Study and understanding of limits, fits & tolerances.
10. Experiment on measurement of pressure.
11. Study of temperature measuring equipments.
12. Measurement using Strain gauge.
13. Measurement of speed using stroboscope.
14. Experiment on measurement of flow.
15. Measurement of vibration/power.
16. Experiment on dynamometers.
17. To study the displacement using LVDT.

NEE – 459 : ELECTRICAL MACHINES & CONTROL LAB **L T P**
0 0 2

Note: To perform at least 7 experiments of Electrical Machines and 3 experiments of Automatic Control System [Out of total 10, at least 04 experiments should be Simulation based]

A. Electrical Machines

1. To obtain speed-torque characteristics and efficiency of a dc shunt motor by direct loading.
2. To obtain efficiency of a dc shunt machine by no load test.
3. To obtain speed control of dc shunt motor using (a) armature voltage control (b) field control.
4. To determine polarity and voltage ratio of single phase and three phase transformers.
5. To obtain efficiency and voltage regulation by performing O.C. and S.C. tests on a single phase transformer at full load and 0.8 p.f. loading.
6. To perform load test on a 3-phase induction motor and determine (i) speed- torque characteristics (ii) power factor v/s line current characteristics.
8. To study speed control of a 3-phase induction motor using (a) Voltage Control, (b) Constant (Voltage/ frequency) control.
9. To perform open circuit and short circuit test on a 3-phase synchronous machine and determine voltage regulation at full load and unity, 0.8 lagging and 0.8 leading power factor using synchronous impedance method.
10. To determine V-curve of a 3-phase synchronous motor at no load, half load and full load.

B. Automatic Control System:

1. To determine transient response of a second order system for step input for various values of constant ‘K’ using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To determine speed – torque characteristics of an AC 2-phase servo motor.
4. To study dc servo position control system within P and PI configurations.
6. To study Synchro transmitter and receiver system and determine output V/s input characteristics.
7. To study open loop and closed loop control of a dc separately excited motor.

U.P. TECHNICAL UNIVERSITY, LUCKNOW

Syllabus

3rd Year

[Effective from session 2015-16]

1. B. Tech. Mechanical Engineering
2. B. Tech. Production Engineering
3. B. Tech. Industrial & Production Engineering
4. B. Tech. Mechanical & Industrial Engineering

U.P. TECHNICAL UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Mechanical Engineering

[Effective from Session 20015-16]

YEAR III, SEMESTER-V

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NME-501	Machine Design-I	2	1	0	15	10	25	50	75	3
2	NME-502	Kinematics of Machines	3	1	0	30	20	50	100	150	4
3	NME-503	Manufacturing Science& Technology-II	3	1	0	30	20	50	100	150	4
4	NME-504	Heat & Mass Transfer	3	1	0	30	20	50	100	150	4
5	NME-505	I.C. Engines & Compressors	3	1	0	30	20	50	100	150	4
6	NHU-501	Engineering Economics	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NME-551	Machine Design-I Lab	0	0	2	10	10	20	30	50	1
8	NME-552	Seminar	0	0	2	--	--	50	--	50	1
9	NME-553	Manufacturing Technology-II Lab	0	0	3	10	10	20	30	50	1
10	NME-554	Heat & Mass Transfer Lab	0	0	3	10	10	20	30	50	1
11	NGP-501	General Proficiency	--	--	--	--	--	50	--	50	
		TOTAL	16	5	10					1000	25

U.P. TECHNICAL UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Mechanical Engineering

[Effective from Session 20015-16]

YEAR III, SEMESTER-VI

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NME-602	Machine Design-II	3	1	0	30	20	50	100	150	4
2	NME-603	Dynamics of Machines	3	1	0	30	20	50	100	150	4
3	NME-604	Refrigeration & Air-conditioning	3	1	0	30	20	50	100	150	4
4	NME-011 to NME-014	Departmental Elective - I	3	1	0	30	20	50	100	150	4
5	NME-021 to NME-024	Departmental Elective - II	2	1	0	15	10	25	50	75	3
6	NHU-601	Industrial Management	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NME-651	Fluid Machinery Lab	0	0	3	10	10	20	30	50	1
8	NME-652	Machine Design-II Lab	0	0	2	10	10	20	30	50	1
9	NME-653	Theory of Machines Lab	0	0	2	10	10	20	30	50	1
10	NME-654	Refrigeration & Air Conditioning Lab	0	0	3	10	10	20	30	50	1
11	NGP-601	General Proficiency	--	--	--	--	--	50	--	50	
		TOTAL	16	5	10					1000	25

Note- 4 to 6 Weeks Industrial Training-II after VI semester also to be evaluated in VII semester

Departmental Electives:

Department Elective - I

1. NME-011 Engineering Optimization
2. NME-012 Finite Element Methods
3. NME-013 Mechanical Vibrations
4. NME-014 Mechatronics

Department Elective - II

1. NME-021 Fluid Machinery
2. NME-022 Product Design & Development
3. NME-023 Reliability Engineering
4. NME-024 Unconventional Manufacturing Processes

U.P. TECHNICAL UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Production Engineering / Industrial & Production Engineering / Mechanical & Industrial Engineering

[Effective from Session 20015-16]

YEAR III, SEMESTER-V

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NME-501	Machine Design-I	2	1	0	15	10	25	50	75	3
2	NME-502	Kinematics of Machines	3	1	0	30	20	50	100	150	4
3	NME-503	Manufacturing Science& Technology-II	3	1	0	30	20	50	100	150	4
4	NME-504	Heat & Mass Transfer	3	1	0	30	20	50	100	150	4
5	NPI-501	Production Planning & Control	3	1	0	30	20	50	100	150	4
6	NHU-501	Engineering Economics	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NME-551	Machine Design-I Lab	0	0	2	10	10	20	30	50	1
8	NME-552	Seminar	0	0	2	--	--	50	--	50	1
9	NME-553	Manufacturing Technology-II Lab	0	0	3	10	10	20	30	50	1
10	NME-554	Heat & Mass Transfer Lab	0	0	3	10	10	20	30	50	1
11	NGP-501	General Proficiency	--	--	--	--	--	50	--	50	
		TOTAL	16	5	10					1000	25

U.P. TECHNICAL UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Production Engineering / Industrial & Production Engineering / Mechanical & Industrial Engineering

[Effective from Session 20015-16]

YEAR III, SEMESTER-VI

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NME-602	Machine Design-II	3	1	0	30	20	50	100	150	4
2	NME-603	Dynamics of Machines	3	1	0	30	20	50	100	150	4
3	NPI-601	Principles of Machine Tool Design	3	1	0	30	20	50	100	150	4
4	NME-011 to NME-015	Departmental Elective - I	3	1	0	30	20	50	100	150	4
5	NME-021 to NME-024	Departmental Elective - II	2	1	0	15	10	25	50	75	3
6	NHU-601	Industrial Management	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NME-651	Fluid Machinery Lab	0	0	3	10	10	20	30	50	1
8	NME-652	Machine Design-II Lab	0	0	2	10	10	20	30	50	1
9	NME-653	Theory of Machines Lab	0	0	2	10	10	20	30	50	1
10	NPI-651	Machine Tool Design Lab	0	0	3	10	10	20	30	50	1
11	NGP-601	General Proficiency						50		50	
		TOTAL	16	5	10					1000	25

Note- 4 to 6 Weeks Industrial Training-II after VI semester also to be evaluated in VII semester

Departmental Electives:

Department Elective - I

1. NME-011 Engineering Optimization
2. NME-012 Finite Element Methods
3. NME-013 Mechanical Vibrations
4. NME-014 Mechatronics

Department Elective - II

1. NME-021 Fluid Machinery
2. NME-022 Product Design & Development
3. NME-023 Reliability Engineering
4. NME-024 Unconventional Manufacturing Processes

NME-501 : MACHINE DESIGN-I **L T P**
2 1 0

UNIT I

Introduction

Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads.

3

Design for Static Load

Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.

4

UNIT II

Design for Fluctuating Loads Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria.

4

Riveted Joints

Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.

4

UNIT III

Shafts

Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads, Design for rigidity.

4

Keys and Couplings

Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings, Design of rigid and flexible couplings.

4

UNIT IV

Mechanical Springs

Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.

4

Power Screws

Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws, Design of screw jack

3

Note: Design data book is allowed in the examination

Books and References:

1. Design of Machine Elements,V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Elements-M.F. Spott, Pearson Eductaion

6. Machine Design-Maleev and Hartman, CBS Publishers.
7. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
8. Elements of Machine Component Design, Juvinal&Marshek, John Wiley & Sons.

NME-502 : KINEMATICS OF MACHINES **L:T:P**
3: 1: 0

Unit I

Introduction, mechanisms and machines, kinematics and kinetics, types of links, kinematic pairs and their classification, types of constraint, degrees of freedom of planar mechanism, Grubler's equation, mechanisms, inversion of four bar chain, slider crank chain and double slider crank chain.

4

Velocity analysis:

Introduction, velocity of point in mechanism, relative velocity method, velocities in four bar mechanism, slider crank mechanism and quick return motion mechanism, rubbing velocity at a pin joint, instantaneous center method, types and locations of instantaneous center, Kennedy's theorem, velocities in four bar mechanism and slider crank mechanism.

4

Unit II

Acceleration analysis:

Introduction, acceleration of a point on a link, acceleration diagram, Corioli's component of acceleration, crank and slotted lever mechanism, Klein's construction for slider crank mechanism and four bar mechanism, analytical method for slider crank mechanism.

4

Kinematic synthesis of mechanism:

Introduction, dimensional synthesis of mechanisms, motion, path and function generation, Chebyshev spacing, three position synthesis, graphical approach for four link mechanisms, straight line mechanisms, special mechanisms – indicator diagram mechanisms, steering mechanisms, Hook's Joint

4

Unit III

Cams

Introduction, classification of cams and followers, cam profiles for knife edge, roller and flat faced followers for uniform velocity, uniform acceleration, simple harmonic and cycloidal motions of follower. Analytical methods for cam profile.

8

Unit IV

Gears and gear trains

Introduction, classification of gears, law of gearing, tooth forms and their comparisons, systems of gear teeth, length of path of contact, contact ratio, interference and undercutting in involute gear teeth, minimum number of teeth on gear and pinion to avoid interference, simple, compound, reverted and planetary gear trains, sun and planet gear train.

8

Unit V

Friction drives

Introduction, belt and rope drives, open and crossed belt drives, velocity ratio, slip, power transmission, effect of mass of belt on power transmission, maximum power transmission, initial tension and maximum tension, pivots and collars, uniform pressure and uniform wear, clutches.

8

Books:

1. Theory of Mechanisms and Machines: A Ghose and A K Malik, East West Press Pvt Ltd.
2. Theory of Mechanisms and Machines: J JUicker, G R Pennock and J E Shigley, Oxford University Press.
3. Kinematics and dynamics of machinery: C E Wilson and J E Sadler: PEARSON
4. Kinematics and dynamics of machinery: R L Norton, McGraw Hill
5. Theory of Machines: S S Rattan, McGraw Hill
6. Theory of Machines: Thomas Bevan, Pearson

NME-503: MANUFACTURING SCIENCE& TECHNOLOGY-II **L T P**
3 1 0

Unit I

Metal Cutting-

Mechanics of metal cutting.Geometry of tool and nomenclature .ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Heat generation and cutting tool temperature, Cutting fluids/lubricants.Tool materials. Tool wear and tool life. Machinability.Dynamometer, Brief introduction to machine tool vibration and surface finish.Economics of metal cutting.

9

Unit-II

Machine Tools

(i) Lathe: Principle, construction, types, operations, Turret/capstan, semi/Automatic, Tool layout

2

(ii) Shaper, slotter, planer: Construction, operations & drives.

1

(iii) Milling: Construction, Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required.

2

(iv) Drilling and boring: Drilling, boring, reaming tools. Geometry of twist drills.

2

Unit-III

Grinding &Super finishing

(i) Grinding: Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and cylindrical grinding.Centerless grinding

4

(ii) Super finishing: Honing, lapping and polishing.

1

Limits, Fits & Tolerance and Surface roughness:

Introduction to Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness.

3

Unit-IV

B. Metal Joining (Welding)

Survey of welding and allied processes.Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters.Resistance welding - spot, seam projection etc.Other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding. Soldering & Brazing. Adhesive bonding. Thermodynamic and Metallurgical aspects in welding and weld, Weldability, Shrinkage/residual stress in welds. Distortions & Defects in welds and

remedies. Weld decay in HAZ.

10

Unit-V

C. Introduction to Unconventional Machining and Welding

Need & benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM. Similarly, non-conventional welding applications such as LBW, USW, EBW, Plasma-arc welding, Diffusion welding, Explosive welding/cladding. Introduction to Hybrid machining processes

6

Books and References:

1. Manufacturing Science – A. Ghosh and A.K. Mallik,Affiliated East-West Press
2. Fundamentals of Metal Machining and Machine Tools – Geoffrey Boothroyd, CRC Press
3. Production Technology - R.K. Jain Khanna Publishers.
4. Introduction to Manufacturing Processes – John A. Schey ,McGraw-Hill
5. Production Engineering Science - P.C. Pandey,Standard Publishers Distributors,
6. Modern Machining Processes - P.C. Pandey& H.S. Shan, McGraw-Hill
7. Degarmo's Materials and Processes in Manufacturing - Ernest P. De Garmo, J. T. Black, Ronald A. Kohser, Wiley
8. Fundamentals of Metal Cutting & Machine Tools – B.L. Juneja& G.S. ShekhonWiley
9. Process &Materials of Manufacturing – R.A. Lindburg, Pearson Eductaion
10. Advanced Machining Process - VK Jain ,Allied Publishers
11. Manufacturing Engineering & Technology, -Kalpakjian, Pearson
12. Manufacturing Technology Part I and Part II,-Rao,PN, McGraw-Hill

NME-504 : HEAT & MASS TRANSFER **L T P**
3 1 0

UNIT-1

Introduction to Heat Transfer:

Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.

2

Conduction :

General differential heat conduction equation in the rectangular, cylindrical and spherical coordinate systems.Initial and boundary conditions.

3

Steady State one-dimensional Heat conduction :

Simple and Composite Systems in rectangular, cylindrical and spherical coordinates with and without energy generation; Concept of thermal resistance.Analogy between heat and electricity flow; Thermal contact resistance and over all heat transfer coefficient; Critical radius of insulation.

3

UNIT-2

Fins:

Heat transfer from extended surfaces, Fins of uniform cross-sectional area; Errors of measurement of temperature in thermometer wells.

3

Transient Conduction:

Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction in one dimension only, Heisler charts.

5

UNIT-3

Forced Convection:

Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Thermal entrance region, Empirical heat transfer relations; Relation between fluid friction and heat transfer; Liquid metal heat transfer.

5

Natural Convection :

Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere, Combined free and forced convection.

3

UNIT-4

Thermal Radiation :

Basic radiation concepts; Radiation properties of surfaces; Black body radiation Planck's law, Wein's displacement law, Stefan Boltzmann law, Kirchoff's law; ; Gray body; Shape factor; Black-body radiation; Radiation exchange between diffuse non black bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation; Green house effect.

8

UNIT-5

Heat Exchanger :

Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers.

3

Condensation and Boiling:

Introduction to condensation phenomena; Heat transfer relations for laminar film condensation on vertical surfaces and on outside & inside of a horizontal tube; Effect of non-condensable gases; Dropwise condensation; Heat pipes; Boiling modes, pool boiling; Hysteresis in boiling curve; Forced convection boiling.

3

Introduction to Mass Transfer:

Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusion though a stagnant gas film.

2

Books:

1. Fundamentals of Heat and Mass Transfer, by Incroperra& DeWitt, John Wiley and Sons
2. Heat and Mass Transfer by Cengel, McGraw-Hill
3. Heat Transfer by J.P. Holman, McGraw-Hill
4. Heat and Mass Transfer by Rudramoorthy and Mayilsamy, Pearson Education
5. Heat Transfer by Ghoshdastidar, Oxford University Press
6. A text book on Heat Transfer, by Sukhatme, University Press.
7. Heat Transfer by Venkateshan, Ane Books Pvt Ltd
8. Schaum's outline of Heat Transfer by Pitts & Sisson McGraw-Hill
9. Heat and Mass Transfer by R Yadav, Central Publishing House

NME-505 : I C ENGINES & COMPRESSORS **L T P**

3 1 0

Unit-1

Introduction to I.C Engines: Engine classification and basic terminology, Two and four stroke engines, SI and CI engines, Valve timing diagram.

Thermodynamic analysis of Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Stirling cycle, Ericsson cycles, Comparison of Otto, Diesel and Dual cycles

Fuel air cycle, factors affecting the fuel air cycle, Actual cycle.

8

Unit–II

SI Engines: Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, combustion chamber design for SI engines.

Carburetion, Mixture requirements, Carburetors and fuel injection system in SI Engine

Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect

9

Unit–III

CI Engine: Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines.

Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings

Exhaust emissions from SI engine and CI engine and it's control

9

Unit-IV

Engine Cooling and Lubrication: Different cooling systems, Radiators and cooling fans, Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation.

Fuels: Fuels for SI and CI engine , Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.

Testing and Performance: Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines

9

Unit V

Compressors: Classification, Reciprocating compressors, Single and Multi stage compressors, Intercooling, Volumetric efficiency.

Rotary compressors, Classification, Centrifugal compressor , Axial compressors, Surging and stalling, Roots blower, Vaned compressor.

7

BOOKS:

1. Fundamentals of Internal Combustion Engine by Gill, Smith,Ziurs, Oxford & IBH Publishing CO.
2. Fundamentals of Internal Combustion Engines by H.N. Gupta, Prentice Hall of India
3. A Course in International Combustion Engines, by Mathur& Sharma, DhanpatRai& Sons.
4. I.C Engine Analysis & Practice by E.F Obert.
5. I.C Engine, by Ganeshan, Tata McGraw Hill Publishers.
6. I.C Engine, by R. Yadav, Central Publishing House, Allahabad
7. Reciprocating and Rotary Compressors, by Chlumsky, SNTI Publications, Czechoslovakia
8. Turbines, Compressors and Fans, by S.M.Yahya, Tata McGraw Hill Pub.
9. Engineering Fundamentals of Internal Combustion Engines by W.W. Pulkrabek,,Pearson Eductaion

NPI-501: PRODUCTION PLANNING & CONTROL **L T P**
3 1 0

Unit-I
Introduction:
Types and characteristics of Manufacturing systems and Production systems, Objective and functions of Production, Planning & Control, organization

4

Preplanning:
Forecasting & Market Analysis.Factory Location & Layout, Equipment policy and replacement. Preplanning production, capacity planning

4

Unit-II
Production Planning:
Product development and design. BEP, profit volume chart, Material Resource Planning, Selection of material, methods, machines & manpower. Routing, Loading, Scheduling, Job shop scheduling, sequencing of production operation, line balancing

9

Unit-III
Production Control:
Dispatching rules, dispatching of work card, move card, inspection card and reports, Control boards and charts. Expediting, progress reporting, corrective action, change in schedules.

6

Unit-IV
Evaluation and Analysis:
Elements of network and its development, Introduction to CPM and PERT techniques.

7

UNIT-V
Material Planning and Control:
Field and scope, material planning, inventories, types and classification, ABC analysis, economic lot (batch) size, lead time and reorder point, modern trends in purchasing, store keeping, store operations, Introduction to manufacturing resource planning (MRP) and enterprise resource planning (ERP)

10

Books and References:

1. Elements of Production Planning & Control by Samuel Eilon, Universal Publishing Corporation.
2. Production Planning & Control & Industrial Management by K.C. Jain and L.N. Agarwal, Khanna Publishers.
3. Modern Production/Operations Management by E.S. Buffa , Wiley.
4. Production System: Planning, Analysis, and Control by J.L. Riggs,Wiley.
5. Production Planning and Inventory Managementby J.F. Magee &David Morris BOODMAN, McGraw Hill.
6. Industrial Engg& Management by O.P. Khanna, DhanpatRai& Sons.

NME-551 : MACHINE DESIGN-I Lab **L T P**

0 0 2

Minimum eight experiments out of the following are to be performed.

Students are advised to use design data book for the design. Drawing shall be made wherever necessary on small drawing sheets

1. Design & drawing of Cotter joint.
2. Design & drawing of Knuckle joint
3. Design of machine components subjected to combined steady and variable loads
4. Design of eccentrically loaded riveted joint
5. Design of boiler riveted joint
6. Design of shaft for combined constant twisting and bending loads
7. Design of shaft subjected to fluctuating loads
8. Design and drawing of flanged type rigid coupling
9. Design and drawing of flexible coupling
10. Design and drawing of helical spring
11. Design and drawing of screw jack

NME-553 : MANUFACTURING TECHNOLOGY -II – LAB **L T P**

0 0 3

Minimum eight experiments out of the following along-with study of the machines / processes

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. Bolt (thread) making on Lathe machine
3. Tool grinding (to provide tool angles) on tool-grinder machine.
4. Gear cutting on Milling machine.
5. Machining a block on shaper machine.
6. Finishing of a surface on surface-grinding machine.
7. Drilling holes on drilling machine and study of twist-drill.
8. Study of different types of tools and its angles & materials.
9. Experiment on tool wear and tool life.
10. Experiment on jigs/Fixtures and its uses
11. Gas welding experiment
12. Arc welding experiment
13. Resistance welding experiment.
14. Soldering & Brazing experiment

15. Experiment on unconventional machining.
16. Experiment on unconventional welding.
17. Experiment on TIG/MIG Welding.
18. Macro and Microstructure of welding joints.

NME-554 : HEAT & MASS TRANSFER – LAB **L T P**

0 0 3

Minimum eight experiment of the following

1. Conduction – Experiment on Composite plane wall
2. Conduction – Experiment on Composite cylinder wall
3 Conduction - Experiment on critical insulation thickness
4. Conduction – Experiment on Thermal Contact Resistance
5. Convection - Pool Boiling experiment
6. Convection - Experiment on heat transfer from tube-(natural convection).
7. Convection - Heat Pipe experiment.
8. Convection - Heat transfer through fin-(natural convection) .
9. Convection - Heat transfer through tube/fin-(forced convection).
10 Convection - Determination of thermal conductivity of fluid
11 Experiment on Stefan's Law, on radiation determination of emissivity, etc.
12 Experiment on solar collector, etc.
13. Heat exchanger - Parallel flow experiment
14. Heat exchanger - Counter flow experiment

NME-602: MACHINE DESIGN-II **L T P**

3 1 0

UNIT I

Principle of transmission and conjugate action

Spur Gears

Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards.

6

Helical Gears

Terminology, Proportions for helical gears, Forces components on a tooth of helical gear, Virtual number of teeth, Beam strength& wear strength of helical gears, Dynamic load on helical gears, Design of helical gears.

6

UNIT II

Bevel gears

Terminology of bevel gears, Force analysis, Virtual number of teeth, Beam strength and wear strength of bevel gears,Effective load of gear tooth, Design of a bevel gear system.

4

Worm Gears

Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing system.

4

UNIT III

Sliding Contact Bearing

Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing,

6

UNIT IV

Rolling Contact Bearing

Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing

6

UNIT V

IC ENGINE parts,

Selection of type of IC engine, General design considerations, Design of cylinder and cylinder head; Design of piston and its parts like piston ring and gudgeon pin etc.; Design of connecting rod; Design of crankshaft

10

Note: Design data book is allowed in the examination

Books and References:

1. Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Eesign-M.F. Spott, Pearson Eductaion
6. Machine Design-Maleev and Hartman, CBS Publishers.
7. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
9. Elements of Machine Component Design, Juvinal&Marshek, John Wiley & Sons.

NME-603 : DYNAMICS OF MACHINES **L T P**
3 1 0

Unit I

Force analysis:

Static force analysis of mechanisms, D'Alembert's Principle, dynamics of rigid link in plane motion, dynamic force analysis of planar mechanisms, piston force and crank effort. Turning

moment on crankshaft due to force on piston, Turning moment diagrams for single cylinder double acting steam engine, four stroke IC engine and multi-cylinder engines, Fluctuation of speed, Flywheel.

7

Unit II

Gyroscope:

Space motion of rigid bodies, angular momentum, gyroscopic couples, gyroscopicstabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

4

Mech. Vibrations:

Types of Vibration, Degrees of freedom. Longitudinal Vibration: Single degree free and damped vibration. Forced vibration of single degree under harmonic excitation.Vibration isolation.Whirling of shaft and critical speed.

5

Unit III

Balancing:

Introduction,static balance, dynamic balance, balancing of rotating masses,two plane balancing, graphical and analytical methods, balancing of reciprocating masses,balancing of single cylinder engine, balancing of multi cylinder inline engines.

8

Unit IV

Governors:

Introduction, types of governors, characteristics of centrifugal governors, gravitycontrolled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors. Effort and Power of governor, Controlling force diagrams for Porter governor and spring controlled governors.

8

Unit V

Brakes and dynamometers:

Introduction, Law of friction and types of lubrication, types of brakes, effect of braking on rear and front wheels of a four wheeler, dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer

8

Text/Reference Books:

1. Kinematics and dynamics of machinery: Wilson and Sadler, Third edition, Pearson.
2. Theory of Mechanisms and Machines: AmitabhaGhosh and Ashok kumarMallik, Third Edition Affiliated East-West Press.
3. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Oxford University Press
4. Kinematics and dynamics of machinery: R L Norton, McGraw Hill
5. Theory of Mchines: S.S. Rattan, McGraw Hill
6. Theory of Mchines: Thomas Bevan, CBS Publishers.

NME-604 : REFRIGERATION & AIR CONDITIONING **L T P**
3 1 0

Unit-1

Refrigeration:

Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P.

Air Refrigeration cycle:

Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).

8

Unit-2

Vapour Compression System:

Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system, Cascade system.

8

Unit-3

Vapour Absorption system;

Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration diagram & Enthalpy – concentration diagram , Adiabatic mixing of two streams, Ammonia – Water vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison. Three fluid system.

5

Refrigerants:

Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. Ozone layer depletion and global warming considerations of refrigerants

3

Unit-4

Air Conditioning:

Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). Air Washers, Cooling towers & humidifying efficiency.

9

Unit-5

Refrigeration Equipment & Application:

Elementary knowledge of refrigeration & air conditioning equipmentse.g compressors, condensers, evaporators & expansion devices, Food preservation, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.

7

Books:

1. Refrigeration and Air conditioning by C.P Arora, McGraw-Hill
2. Refrigeration and Air conditioning, by Manohar Prasad, New Age International (P) Ltd.Pub.
3. Refrigeration and Air conditioning by R. C. Arora, PHI
4. Principles of Refrigeration by Roy J. Dossat. Pearson Education
5. Refrigeration and Air conditioning by stoecker& Jones. McGraw-Hill
7. Refrigeration and Air conditioning by Arora&Domkundwar. DhanpatRai
7. Thermal Environment Engg. byKuhen, Ramsey &Thelked.

NPI- 601 : PRINCIPLES OF MACHINE TOOL DESIGN **L T P**
3 1 0

Unit-I

Introduction: Developments is machine tools, types of machine tools surface, profits and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc.General requirement of machine tool design.Machine tool design process. Tool wear, force Analysis.

9

Unit-II

Machine Tools Drives: Classification of machine tool drives, group Vs individual drives, election of electric motor, A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system. e.g. pumps, cylinder, directional control valves, pressure valves etc. Fundamentals of Kinematics structure of machine tools.

8

Unit-III

Regulation of Speed and Feed rates: Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control.

7

Unit-IV

Design of Machine Tool Structure: Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, column and housing, Model technique in design.

3

Design of guideways and power screws: Basic guideway profiles, Designing guideway for stiffness a wear resistance & hydrostatic and antifriction guideways. Design of sliding friction power Screws. Design of spindlier & spindle supports.

3

Layout of bearings, selection of bearings machine tools

2

Unit-V

Dynamics of machine tools: General procedure for assessing the dynamic stability of cutting process, closed loop system, chatter in machine tools.

5

Control Systems: Functions, requirements & types of machine tool controls, controls for speed & feed change. Automatic and manual Controls.Basics of numerical controls.Machine tool testing.

3

Books :
1. Machine Tools Design & Numerical Controls by N.K. Mehta, McGraw-Hill
2. Design of Machine Tools by S.K. Basu Allied Publishers.
3. Principles of Machine Tools by Bhattacharya and Sen. New Central Book Agency.
4. Machine Tool Design Handbook by CMTI, McGraw-Hill.

NME-011 : ENGINEERING OPTIMIZATION **L T P**
3 1 0

UNIT I
Introduction:
Historical Developments, and Review of Engineering applications of Optimization Techniques
Linear Programming:
Simplex method, Revised simplex method, Two phase method, Duality, Dual simplex method, Intgerlinear programming, 0-1 integer linear programming, solution by branch and bound method.

9

UNIT II
Classical Optimization Techniques: Introduction, Review of single and multivariable optimization methods with and without constraints, Non-linear one-dimensional minimization problems, Examples.

8

UNIT-III
Constrained Optimization Techniques: Introduction, Direct methods - Cutting plane method and Method of Feasibledirections, Indirect methods - Convex programming problems, Exterior penalty function method, Examples and problems

8

UNIT-IV
Unconstrained Optimization Techniques: Introduction, Direct search method - Random, Univariate and Pattern searchmethods, Rosenbrock's method of rotating co-ordinates, Descent methods - Steepest Decent methods-Quasi-Newton's andVariable metric method, Examples.

8

UNIT-V
Geometric Programming: Introduction, Unconstrained minimization problems, solution of unconstrained problem fromarithmetic-geometric inequality point of view, Constrained minimization problems, Generalized polynomial optimization,Applications of geometric problems, Introduction to stochastic optimization.

Books and References:

1. Engineering Optimization by Ravindran, Wiley India
2. Engineering Optimization:Theory and Application by S SRao, Wiley India
3. Linear and Non Linear Programming by Luenberger , Narosa

NME-012: FINITE ELEMENT METHODS **L T P**
3 1 0

Unit 1
Introduction, exact solution vs approximate solution, principle of FEM, general procedure for finite element analysis, pre-processing, solution, post processing, various approximate methods, weighted residual method, variational or Rayleigh Ritz method, principle of minimum potential energy.
Review of matrices, definition, types, addition or subtraction, multiplication, inverse of a matrix, calculus of matrix.

8

Unit II
Direct stiffness methods, linear spring as finite element, direct formulation of uni-axial bar, truss and beam elements, local and global coordinates, nodes and elements, stiffness matrix, formulation of global stiffness matrix, application of boundary conditions and forces, essential and natural boundary conditions, elimination method, penalty methods, calculation of element stresses and strains.

8

Unit III
Finite element formulation of 1-d problems, method of weighted residuals, strong and weak form, the Galerkin finite element method, application of Galerkin's method to uni-axial bar and truss elements, Galerkin method for one dimensional heat conduction problems like heat transfer through wall, heat transfer through fin etc., one dimensional conduction with convection.

8

Unit IV
Interpolation or shape functions, compatibility, completeness and convergence requirements, shape functions for one and two dimensional elements, finding shape function using Lagrange polynomials.
Application of FEM in scalar field problems, heat transfer in two dimensions, time dependent heat transfer.

8

Unit V
Concepts of plane stress and plain strain, displacement relation, stress-strain relations, equilibrium and compatibility equations, vector field problems, derivation of constant strain triangular element stiffness matrix and equations, treatment of body and surface forces, stress and strain computation.
Practical considerations in finite element application, programming aspects, commercially available FEM packages, desirable features of a FEM packages, problem solving on a general purpose FEM software package like ANSYS, ABAQUS, NISA etc.

8

Books and References:

1. Fundamentals of Finite Element Analysis by David V Hutton, McGraw-Hill Learning
2. A First Course in Finite Element Method 5e by Daryl L Logan, Cengage Learning
3. Finite Element Analysis by G L Narasaiah, BS Publications.
4. An Introduction to Finite Element Method, 3e by J N Reddy, McGraw-Hill
5. Finite Element Method with Application in Engineering by Desai, Eldho and Shah, Pearson Education.
6. Introduction to Finite Element Analysis and Design by Kim & Shankar, John Wiley & Sons.
7. Introduction to Finite Elements in Engineering by Chandrupatla&Belagundu, Pearson Education.

NME-013 : MECHANICAL VIBRATIONS **L T P**
3 1 0

UNIT - I

Introduction, Classification of Vibration Systems, Harmonic motion, Vector re[presentation of harmonic motion, Natural frequency & response, Effects of vibration, superposition of simple harmonic motions, beats, Fourier analysis-analytical and numerical methods.

3

Single Degree Freedom System, Equation of motion, Newton's method, D'Alembert's principle, Energy method etc., Free vibration, Natural frequency, Equivalent systems, Displacement, Velocity and acceleration, Response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement, Energy dissipation in viscous damping.

5

UNIT - II

Single Degree Freedom: Forced Vibration Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments

8

UNIT- III

Two Degree Freedom systems Introduction, Principal modes, Double pendulum, Torsional system with damping, Coupled system, Principle of vibration absorber, Undamped dynamic vibration absorbers, Torsional vibration absorber, Centrifugal pendulum absorbers, Vibration isolators and Dampers.

8

UNIT- IV

Multi-degree Freedom system: Exact Analysis, Undamped free and forced vibrations of multi-degree freedom systems, influence coefficients, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts**.**

8

UNIT- V

Multi Degree Freedom system: Numerical Analysis by Rayleigh's method, Dunkerely's, Holzer's and Stodola methods, Rayleigh-Ritz method

5

Critical speed of shafts, Whirling of uniform shaft, Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed.

3

Books and References:

1. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee.
2. Mechanical Vibrations-Theory & Practice, S Bhave, Pearson Education.
3. Mechanical Vibrations-Theory & Applications, Singhal, Katson Books.
4. Theory of Vibrations with Applications, Thomson&Dahleh, Pearson Education.
5. Elements of Vibration Analysis, L Meirovitch, McGraw-Hill Education.
6. Mechanical Vibrations – Tse, Morse & Hinkle
7. Mechanical Vibrations – V. Rama Murthy, Narosa Publications
8. Mechanical Vibrations – D. Nag, Wiley

NME-014: MECHATRONICS **L T P**
3 1 0

Unit 1
Introduction, synergy of systems, definition of mechatronics, applications of mechatronics in design and modeling, actuators and sensors, intelligent controls, robotics, manufacturing etc., objectives, advantages and disadvantages of mechatronics, examples of mechatronics systems in industry.
Mechanical components in mechatronics, force, friction and lubrication, materials, mechanical behavior of materials, mechanisms used in mechatronics, lever and four bar mechanisms, bearing, belt, chain, cam, slider crank, clutches etc.

8

Unit II
Electronics elements in mechatronics, conductors, insulators and semi conductors, passive electrical components, resistors, capacitor and inductor, transformer, active elements, semi conductor devices, transistors and integrated circuits, digital electronics components like logic gates, flip-flops, shift register, multiplexer and counter.
Computing elements in mechatronics, analog computer, timer, analog to digital converter, digital to analog converter, digital computer, microprocessor and its architecture, micro-controllers, programming logic controllers, their basic structures, mnemonics.

8

Unit III
System modeling and analysis, control system concepts, transfer function of physical systems, block diagrams representation of systems, transfer function of a system, standard input signals, time response of a first and second order systems to a step input, frequency response analysis, automatic control systems, digital control systems.
Motion control devices, actuator types & application areas, hydraulic and pneumatic actuators, electrical actuators, DC servomotor, AC servomotor and stepper servomotor, micro-actuators, drive selection and applications.

8

Unit IV
Sensors and transducers, their static and dynamic performance characteristics, internal sensors, external sensors and micro-sensors, sensors for displacement, position and proximity; velocity, motion, force, fluid pressure, liquid flow, liquid level, temperature, light sensors, selection of Sensors.
Stages in designing mechatronics systems, traditional and mechatronic design, possible design solutions, case studies of mechatronics systems, pick and place robot, automatic car park systems, engine management systems etc.

8

Unit V
Mechatronics in industry, autotronics, bionics and avionics and their various applications, mechatronics in manufacturing, features of mechatronics in manufacturing, flexible manufacturing systems, manufacturing automatic protocol, computer integrated manufacturing, just in time production systems, CNC machines, adaptive control machine system, CNC machine operations, challenges in mechatronics production units.

8

BOOKS & REFERENCES:

1. A Kuttan, “Introduction to Mechatronics, Oxford University Press, 2010.
2. Alciatore&Histand, “Introduction to Mechatronics & Measurement Systems, 4e”, McGraw-Hill Education, 2014.
3. M Jouaneh, “Fundamentals of Mechatronics”, Cengage Learning, 2013.
4. W. Bolton, “Mechatronics”, Pearson Education, Second Edition, 1999.

5. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
6. Dan Necsulesu, “Mechatronics”, Pearson Education Asia, 2002 (Indian Reprint).
7. NitaigourPremchandMahadik, “Mechatronics”, McGraw-Hill Education, 2015.
8. Lawrence J. Kamm, “Understanding Electro – Mechanical Engineering, An Introduction to Mechatronics”, Prentice – Hall of India Pvt., Ltd., 2000.
9. Ramachandran K. P., Vijayaraghavan G. K., Balasundaram M.S. “Mechatronics: Integrated Mechanical Electronic Systems”, Wiley

NME-021 : FLUID MACHINERY **L T P**
2 1 0

UNIT-I

Introduction: Impulse of Jet and Impulse Turbines:

Classification of Fluid Machines & Devices, Application of momentum and moment of momentum equation to flow through hydraulic machinery, Euler’s fundamental equation.Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & *c*urve),Classification of turbines, Impulse turbines, Constructional details, Velocity triangles,Power and efficiency calculations, Governing of Pelton wheel

8

UNIT-II

Reaction Turbines:

Francis and Kaplan turbines, Constructional details, Velocity triangles, Power andefficiency calculations, Degree of reaction, Draft tube, Cavitation in turbines, Principlesof similarity, Unit and specific speed, Performance characteristics, Selection of waterturbines.

8

UNIT-III

Centrifugal Pumps:

Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficienciesof centrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics.

8

UNIT-IV

Positive Displacement and other Pumps:

Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels, Comparison of centrifugal and reciprocating pumps, Performance characteristics.
Hydraulic ram, Jet pumps, Air lift pumps.

8

BOOKS:

1. Hydraulic Machines by JagdishLal, Metropolitan book co. pvt ltd.
2. Hydraulic Machines by K Subramanya, Tata McGraw Hill
3. Fluid Mechanics and Machinery by C.S.P.Ojha, R. Berndtsson, P.N. Chandramouli, Oxford University Press
4. Fluid Mechanics and Fluid Power Engineering by D S Kumar, S K Kataria& Sons
5. Fluid Mechanics and Turbo machines by Das, PHI
6. Fluid Power with Applications, by Esposito, Pearson
7. Fluid Mechanics and hydraulic machines by Modi& Seth, Standard Book House
8. Fundamentals of Turbomachinery by Venkanna B.K., PHI
9. Hydraulic Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.

10. Fluid Mechanics and Hydraulic Machines by SukumarPati, Tata McGraw Hill

NME -022: PRODUCT DESIGN & DEVELOPMENT **L T P**
2 1 0

UNIT I:
Introduction to Product Design, Applications, Relevance, Product Definition, Scope, Design definitions, The role and nature of design, Old and new design methods, Design by evolution vs design by innovation. Examples such evolution of bicycle, safety razor etc. Need based development, Technology based developments. Physical realisability& Economic feasibility of design concepts.

8

UNIT II:
Morphology of Design, Divergent, Transformation and Convergent phases of product design, Identification of need, Analysis of need, Design criteria, Functional aspects, Aesthetics, ergonomics, form (structure). Shape, size, color, Creativity, Mental blocks in creativity, Removal of blocks, Ideation Techniques.

8

UNIT III:
Transformations stage of design, Brainstorming &Synectics, Morphological techniques, Utility concept, Utility value, Utility index, Economic aspects of design, Fixed and variable costs, Break-even analysis, Product Appraisal Information and literature search, patents, standards and codes, Environment and other safety considerations in product design.

8

UNIT IV:
Reliability, Reliability considerations in product design, Bath tub curve, Reliability of systems in series and parallel. Failure rates, MTTF and MTBF, Optimum spares from reliability consideration, Design of displays and controls, Man-Machine interface, Compatibility of displays and controls, Ergonomic aspects of design, Anthropometric data and its importance in design

8

Books and references:

1. Product Design & Manufacturing - A.K.Chitale&R.C.Gupta, Prentice Hall.
2. Engg . Product Design -C .D. Cain, Bussiness Books.
3. Product Design by Otto and Wood- Pearson
4. Industrial design for Engineers –W .H. Mayall, Itiffe.
5. Product Design & Decision Theory - M.K. Starr - Prentice Hall
6. The Technology of Creation Thinking - R.P. Crewford – Prentice Hall.
7. Design Methods – seeds of human futures – J. Christopher Jones, John Wiley & Sons.
8. Human Factor Engg. – Mccormick E.J., McGraw-Hill.
9. Industrial Design In Engineering – A marriage of Techniques – Charles H .Flurscheim, The Design Council - London.

NME-023: RELIABILITY ENGINEERING **L T P**
2 1 0

UNIT-I

Introduction: Definition of reliability, Failures & failures modes, Failure rates, MTTF, MTBF, Bath tub curve, Definition and factors influencing system effectiveness, various parameters of system effectiveness.

6

UNIT-II

Reliability Mathematics, Definition of probability, laws of probability, conditional probability, Bay's theorem, Various probability distributions, Data collection, Recovery of data, Data analysis Procedures, Empirical reliability calculations.

8

UNIT-III

Reliability types, System of series, parallel, series parallel, Stand by and complex systems; Development of logic diagram, Methods of reliability evaluation; Cut set and tie set methods, Matrix methods, Event trees and fault trees methods, Reliability evaluation using probability distributions, The Weibull distribution and its application in reliability, Markov method, Frequency and duration method.

10

UNIT-IV

Reliability Improvements: Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance

4

Reliability Testing, Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards.

4

Books & references:

1. R.Billintan& R.N. Allan,"Reliability Evaluation of Engineering and Systems", Plenum Press.
2. K.C. Kapoor& L.R. Lamberson,"Reliability in Engineering and Design", John Wiely and Sons.
3. S.K. Sinha& B.K. Kale,"Life Testing and Reliability Estimation", Wiely Eastern Ltd.
4. A Birolini. Reliability Engineering-Theory & Practice, Springer.
5. G.H.Sandler,"System Reliability Engineering", Prentice Hall.
6. D J Smith, Reliability, Maintainability & Risk, Butterworth-Heinemann.

NME-024 : UNCONVENTIONAL MANUFACTURING PROCESSES **L T P**
2 1 0

UNIT-I

Introduction, Limitations of conventional manufacturing processes, Need for unconventional manufacturing processes, its classification and future possibilities, Hybrid processes

4

Unconventional Machining Process based on material removal by abrasion, Principle and working and applications Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet machining and Ultrasonic Machining.

4

UNIT-II

Thermoelectric unconventional methods, Principle, working and applications of Plasma Arc Machining, Laser Beam Machining, Electron Beam Machining etc

4

Working principle and applications of Electric Discharge Machining, EDM machines, EDM process characteristics, Wire electric discharge machining

4

UNIT-III

Electro-chemical machining processes, ECM, its working principle, advantages and applications, Electro-chemical grinding, Electro-chemical deburring, Chemical machining.
Unconventional welding processes: Explosive welding, Cladding etc., Under water welding, Metalizing, Plasma are welding/cutting etc.

8

UNIT-IV

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-discharge forming, water hammer forming, explosive compaction etc.

5

Electronic-device Manufacturing, Diffusion and Photo- Lithography process for electronic-device manufacturing.

3

Books and references:

1. Modern Machining Processes – P.C. Pandey
2. Advanced Machining Processes, V.K. Jain, Allied Publishers.
3. Handbook of Manufacturing Processes, James G Bralla, Industrial Press.

NME-651 : FLUID MACHINERY Lab **L T P**
0 0 3

Minimum ten experiments out of the following along with study of the machines and processes

1. Impact of Jet experiment.
2. Experiment on Pelton wheel.
3. Experiment on Francis turbine.
4. Experiment on Kaplan turbine.
5. Experiment on Reciprocating pump.
6. Experiment on centrifugal pump.
7. Experiment on Hydraulic Jack/Press
8. Experiment on Hydraulic Brake
9. Experiment on Hydraulic Ram
10. Study through visit of any water pumping station/plant
11. Any other suitable experiment/test rig such as comparison & performance of different types of pumps and turbines.
12. Experiment on Compressor
13. Experiment for measurement of drag and lift on aerofoil in wind tunnel

NME-652 : MACHINE DESIGN-II Lab **L T P**
0 0 2

A. Computer and Language :students are required to learn the basics of computer language such as C and C++ so that they should be able to write the computer programme (*3practical turns*)

B. Writing Computer programme for conventional design: Students are required to write computer program and validate it for the design of machine components done in theory subject (*5practical turns*)

C. Mini Project: Each **s**tudent will be given a real life problem for the complete design of a subsystem/system using either manual calculation with the help of design handbook or through computer programme, if needed. This will be done as home assignment to be submitted at the end of the semester.

NME-653 : THEORY OF MACHINES LAB **L T P**
0 0 2

Minimum eight experiments out of the following:

1. Study of simple linkage models/mechanisms
2. Study of inversions of four bar linkage
3. Study of inversions of single/double slider crank mechanisms
4. Experiment on Gears tooth profile, interference etc.
5. Experiment on Gear trains
6. Experiment on longitudinal vibration
7. Experiment on transverse vibration
8. Experiments on dead weight type governor
9. Experiment on spring controlled governor
10. Experiment on critical speed of shaft
11. Experiment on gyroscope
12. Experiment on static/dynamic balancing
13. Experiment on Brake
14. Experiment on clutch

NME-654 : REFRIGERATION & AIR CONDITIONING Lab **L T P**
0 0 3

Minimum eight experiments out of the following:

1. Experiment on refrigeration test rig and calculation of various performance parameters.
2. Study of different types of expansion devices used in refrigeration system.
3. Study of different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.

6. Experiment on air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant and its detailed study.
10. Visit of cold-storage and its detailed study.
11. Experiment on Ice-plant.
12. Experiment on two stage Reciprocating compressor for determination of volumetric efficiency , PV diagram and effect of intercooling.
13. Study of Hermetically sealed compressor.
14. Experiment on Desert coolers.

NPI-651 : MACHINE TOOL DESIGN LAB **L T P**
0 0 2

Minimum eight experiments out of the following:

1. Measurement and analysis of cutting forces in orthogonal turning.
2. Flank wear – time characteristics for single point cutting tools.
3. (i) Checking the level of installation of a lathe in horizontal & vertical planes

   (ii) Checking the bed ways for straightness and parallelism.
4. Testing the main spindle of a lathe for axial movement and true running.
5. Process capability determination of a center lathe.
6. Flatness checking of a surface plate.
7. A study of devices for intermittent motion used in machine tools e.g. ratchet gear & Geneva Mechanism.
8. A study of Kinematics structure of lathe/milling machine.
9. A study of the drives for reciprocation used in machine tools.
10. Development the speed chart and gearing diagram for a gassed head lathe.
11. A study of the cone pulley drive in center lathe and development of its raydiagram for the speed structure.
12. Efficiency testing of lathe at various parameters-values.
13. Accuracy analysis of finished cylindrical work-pieces produced on a lathe.
14. Cutting (turning) with inclined placed tool (in tool fixture).
15. Turning with two simultaneously cutting tool (one from front on usual tool postand the other tool from back on tool-fixture on carriage)

U.P. TECHNICAL UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Mechanical Engineering / Production Engineering / Industrial & Production Engineering / Mechanical & Industrial Engineering

[Effective from Session 20016-17]

YEAR IV, SEMESTER-VII

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NOE-071 to 074	Open Elective -I	3	1	0	30	20	50	100	150	4
2	NME-701	CAD	3	1	0	30	20	50	100	150	4
3	NME-702	Automobile Engineering	3	1	0	30	20	50	100	150	4
4	NME-031 to NME-034	Departmental Elective – III	3	1	0	30	20	50	100	150	4
5	NME-041 to NME-044	Departmental Elective – IV	3	1	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
5	NME-751	CAD/CAM Lab	0	0	2	10	10	20	30	50	1
6	NME-752	I. C. Engine and Automobile Lab.	0	0	2	10	10	20	30	50	1
7	NME-753	INDUSTRIAL TRG.	0	0	2	-	50	50	-	50	1
8	NME-754	PROJECT	0	0	3	-	50	50	-	50	2
	GP-701	GP	-	-	-	-	-	50	-	50	-
		TOTAL	15	5	9					1000	25

Note- Practical Training-1 & 2 (4-weeks each) done after 4th & 6th Semesters would be evaluated in 7th semester through report and viva voce etc.
Project should be initiated in 7th semester beginning **(End Semester Examination to be conducted for evaluation for 7th sem),** and should be complete by the end of 8th semester with good Report and power-point Presentation etc.

Open Electives – I

NOE-071 Entrepreneurship Development
NOE-072 Quality Management
NOE-073 Operations Research
NOE-074 Introduction to Biotechnology

Departmental Elective III

NME-031 Computer Aided Manufacturing
NME-032 Project Management
NME-033 Computational Fluid Dynamics
NME-034 Composite materials

Departmental Elective IV

NME-041 Total Quality Management
NME-042 Thermal Turbo Machines
NME-043 Mechanical System Design
NME-044 Automation and Robotics

U.P. TECHNICAL UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Production Engineering / Industrial & Production Engineering / Mechanical & Industrial Engineering
[Effective from Session 20016-17]

YEAR IV, SEMESTER-VIII

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NOE-081 to 084	Open Elective -II	3	1	0	30	20	50	100	150	4
2	NPI-801	Quality Control	3	1	0	30	20	50	100	150	4
3	NME-051 to NME-055	Departmental Elective –V	3	1	0	30	20	50	100	150	4
4	NME-061 to NME-065	Departmental Elective -VI	3	1	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
5	NME-851	SEMINAR	0	0	3	-	50	50	-	50	2
6	NME-852	PROJECT	0	0	12	-	100	100	200	300	7
7	GP-801	GP	-	-	-	-	-	50	-	50	-
		TOTAL	12	4	15					1000	25

Open Electives – II

NOE-081 Non Conventional Energy Resources
NOE-082 Nonlinear Dynamic Systems
NOE-083 Product Development
NOE-084 Automation and Robotics

Departmental Elective V

NME-051 Operations Research
NME-052 Design of Thermal Systems
NME-053 Advance Synthesis of machines
NME-054 Industrial Automation
NME-055 Advance Welding Technology

Departmental Elective VI

NME-061 Experimental Stress Analysis
NME-062 Plant Layout and Material Handling
NME-063 Additive Manufacturing
NME-064 Computer Aided Process Planning
NME-065 Non Destructive Testing

U.P. TECHNICAL UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Mechanical Engineering
[Effective from Session 2016-17]

YEAR IV, SEMESTER-VIII

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NOE-081 to 084	Open Elective -II	3	1	0	30	20	50	100	150	4
2	NME-801	Power Plant Engineering	3	1	0	30	20	50	100	150	4
3	NME-051 to NME-055	Departmental Elective -V	3	1	0	30	20	50	100	150	4
4	NME-061 to NME-065	Departmental Elective -VI	3	1	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
5	NME-851	SEMINAR	0	0	3	-	50	50	-	50	2
6	NME-852	PROJECT	0	0	12	-	100	100	200	300	7
7	GP-801	GP	-	-	-	-	-	50	-	50	-
		TOTAL	12	4	15					1000	25

Open Electives – II

NOE-081 Non Conventional Energy Resources
NOE-082 Nonlinear Dynamic Systems
NOE-083 Product Development
NOE-084 Automation and Robotics

Departmental Elective V

NME-051 Operations Research
NME-052 Design of Thermal Systems
NME-053 Advance Synthesis of machines
NME-054 Industrial Automation
NME-055 Advance Welding Technology

Departmental Elective VI

NME-061 Experimental Stress Analysis
NME-062 Plant Layout and Material Handling
NME-063 Additive Manufacturing
NME-064 Computer Aided Process Planning
NME-065 Non Destructive Testing.

NME-701: COMPUTER AIDED DESIGN (CAD) **L T P**
3 1 0

UNIT-I

Introduction: Introduction to CAD/CAED/CAE, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications Computer Graphics-I CAD/CAM systems,

Computer Graphics-I Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner, Speech control devices and Touch, panels, Graphics display devices-Cathode Ray Tube, Random & Raster scan display, Color CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters

8

UNIT-II

Computer Graphics-II Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives- Bresenham's line drawing algorithm and Bresenham's circle generating algorithm Geometric Transformations: World/device Coordinate Representation, Windowing and clipping, 2 D Geometric transformations-Translation, Scaling, Shearing, Rotation & Reflection Matrix representation, Composite transformation, 3 D transformations, multiple transformation .

8

UNIT-III

Curves: Curves representation, Properties of curve design and representation, Interpolation vs approximation, Parametric representation of analytic curves, Parametric continuity conditions, Parametric representation of synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves and its properties, Periodic and non-periodic B-spline curves

8

UNIT-IV

3D Graphics: Polygon surfaces-Polygon mesh representations, Quadric and Superquadric surfaces and blobby objects; Solid modeling-Solid entities, Fundamentals of Solid modeling-Set theory, regularized set operations; Half spaces, Boundary representation, Constructive solid geometry, Sweep representation, Color models. Basic application commands for 2d drafting software like AutoCAD/Draftsight (any one)&3d solid modeling software Solidworks/Autodesk Inventor/PTC Creo /Catia (Any one)etc.

8

UNIT-V

Finite Element Analysis: Basic concept of the finite element method, comparison of FEM with direct analytical solutions; Steps in finite element analysis of physical systems, Finite Element analysis of 1-D problems like spring, bar, truss and beam elements formulation by direct approach; development of elemental stiffness equations and their assembly, solution and its post processing.

8

Books and References:

1. Computer Graphics, by Hearn & Baker, Prentice Hall of India

2. CAD/CAM, by Groover and Zimmers, Prentice Hall India Ltd.
3. CAD/CAM :Theory and Practice, by Zeid, McGraw Hill
4. CAD/CAM: Computer Aided Design and Manufacturing, by Groover, Pearson India
5. Mathematical Elements for Computer Graphics, buy Rogers and Adams, McGraw Hill
6. Finite Element Method By S S Rao
7. FE Analysis Theory and Programming, by Krishnamoorthy, Tata McGraw Hill

NME-702: AUTOMOBILE ENGINEERING **L T P**
3 1 0

UNIT-I

Introduction:

Basic concepts of Automobile Engineering and general configuration of an automobile, Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box. Gear ratio determination.

6

UNIT-II

Transmission System:

Requirements. Clutches. Toque converters. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber & Toe-in, Toe-out etc.. Steering geometry. Ackerman mechanism, Understeer and Oversteer.

8

UNIT-III

Braking System:

General requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects.

5

Chasis and Suspension System:

Loads on the frame, Strength and stiffness, Independent front & rear suspension, Perpendicular arm type, Parallel arm type, Dead axle suspension system, Live axis suspension system,Air suspension & shock absorbers.

5

UNIT-IV

Electrical System :

Types of starting motors, generator & regulators, lighting system, Ignition system, Horn, Battery etc.

5

Fuel Supply System:

Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, Carburetor etc. MPFI.

4

UNIT-V

Emission standards and pollution control :

Indian standards for automotive vehicles-Bharat I and II, Euro-I and Euro-II norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives and modern trends in automotive engine efficiency and emission control.

5

Maintenance system:

Preventive maintenance, break down maintenance and over hauling.

2

Books and References:

1. Automotive Engineering- Hietner
2. Automobile Engineering - Kripal Singh.
3. Automobile Engineering - Narang.
4. Automobile Engineering –TTTI, Pearson India
5. Automotive Mechanics- Crouse
6. Automobile Engineering - Newton and Steeds.
7. Automobile Engineering –Ramakrishna, PHI, India

NME:801 POWER PLANT ENGINEERING **L T P**

3 1 0

UNIT-I

Introduction

Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion calculations.

3

Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant units.

2

Power plant economics and selection

Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor.s profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.

3

UNIT-II

Steam power plant

General layout of steam power plant, Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverizers and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating , flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power plant.

8

UNIT-III

Diesel power plant

General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, ubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant.

2

Gas turbine power plant

Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant

6

UNIT-IV

Nuclear power plant

Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants.

3

Hydro electric station Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems.

4

Non Conventional Power Plants

Introduction to non-conventional power plants (Solar, wind, geothermal, tidal)etc.

2

UNIT-V

Electrical system

Generators and generator cooling, transformers and their cooling, bus bar, etc.

2

Instrumentation

Purpose, classification, selection and application, recorders and their use, listing of various control rooms.

3

Pollution

Pollution due to power generation

2

Books and References:

1. Power Plant Engineering, by F.T. Morse, Affiliated East-West Press Pvt. Ltd
2. Power Plant Engineering by Hedge, Pearson India
3. Power Plant Technology, by Wakil, McGraw Hill.
4. Power Plant Engineering by P.K. Nag, Tata McGraw Hill.
5. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, Central Pub.House.
6. Power Plant Engineering by Gupta, PHI India
7. Power Plant Engineering. Mahesh Verma, Metropolitan Book Company Pvt. Ltd.

NPI- 801 : **QUALITY CONTROL** **L T P**
3 1 0

UNIT-I

Introduction : Concept and evaluation of quality control. Measurement & Metrology, precision vs accuracy. Process capability, standrdisation & Interchangeability.

3

Inspection and Gauges : Inspection methods. Types of Gauges. Limits Fits and Tolerances. Non-Destructive Testings & Evaluation.

5

UNIT-II

Control Charts for SQC : Statistical Quality Control (SQC). Control charts for variables such as X, R charts and control charts for attributes such as p-chart, c-chart. Construction & use of the control charts. Process capability.

8

UNIT-III

Acceptance Sampling for SQC : Principle of acceptance sampling. Producer's and consumer's risk. Sampling plans –single, double & sequential. Sampling by attributes and variables.

7

UNIT-IV

Reliability : Introduction to reliability, bath-tub curve. Life expectancy. Reliability based design. Series & Parallel System.

3

Defect Diagnosis and prevention : Basic causes of failure, curve/control of failure.
MTBF. Maintainability, Condition monitoring and dignostic techniques.

4

Value Engineering : Elements of value analysis, Techniques.

2

Unit-V :

TQM : Basic Concept, Quality control , Quality Assurance and Quality Management and Total Quality Management. Implementation of TQM . ISO 9000 and its series, Zero defect. . Taguchi method, Six Sigma concepts.

6

Other Factors in Quality : Human Factors such as attitude and errors. Material-Quality, Quality circles, Quality in sales & service.

2

Books and Reference:

1. Statistical Quality Control by Grant and Leavarworth, McGraw Hill
2. Maintenance for Reliability by Rao.

NME-751:CAD/CAM LAB

L	T	P
0	1	2

Total TEN Experiments are to carried out. FIVE Experiments each from CAD and CAM.

A. CAD Experiments

1. Line Drawing or Circle Drawing experiment: Writing and validation of computer program.
2. Geometric Transformation algorithm experiment for translation/rotation/scaling: Writing and validation of computer program.

3. Design of machine component or other system experiment: Writing and validation of computer program.
4. Understanding and use of any 3-D Modeling Software commands.
5. Pro/E/Idea etc. Experiment: Solid modeling of a machine component
6. Writing a small program for FEM for 2 spring system and validation of program or using a FEM Package
7. Root findings or curve fitting experiment: Writing and validation of computer program.
8. Numerical differentiation or numerical integration experiment: Writing and validation of computer program.

B. CAM Experiments

1. To study the characteristic features of CNC machine
2. Part Programming (in word address format) experiment for turning operation (including operations such as grooving and threading) and running on CNC machine
3. Part Programming (in word address format or ATP) experiment for drilling operation (point to point) and running on CNC machine
4. Part Programming (in word address format or ATP) experiment for milling operation (contouring) and running on CNC machine
5. Experiment on Robot and programs
6. Experiment on Transfer line/Material handling
7. Experiment on difference between ordinary and NC machine, study or retrofitting
8. Experiment on study of system devices such as motors and feed back devices
9. Experiment on Mecatronics and controls

NME-752: I.C. ENGINES AND AUTOMOBILE LAB

L	T	P
0	0	2

Experiments : Say minimum 10 experiments out of following in depth and details.

1. Performance Analysis of Four stroke S.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
2. Determination of Indicated H.P. of I.C. Engine by Morse Test.
3. Performance Analysis of Four stroke C.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
4. Study & experiment on Valve mechanism.
5. Study & experiment on Gear Box.
6. Study & experiment on Differential Gear Mechanism of Rear Axle.
7. Study & experiment on Steering Mechanism.

8. Study & experiment on Automobile Braking System.
9. Study & experiment on Chassis and Suspension System.
10. Study & experiment on Ignition system of I.C. Engine.
11. Study & experiment on Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.
12. Study & experiment on Fuel Supply System of C.I. Engines- Injector & Fuel Pump.
13. Study & experiment on Air Conditioning System of an Automobile.
14. Comparative study of technical specifications of common small cars (such as Maruti Swift, Hyundai i20, Cheverlet Aveo, Tata Indica, Ford Fusion etc.
15. Comparative study & technical features of common scooters & motorcycles available in India.
16. Visit of an Automobile factory.
17. Visit to a Modern Automobile Workshop.
18. Experiment on Engine Tuning.
19. Experiment on Exhaust Gas Analysis of an I.C. Engine.

DEPARTMENT ELECTIVE-III

NME-031: COMPUTER AIDED MANUFACTURING (CAM) **L T P**
3 1 0

UNIT-I

Introduction to Automation: Automated Manufacturing system; Need of automation, Basic elements of automation, Levels of automation, Automation Strategies, Advantages & disadvantages of automation, Historical development and future trends.

8

UNIT-II

Fundamental of Numerical Control, elements of NC machine tools, classification of NC machine tools, Advantages, suitability and limitations of NC machine tools, Application of NC system.
Definition and designation of control axes, Constructional details of Numerical Control Machine Tools, MCU structure and functions, Methods of improving accuracy and productivity using NC.

8

UNIT -III

Computer Numerical Control (CNC) : Features of CNC, Elements of CNC machines, the machine control unit for CNC , Direct Numerical Control(DNC) and Adaptive Controls.
System Devices: Drives, Feedback devices, Counting devices, DAC and ADCs, Interpolator systems, Control loop circuit elements in PTP system, Contouring system, Incremental and absolute systems.

8

UNIT -IV

NC Part Programming- (a) Manual (word address format) programming Examples Drilling, Turning and Milling; canned cycles, Subroutine, and Macro.
(b) Computer Assisted Part programming (APT) Geometry, Motion and Additional statements, Macro- statement.

8

UNIT-V

Computer Integrated manufacturing system , Group Technology, Flexible Manufacturing System, Computer aided process planning-Retrieval and Generative System. Types and generations of Robots, Structure and operation of Robot, Robot applications.

8

Books and References :

1. Automation, Production System and Computer Integrated Manufacturing, by Mikell P. Grover, Prentice Hall of India Pvt Ltd.
2. CAD/CAM – Theory and Practice, by Ibrahim Zeid, McGraw Hill
3. Computer Aided Manufacturing, by Cheng, Pearson India
4. CAD/CAM: Principles and Oerations, by P. N. Rao, McGraw Hill
5. CAD/CAM: Computer Aided Design and Manufacturing, by M. Groover, Pearson India.
6. CAD/CAM: Concepts and Applications by Alavala, PHI India
7. Computer Aided Manufacturing, by Srinivas, Oxford University Press.

NME-032: PROJECT MANAGEMENT **L T P**
3 1 0

UNIT-I
Project Management Concepts
Introduction, project characteristics, taxonomy of projects, project identification and formulation. Establishing the project and goals. Nature & context of project management; phases of PM, A framework for PM issues, PM as a conversion process, project environment & complexity. Organizing human resources, organizing systems & procedures for implementation. Project direction.

8

UNIT-II
Project Organization & Project Contracts
Introduction, functional organization, project organization, matrix organization, modified matrix organization, pure project organization, selection of project organization structure, project breakdown structures, project contracts, types of contracts, types of payments to contractors.

8

UNIT-III
Project Appraisal & Cost Estimation
Introduction, technical appraisal, commercial appraisal, economic appraisal, financial appraisal, management appraisal, social cost/benefit analysis, project risk analysis. Cost analysis of the project, components of capital cost of a project, modern approach to project performance analysis.

8

UNIT-IV
Project Planning & Scheduling
Introduction to PERT & CPM, planning and scheduling networks, time estimation, determination of critical path, CPM model, event slacks & floats, PERT model, expected time for activities, expected length of critical path, calculating the project length and variance, PERT & CPM cost accounting systems, lowest cost schedule, crashing of networks, linear programming formulation of event oriented networks, updating of networks, LOB technique.

8

UNIT-V
Modification & Extensions of Network Models
Complexity of project scheduling with limited resources, resource leveling of project schedules, resource allocation in project scheduling - heuristic solution. Precedence networking- examples with algorithm, decision networks, probabilistic networks, computer aided project management-

essential requirements of PM software, software packages for CPM. Enterprise- wide PM, using spread sheets for financial projections.

8

Books and References :

1. Project Management by Harvey Maylor, Pearson India
2. Project Management by Choudhury, McGraw Hill
3. Project Management by K. Nagarajan
4. Project Management: A Systems Approach to Planning, Scheduling and Controlling, by Kerzner, Willey
5. Project Management: A Life Cycle Approach by Kanda, PHI, India
6. Project Management and Appraisal, byKhatua, Oxford University Press.

NME-033: COMPUTATIONAL FLUID DYNAMICS **L T P**
3 1 0

UNIT- I
GOVERNING EQUATIONS AND BOUNDARY CONDITIONS:
Basics of computational fluid dynamics. Governing equations of fluid dynamics. Continuity, Momentum and Energy equations. Chemical species transport. Physical boundary conditions, Time-averagedequations for Turbulent Flow. Turbulent–Kinetic Energy Equations Mathematical behavior of PDEs onCFD. Elliptic, Parabolic and Hyperbolic equations.

8

UNIT -II
FINITE DIFFERENCE METHOD:
Derivation of finite difference equations. Simple Methods. General Methods for first and second orderaccuracy, solution methods for finite difference equations. Elliptic equations. Iterative solution Methods. Parabolic equations . Explicit and Implicit schemes. Example problems on elliptic and parabolic equations.

9

UNIT- III
FINITE VOLUME METHOD (FVM) FOR DIFFUSION:
Finite volume formulation for steady state One, Two and Three dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank. Nicolson and fully implicit schemes.

9

UNIT -IV
FINITE VOLUME METHOD FOR CONVECTION DIFFUSION:
Steady one-dimensional convection and diffusion. Central, upwind differencing schemes-properties ofdiscretization schemes. Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICKSchemes.

10

UNIT- V
CALCULATION FLOW FIELD BY FVM:

Representation of the pressure gradient term and continuity equation. Staggered grid. Momentum equations. Pressure and Velocity corrections; Pressure Correction equation, SIMPLE algorithm and itsvariants. Turbulence models, mixing length model, Two equation (k-Є) models. High and low Reynoldsnumber models

9

Books and References:

1. An Introduction to Computational Fluid Dynamics: The Finite Volume Method, by Versteeg, Pearson, India.
2. Numerical Heat Transfer and Fluid Flow, by Patankar, Tayers & Francis .
3. Computational Heat Transfer, by Jaluria ans Torrance, CRC Press
4. Computational Fluid Dynamics, by Anderson, Mc Graw Hill
5. Computational Fluid Dynamics, by Chung, Cambridge University Press.
6. Computer Simulation of flow and heat transfer, by Ghoshdastidar McGraw Hill.
7. Introduction to Computational Fluid Dynamics, by Prodip Niyogi. Pearson India.
8. Computational Fluid Flow and Heat Transfer, by Muralidhar and Sundararajan, Narosa Publishing House.
9. Computational Fluid Dynamics: Principles and Applications, by Blazek, Elsevier Science & Technology.

NME-034: COMPOSITE MATERIALS **L T P**
3 1 0

UNIT-1

Introduction: Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc.

7

UNIT-II

Types of Reinforcements/Fibers: Role and Selection of reinforcement materials, Types of fibres, Glass fibers, Carbon fibers, Aramid fibers , Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc., Mechanical properties of fibres. Material properties that can be improved by forming a composite material and its engineering potential.

7

UNIT-III

Various types of composites: Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC); Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites.

10

UNIT-IV

Fabrication methods: Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression molding, resin-transplant method, pltrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix

performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films.

10

UNIT-V

Testing of Composites: Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc.

6

Books and References :

1. Materials characterization, Vol. 10, ASM hand book
2. Mechanical Metallurgy, by G. Dieter, McGraw Hill
3. Analysis and Performance of Fiber Composites, by Agarwal, McGraw Hill
4. Thermal Analysis of Materials, by R.F. Speyer, Marcel Decker
5. Engineering Mechanics and Composite Materials , by Daniels, Oxford University Press.
6. Engineering Materials: Polymers, Ceramics and Composites, by A.K Bhargava Prentice Hall India
7. Material Science and Engineering (SIE) with CD, by Smith, McGraw Hill

DEPARTMENT ELECTIVE-IV

NME-041: TOTAL QUALITY MANAGEMENT (TQM) **L T P**
3 1 0

UNIT -I

Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type.

4

Control on Purchased Product

Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

4

Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

3

UNIT -II

Quality Management

Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

5

Human Factor in Quality

Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.

3

UNIT -III

Tools and Techniques

Seven QC tools (Histogram, Check sheet, Ishikawa diagram, Pareto, Scatter diagram, Control chart, flow chart).

3

Control Charts

Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

3

Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

3

UNIT -IV

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

6

UNIT -V

IS0-9000 and its concept of Quality Management

ISO 9000 & ISO 14000 series, Quality information system and documentation, Auditing, Taguchi method, JIT in some details.

6

Books and References:

1. Total Quality Management, by Dale H. Besterfield, Pearson India
2. Beyond Total Quality Management, Greg Bounds, McGraw Hill.
3. TQM in New Product manufacturing, H. G. Menon, McGraw Hill.
4. Total Quality Management, by Suri, Wiley.
5. Total Quality Management, by Subburaj, McGraw Hill.
6. Total Quality Management, by Poornima Chantimath, Pearson India
7. Quality Management by Bedi, Oxford University Press.
8. Total Quality Management-Text and Cases, by Janakiraman & Gopal, PHI, India.
9. Total Quality Management, H. Lal, Eastern Limited.
10. Total Quality Management, A. Arivalagar , R. S. Naagarazan, New Age International.

NME-042: THERMAL TURBOMACHINES **L T P**
3 1 0

UNIT-I

Brief history of turbo machinery, introduction to blowers, pumps, compressors, steam &gas turbines, turbojet, Review of laws of thermodynamics & SFEE in reference to turbomachinery, Energy transfer in turbo machines, Euler's equation, Definition of variousefficiencies, Preheat factor, Reheat factor, Blade classification, Blade terminology,Cascade testing, Velocity diagrams for axial and radial turbomachinery and pumps.

8

UNIT-II

Centrifugal compressors- Principle of operation, work done and pressure rise, Velcoitydiagram for centrifugal compressor, Slip factor, Stage pressure rise, Loading coefficient,Diffuser, degree of reaction, Effect of impeller blade profile, Pre-whirl and inlet guidevanes, Centrifugal Compressor characteristic curves.

4

Axial flow compressor- Principle of operation and working, Energy transfer, Velocitydiagram for axial compressor, Factors affecting stage pressure ratio, Blockage incompressor annulus, Degree of reaction, 3-D flow, Design process, blade design,calculation of stage performance, Axial compressor performance characteristic curves.

4

UNIT-III

Axial flow turbines-Elementary theory of axial flow turbine, Energy transfer, Velocitydiagram, Types of blades, Vortex theory, Choice of blade profile, pitch and chord,Estimation of stage performance, Characteristic curves.

4

UNIT-IV

Steam turbines- Constructional details, working of steam turbine.

4

Pumps : Classification of Pumps, Main components, indicator diagram and modificationdue to piston acceleration, Performance characteristics, Cavitation and its control,Miscellaneous types of pumps.

4

Radial flow turbines: Elementary theory of radial flow turbines, Enthalpy- Entropydiagram, State losses, Estimation of stage performance, Performance characteristics.

4

UNIT-V

Gas Turbine Starting & Control Systems: Starting ignition system, Combustionsystem types, Safety limits & control.

Turbine Blade coding: Different cooling techniques, Types of coolants, Comparativeevaluation of different cooling techniques.

Mechanical Design consideration: Overall design choices, Material selection, Designwith traditional materials.

8

Books and References:

1. Gas turbine theory : Cohen & Rogers, Addison Weslay Longman Ltd.
2. Fundamentals of Turbomachinery by Venkanna, PHI, India
3. Turbine, Compressors and Fans, S.M. Yahya, Tata Mc Graw Hill.

4. Gas Turbine- Ganeshan, Tata Mc Graw Hill.
5. Thermal Turbomachines, by Singh, Wiley
6. Fundamentals of Turbomachinery, by Venkanna, PHI, India.

NME – 043: MECHANICAL SYSTEM DESIGN **L T P**
3 1 0

UNIT-I

Engineering process and System Approach

Basic concepts of systems, Attributes characterizing a system, types of system, Application of system concepts, Advantages of system approach, Problems concerning systems, Concurrent engineering, A case study-Viscous lubrication system in wire drawing.

4

Problem Formulation : Nature of engineering problems, Need statement, hierarchical nature of systems, hierarchical nature of problem environment, problem scope and constraint, A case study: heating duct insulation system, high speed belt drive system.

4

UNIT-II

System Theories: Introduction, System Analysis, Black box approach, state theory approach, component integration approach, Decision process approach, A case study- automobile instrumentation panel system.

4

System modeling

Introduction, Model types and purpose, linear systems, mathematical modeling, concepts, A case study compound bar system.

4

UNIT-III

Graph Modeling and Analysis

Graph Modeling and analysis process, path problem, Network flow problem, A case study: Material handling system.

4

Optimization Concepts

Optimization processes, Selection of goals and objectives-criteria, methods of optimization, analytical, combinational, subjective. A case study: aluminium extrusion system.

4

UNIT-IV

System Evaluation

Feasibility assessment, planning horizon, time value of money, Financial analysis, A case study: Manufacture of maize starch system.

4

Calculus Method for Optimization

Model with single decision variable, model with two decision variables, model with equality constraints, model with inequality constraints, A case study: Optimization of an insulation system.

4

UNIT-V

Decision Analysis

Elements of a decision problem, decision making, under certainty, uncertainty risk and conflict probability, density function, Expected monetary value, Utility value, Baye's theorem, A case study: Installation of machinery.

4

System Simulation

Simulation concepts, simulation models, computer application in simulation, spread sheet simulation, Simulation process, problem definition, input model construction and solution, limitation of simulation approach, A case study: Inventory control in production plant.

5

Books and References:

1. Design and Planning of Engineering systems-DD Reredith, KV Wong, RW Woodhead, and RR Worthman, Prentice Hall Inc., Eaglewood Cliffs, New Jerse
2. Engineering Design, by Dieter, McGraw Hill
3. Design Engineering-JR Dixon, TMH, New Delhi
4. An Introduction to Engineering Design Method-V Gupta and PN Murthy, TMH, New Delhi
5. Engineering Design-Robert Matousck, Blackie and son ltd. Glasgow
6. Optimization Techniques-SS Rao
7. System Analysis and Project Management-Devid I Cleland, William R King, McGraw Hill.

NME-044: AUTOMATION AND ROBOTICS **L T P**
3 1 0

UNIT- I

AUTOMATION:

Definition, Advantages, goals, types, need, laws and principles of Automation. Elements of Automation.

Fluid power and its elements, application of fluid power, Pneumatics vs. Hydraulics, benefit and limitations of pneumatics and hydraulics systems, Role of Robotics in Industrial Automation.

7

UNIT- II

Manufacturing Automation:

Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multimodel and mixed model production lines. Programmable Manufacturing Automation CNC machine tools, Machining centers, Programmable robots, Robot time estimation in manufacturing operations.

7

UNIT- III

ROBOTICS

Definition, Classification of Robots - Geometric classification and Control classification, Laws of Robotics, Robot Components, Coordinate Systems, Power Source.

Robot anatomy, configuration of robots, joint notation schemes, work volume, manipulator kinematics, position representation, forward and reverse transformations, homogeneous

transformations in robot kinematics, D-H notations, kinematics equations, introduction to robot arm dynamics.

9

UNIT -IV

ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS

Robot drive mechanisms: Hydraulic / Electric / Pneumatics, servo & stepper motor drives, Mechanical transmission method: Gear transmission, Belt drives, Rollers, chains, Links, Linear-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearings.

ROBOT END EFFECTORS

Classification of End effectors – active and passive grippers, Tools as end effectors, Drive system for grippers. Mechanical, vacuum and magnetic grippers. Gripper force analysis and gripper design.

9

UNIT- V

ROBOT SIMULATION

Methods of robot programming, Simulation concept, Off-line programming, advantages of off-line programming.

ROBOT APPLICATIONS

Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Limitation of usage of robots in processing operation.

Robot cell design and control, Robot cell layouts-Multiple robots & Machine interference.

8

Books and Reference :

1. An Introduction to Robot Technology, by Coifet Chirroza, Kogan Page.
2. Robotics for Engineers, by Y. Koren, McGraw Hill.
3. Robotic: Control, Sensing, Vision and Intelligence, by Fu, McGraw Hill.
4. Introduction to Industrial Robotics, by Nagrajan, Pearson India
5. Robotics , by J.J. Craig, Addison-Wesley.
6. Industrial Robots , by Groover, McGraw Hill.
7. Robots & Manufacturing Automation, by Asfahl, Wiley
8. Fundamentals of Robotics: Analysis and Control, by Schilling, Pearson India
9. Automation & Robotics, byGhoshal, Oxford University Press.
10. Introduction to AI Robotics, by Murphy, PHI, India.

DEPARTMENT ELECTIVE-V

NME-051: OPERATIONS RESEARCH **L T P**

3 1 0

UNIT-I

Introduction: Basic of Operation Research, Origin & development of Operation Research,Applications.

2

Linear Programming: Introduction & Scope, Problem formulation, Graphical Method, Simplex methods, primal and dual problem sensitivity analysis.

7

UNIT-II

Transportation Problem: Methods of obtaining initial and optimum solution, degeneracy in transportation problems, unbalanced Transportation Problem.

4

Assignment Problem: Methods of obtaining optimum solution, Maximization problem, travelling salesman problem.

3

UNIT-III

Game Theory: two person Zero sum game, Solution with/without saddle point, dominance rule, Different methods like Algebraic, Graphical and game problem as a special case of Linear Programming.

4

Sequencing: Basic assumptions, n Jobs through 2-3 machines, 2 Jobs on m machines.

3

UNIT-IV

Stochastic inventory models: Single & multi period models with continuous & discrete demands, Service level & reorder policy.

4

Simulation: Use, advantages & limitations, Monte-carlo simulation, Application to queuing, inventory & other problems.

4

UNIT-V

Queuing models: Characteristics of Queuing Model, M/M/1 and M/M/S system, cost consideration.

3

Project management: Basic Concept of network Scheduling, Rules for drawing network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing of operations; resource allocation.

6

Books and References:

1. Operations Research: Principles and Practice, by- Ravindran, Phillips, Solberg, John Wiley & Sons.
2. Principal of Operation Research, by- Harvey M. Wagner, Prentice Hall.
3. Introduction to Operation Research, by- Gillett, McGraw Hill.
4. Operations Research - An Introduction, by- Hamdy A. Taha, Pearson India.
5. Operation Research, by- Wayne L. Winston, Thomsan Learning.
6. Problems in Operations Research by- Prem Kumar Gupta & D.S. Hira, S. Chand.
7. Operation Research Application and Algorithms, by- Wayne L Winston, Duxbury Press.
8. Operations Research, by Jha, McGraw Hill.
9. Operation Research, by Yadav & Malik Oxford University Press
10. Operations Research, by Panneerselvam, PHI, India

NME-052 : DESIGN OF THERMAL SYSTEMS **L:T:P**
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Unit-I

Psychrometry of Air Conditioning Processes, Design Conditions & Load Calculations Psychrometric Processes in Air Conditioning Equipments, Analysis of Air Conditioning systems for summer & winter conditions, Inside & out side design conditions for comfort, Industrial Air Conditioning.

Cooling & Heating Load calculations- Heat transfer through building structures, solar heat gain, Infiltration & ventilation air, Internal heat gain, Occupancy & Product load, Room sensible heat factor, Effective sensible heat factor & Grand sensible heat factor, capacity of the plant.

5

Design & Selection of Air conditioning Apparatus **:**Heat & moisture transfer in Air conditioning apparatus, Enthalpy potential, Analysis of Coil & Spray Equipments Design of Cooling & Dehumidifying coils, Design of Air Washer & Cooling Towers.

3

Unit-II

Analysis of Complete Vapour Compression System – Design and Balancing of System Components

Type of Refrigerant Compressors, Condensers, Evaporators & Expansion devices used in Vapour Compression Refrigeration Cycles, Design and Selection of individual components and their performance characteristics, Use of P-H charts for different refrigerants in performance predication of the cycle.

Analysis of the complete vapour-compression-system and determination of 'Balance Points' using Graphical and Analytical methods, system simulation. Layout & selection of Refrigerant, water and Brine pipings for the designed system. Selection of Refrigeration and Air conditioning Controls for the system.

8

Unit-III

Turbomachines:Principles of Design of turbo machines, Design of axial flow turbine stage, Design of axial flow compressor stage, Design of centrifugal compressor.

8

Unit-IV

Design of Heat Exchanger :Study of design aspects, fluid flow and heat transfer characteristics, Material requirement of heat exchange equipments, Liquid – to liquid and Liquid – to – gas heat exchange systems, Familiarity with use of design related standards and codes, Design of Heat exchanger.

8

Unit-V

Optimization of design of thermal systems like condenser, evaporator, cooling tower for minimum cost and maximum performance, Development of computer program for design, Environmental consideration in design of thermal systems, Analysis of thermal systems using FEM.

8

Books and References:

1. Thermal Environment Engg. by Kuhen, Ramsey & Thelked.
2. Refrigeration & Air Conditioning - By C.P. Arora, McGraw Hill
3. Refrigeration & Air Conditioning - By Manohar Prasad, New Age
4. Heating, Ventilating and Air Conditioning - By Mc Quistion, Parker & Spitler
5. Refrigeration & Air Conditioning Data Book – Manohar Prasad, New Age
6. ASHRAE Hand Book of Fundamentals-ASHRAE
7. Refrigeration & Air Conditioning-Stoecker & Jones, Mc Graw Hill
8. Design of High Efficiency Turbomachinery and Gas Turbine by Wilsonm and Korakianitis, PHI, India
9. Turbines compressors and Fans by Yahaya, Mc Graw Hill
10. Heat Transfer Equipment Design by Shah, CRC Press
11. Thermal System Design and Optimization by Balaji, Ane Books Pvt Ltd

NME-053: ADVANCE SYNTHESIS OF MECHANISMS

L T P
3 1 0

UNIT-I

Introduction:

Mechanisms: Classifications, Relative and absolute motion, degree of freedom, 4-barMechanisms, planar and spatial mechanisms, Inversion and equivalent linkage,Transmission angle.

4

Kinematic analysis of Planer motion: Relative velocity, Instantaneous centre, Poles and centrodes, Relative acceleration.

4

UNIT-II

Kinematic Synthesis: Type, number and dimensional synthesis, spacing of accuracy points, Chebyshev polynomials.

4

Four bar linkage, Equation of coupler curves, Double points and symmetry, RobertChebyshev theorem, Approximate and exact straight line mechanisms .

4

UNIT-III

Graphical Synthesis of Mechanisms:

Poles and relative poles of four bar linkage, Poles and relative poles of slider crankMechanism. Synthesis of four bar mechanisms.

8

UNIT IV

Analytical Synthesis:

Displacement equation of four bar linkage, Crank and follower synthesis with threeaccuracy points, Four bar function generator with three accuracy points, Crank andfollower synthesis, angular velocities and accelerations

8

UNIT-V

Analytical Synthesis:
Synthesis of slider crank mechanism with three accuracy points, Synthesis of slidercrank mechanism with four accuracy points, cam and follower mechanism, Analysis of mechanical errors in linkage.

8

Books and References:

1. Kinematic Synthesis of Linkages RS Hartenberg and J Denavit McGraw Hill, New York
2. Kinematic and Linkage Design AS Hall Jr Prentice Hall India Ltd.
3. Mechanism and Machine Theory Amitabh Ghosh and AK Mallick
4. Mechanism Design: Analysis &Synthesis Erdman & Sandor Prentice Hall of India
5. Kinematics and Dynamics of machinery (SIE), by Norton, McGraw Hill

NME-054: INDUSTRIAL AUTOMATION –I **L T P**
3 1 0

Unit-I:
Historical perspective of Industrial Automation
- Origin, Evolution and Need / Demand of automation in industries, Current and future Trends
- Components of Industrial Automation System and their functionalities, Layers and Types of Automation

6

Unit -II:
Automation Controllers
- Introduction of Industrial Controllers
- Programmable Logic Controller: Constructions, Types, Programming Units, Memory, I/O Modules.
- Programming methodology
- Ladder Logic programming for Industrial Applications, Timers and Counters
- Selection criteria of PLC
- Examples of PLC application

10

Unit-III:
Industrial Switching Elements
- Electronic Logic gates
- Relays, Solenoids
- Pneumatic Valves and Actuators
- Hydraulic valves and Actuators
- Interfacing: Control of Hydraulics and Pneumatics with Electric Signals
- Comparison between different switching elements

10

Unit-IV:
Visualization: Human Machine Interface (HMI), Supervisory Control and Data Acquisition (SCADA) Systems:

- Need for HMI
- Hardware based HMI panels
- PC based HMI Systems – SCADA
- Different Functionalities
- Benefits of implementing SCADA systems
- Case Studies of SCADA implementation.

10

Unit V:

Case Study

- Hydraulic / Pneumatic Press
- Material handling System
- Machine Tool: NC/CNC Machine

4

Books and References :

1. Programmable Logic Controllers with Control Logix, by Jon Stenerson, Delmar Publishers, 2009.
2. Hand book of industrial Automation, by Richard L Shell and Ernest L Hall, Marcel Dekker Inc., 2000.
3. Practical SCADA for Industry, by David Bailey and Edwin Wright, Newness Publishers, 2003.
4. Automation network Selection, by Dick Caro, ISA – The Instrumentation Systems and Automation Society, 2004.
5. Getting Factory Automation Right (the first time), by Edwin H Zimmerman, Manufacturing Engineers, 2001.
6. Automation, Production Systems and Computer Integrated Manufacturing, by Groover, Pearson India.
7. Industrial Instrumentation and Control, by Singh, McGraw Hill.

NME-055: ADVANCED WELDING TECHNOLOGY **L T P**
3 1 0

UNIT-I

Introduction: Welding as compared with other fabrication processes,Importance and application of welding, classification of welding processes, Health & safety measures in welding.

3

Welding Power Sources: Physics of welding Arc**,** Basic characteristics of power sources for various arc welding processes, Transformer, rectifier and generators.

3

Physics of Welding Arc: Welding arc, arc initiation, voltage distribution along the arc, arc characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on arc, isotherms of arcs and arc blow.

4

Metal Transfer: Mechanism and types of metal transfer in various arc welding processes.

3

UNIT-II

Welding Processes: Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electrogas and Electroslag, Flux Cored Arc Welding, Resistance welding, Friction welding, Brazing, Soldering and Braze welding processes, Laser beam welding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction Stir Welding, Underwater welding & Microwave welding.

11

UNIT-III

Heat Flow Welding: Calculation of peak temperature; Width of Heat Affected Zone (HAZ); cooling rate and solidification rates; weld thermal cycles; residual stresses and their measurement; weld distortion and its prevention.

5

UNIT-IV

Repair & Maintenance Welding: Hardfacing, Cladding, Surfacing, Metallizing processes and Reclamation welding.

2

Weldability: Effects of alloying elements on weld ability, welding of plain carbon steel, Cast Iron and aluminium. Micro & Macro structures in welding.

4

UNIT-V

Weld Design : Types of welds & joints, Joint Design, Welding Symbols, weld defects, Inspection/testing of welds, Introduction to Welding Procedure Specification & Procedure Qualification Record.

5

Books and References:

1. Welding and Welding Technology, by- Richard L. Little, McGraw Hill Education.
2. Welding Principals and Practices, by- Edwars R. Bohnart, McGraw Hill Education.
3. Welding Engineering and Technology, by- R. S. Parmar, Khanna Publishsers.
4. Welding Handbooks (Vol. I & II).

DEPARTMENT ELECTIVE-VI

NME- 061: EXPERIMENTAL STRESS ANALYSIS **L T P**
3 1 0

UNIT -I

Stress: Introduction, Two-Dimensional State of Stress, Equations of Equilibrium, Stress Transformation relations, principal Stresses, Special States of Stress.

4

Strain: Introduction, Displacement and Strain, Strain Transformation relations, principal strains, Stress Strain Relations, for Two-Dimensional State of Stress.

4

UNIT- II

Strain Measurements: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid- Method of Strain Analysis.

4

Brittle Coating Method: Introduction, Coating Stresses, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data.

4

UNIT -III

Electrical Resistance Strain Gages: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor.

4

Strain Gage Circuit: Potentiometer, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges.Three Element Rectangular Rosette

4

UNIT- IV

Theory of Photoelasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polariscope, Stressed Model in Circular Polariscope.

8

UNIT -V

Two Dimensional Photoelasticity : Introduction, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method.

8

Books and References :

1. Experimental Stress Analysis, by U C Jindal, Pearson India
2. Experiment Stress Analysis, by James W. Dally and William F. Riley, McGraw-Hill International
3. Experiment Stress Analysis by Dr. Sadhu Singh, Khanna Publishers.
4. Advance Strength and Applied Stress Analysis, by Budynas, McGraw-Hill

NME- 062: PLANT LAYOUT AND MATERIAL HANDELING **L T P**
310

UNIT -I

Introduction

Criteria, Strategies/Tactics, Sustainability and Eco-Efficiency in Facility Design, Basic Planning, Alternative Machine Arrangements, Flow Lines, Location Models, Act/Building Details, Aisles and Security, Storage, Shipping and Receiving, Offices, Specialized Areas.

8

UNIT -II

Workstations, Unit Loads & Containers, Conveyors, Vehicles, Lifting Devices, Workstation Material Handling, Ethics in Facility Design

Facilities design procedure and planning strategies, Production, activity and materials flow analysis, Space requirements and personnel services design considerations.

8

UNIT -III

Layout construction techniques: systematic layout planning; activity relationship analysis, pair wise exchange, graph-based construction algorithmic.

Material Handling: Material handling principles; material handling equipment and material handling systems.

8

UNIT -IV

Computerized Layout and Analytical Methods: ALDEP, CORELAP, CRAFT, BLOCPLAN, etc. **Warehouse operations**: function, storage operations.

Manufacturing operation: JIT, TQM, AM, CIM, SCM, Facility systems,

Quantitative models: Layout model, waiting line, AS/RS, simulation model, etc.

8

UNIT -V

Assessment and evaluation of layout alternatives Projects, Use Spiral software to practice plant layout design, Apply mathematical and engineering techniques such as systematic layout planning approach, quantitative model, cost estimate to solve practical facility layout problem.

8

Books and References:

1. Plant Layout and Material Handling, by- James M. Apple, John Wiley & Sons.
2. Plant Layout and Material Handling, by- Fred E. Meyers, Prentice Hall.
3. Facility Layout and Location: An Analytical Approach, by Richard L, Francis, Pearson India.
4. Plant Layout and Material Handling, by- B. K. Aggarwal, Jain Brothers.
5. Plant Layout and Material Handling, by- S. C. Sharma, Jain Brothers.
6. Materials Handling Handbook, by- Raymond A. Kulwiec, John Wiley & Sons.
7. Plant Design and Economics, by- Peters, McGraw Hill Education.
8. Purchasing and Material Management, by- Gopalakrishnan, McGraw Hill Education.

NME-063: ADDITIVE MANUFACTURING

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UNIT-I

Introduction

History and Advantages of Additive Manufacturing, Distinction Between Additive Manufacturing and CNC Machining, Types of Additive Manufacturing Technologies, Nomenclature of AM Machines, **Direct and Indirect Processes;** Prototyping, Manufacturing and Tooling.

4

Layer Manufacturing Processes; Polymerization, Sintering and Melting, Extrusion, Powder-Binder Bonding, Layer Laminate Manufacturing, Other Processes; Aerosolprinting and Bioplotter.

4

UNIT-II

Development of Additive Manufacturing Technology

Computer Aided Design Technology, Other Associated Technology, Metal and Hybrid Systems.

3

Generalized Additive Manufacturing Process Chain; The Eight Steps in Additive Manufacturing, Variation from one AM Machine to Another, Metal System, Maintenance of Equipment, Material Handling Issue, Design of AM.

5

UNIT-III

Additive Manufacturing Processes

Vat Photopolymerization; Materials, Reaction Rates, Photopolymerization Process Modeling, Scan Patterns, **Powder Bed Fusion Processes;** Material, Powder Fusion Mechanism, Process Parameters and Modeling, powder Handling, **Extrusion Based System;** Basic principles, plotting and Path Control, Bioextrusion, Other Systems, **Material Jetting;** Materials, Material Processing Fundamentals, Material Jetting Machines, **Binder Jetting;** Materials, Process Variations, BJ Machines, **Sheet lamination Processes;** Materials, Ultrosonic Additive Manufacturing, **Directed Energy Deposition Processes;** General DED Process Description, Material Delivery, DED systems, Process Parameters, Processiong-Structure-Properties Relationships, **Direct Write Technologies;** Ink-Based DW, laser Transfer DW, Thermal Spray DW, Beam Deposition DW, Liquid Phase Direct Deposition, Hybrid Technologies.

8

UNIT-IV

Design & Software Issues

Additive Manufacturing Design and Strategies; Potentials and Resulting Perspectives, AM based New Strategies, Material Design and Quality Aspects for Additive Manufacturing; Material for AM, Engineering Design Rules for AM.

4

Software Issue for Additive Manufacturing; Introduction, Preperation of CAD Models: The STL file, Problem with STL file, STL file Manupulation, Beyond the STL file, Additional Software to Assist AM.

4

UNIT-V

Material Design & Quality Aspects

Machines for Additive Manufacturing, Printers, Secondary Rapid Prototyping processes, Intellectual Property, Product Development, Commercialization, Trends and Future Directions in Additive Manufacturing, Business Opportunities

4

Applications

Aerospace, Automotive, Manufacturing, Architectural Engineering, Art, Jewelry, Toys, Medical, Biomedical, Dental, Bio-printing, Tissue & Organ Engineering and many others.

4

Books and References:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, by- Ian Gibson , DSavid W. Rosen , Brent Stucker, Springer.
2. Understanding Additive Manufacturing, by- Andreas Gebhardt, Hanser.
3. Additive Manufacturing, by- Amit Bandyopadhyay, Susmita Bose, CRC Press.
4. Rapid Prototyping: Principles and Applications, by - Chee Kai Chua, Kah Fai Leong, Chu Sing Lim.

NME-064: COMPUTER AIDED PROCESS PLANNING **L T P**
3 1 0

UNIT-I

Introduction to CAPP: Principles, scope and information requirement for CAPP, Role of process planning, Manual and experienced based process planning, Advantages of CAPP over conventional process planning, Decision table and decision trees, process capability analysis, Tolerance analysis, Variant process planning, Generative approach, Forward and Backward planning.

8

UNIT-II

Computer Aided Process Planning: Logical design of process planning systems, Implementation considerations, Computer based process monitoring and control, Computer and process interfacing, Totally integrated process planning systems, Process planning for rotational and prismatic parts, Machining of curves and surfaces, Five axis machining, Process planning of freedom surfaces, Development of NC codes, Computer aided design of fixtures, Inspection policies and inspection planning, Expert systems and their use in developing process planning systems.

8

UNIT-III

Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications. Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples. Generative CAPP system: importance, principle of Generative CAPP system, automation of logical decisions, Knowledge based systems, Inference Engine, implementation, benefits.

8

UNIT-IV

Determination of machining parameters: Reasons for optimal selection of machining parameters, effect of parameters on production, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes, design and manufacturing tolerances, methods of tolerance allocation, sequential approach, integration of design and manufacturing tolerances.

8

UNIT-V

Generation of tool path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods. Implementation techniques for CAPP: MIPLAN system, Computer programming languages tbr CAPP, criteria for selecting a CAPP system and benefits of CAPP. Computer integrated planning systems, and Capacity planning system.

8

Books and References:

1. Production Systems and Computer Integrated Manufacturing System, by- Mikell P Groover, Prentice Hall.
2. Computer Processing of Remotely Sensed Images: An Introduction, 3rd Edition, by- Mather Paul, Wiley.
3. Computer Aided Process Control, by- SK Singh, PHI Learning Pvt. Ltd.
4. Computer Aided Design and Manufacturing, by- M. Sarcar, K. L. Narayan, PHI Learning Pvt. Ltd.

NME-065: NON-DESTRUCTIVE TESTING **L T P**
3 1 0

Unit-I

Introduction

Scope and advantages of NDT, Comparison of NDT with Destructive Testing, Some common NDT methods used since ages, Terminology, Flaws and Defects, Visual inspection, Equipment used for visual inspection. Ringing test, chalk test (oil whitening test). Uses of visual inspection tests in detecting surface defects and their interpretation, advantages & limitations of visual inspection.

6

Unit-II

Die penetrate test (liquid penetrate inspection), Principle, scope. Equipment & techniques, Tests stations, Advantages, types of penetrants and developers, Zyglo test, Illustrative examples and interpretation of defects.

5

Magnetic particle Inspection – scope and working principle, Ferro Magnetic and Non-ferromagnetic materials, equipment & testing. Advantages, limitations Interpretation of results, DC & AC magnetization, Skin Effect, use of dye & wet powders for magna glow testing, different methods to generate magnetic fields, Applications.

5

Unit-III

Radiographic methods

Introduction to electromagnetic waves and radioactivity, various decays, Attenuation of electromagnetic radiations, Photo electric effect, Rayleigh's scattering (coherent scattering), Compton's scattering (Incoherent scattering), Pair production, Beam geometry and Scattering factor.

X-ray radiography: principle, equipment & methodology, applications, types of radiations and limitations. γ-ray radiography – principle, equipment., source of radioactive materials & technique, advantages of γ-ray radiography over X-ray radiography Precautions against radiation hazards. Case Study - casting and forging.

8

Unit-IV

Ultrasonic testing methods

Introduction, Principle of operation, Piezoelectricity. Ultrasonic probes, CRO techniques, advantages, Limitation & typical applications. Applications in inspection of castings, forgings, Extruded steel parts, bars, pipes, rails and dimensions measurements. Case Study – Ultrasonography of human body.

8

Unit-V

Special NDT Techniques

Eddy Current Inspection: Principle, Methods, Equipment for ECT, Techniques, Sensitivity, advanced ECT methods. Application, scope and limitations, types of Probes and Case Studies. Introduction to Holography, Thermography and Acoustic emission Testing.

8

Books and References:

1. Non-Destructive Testing and Evaluation of Materials, by- Prasad, McGraw Hill Education.
2. Basics of Non-Destructive Testing, by Lari & Kumar, KATSON Books.
3. Practical Non-destructive Testing, by- Baldev Raj, T. Jayakumar, M. Thavasimuthu, Woodhead Publishing.
4. Non-Destructive Testing Techniques, by- Ravi Prakash, New Age International.
5. Nondestructive Testing Handbook,by Robert C. McMaster, American Society for Nondestructive.
6. Introduction to Nondestructive Testing: A Training Guide, by- Paul E. Mix, wiley.
7. Electrical and Magnetic Methods of Non-destructive Testing, by- J. Blitz, springer.