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	L	T	P	CT	TA	Total	ESE	Subject Total	Credits
			Periods			Evaluation Scheme					
						Sessional Assessment					
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 & Y ungs, 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   L T P
                                                                    0 0 3

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**
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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
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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.