

**Academic Handbook**  
*for*  
**Bachelor of Technology Programme**  
*in*  
**Mechanical Engineering**



**National Institute of Technology Goa**

**Farmagudi, Ponda, Goa - 403 401**

## Programme Structure Summary

### Institute-wide Categories of the Courses

The Bachelor of Technology (B.Tech.) program at National Institute of Technology Goa (NIT Goa) will have 170 credits as the lower limit for the award of degree. These courses are grouped in a number of categories as shown below:

S.N.	Category	Credits	Remarks
1.	Basic Sciences (BS)	27	Mathematics - 14 Credits Physics - 8 Credits Chemistry - 5 Credits
2.	Basic Engineering Sciences (ES)	14	Engineering Mechanics - 3 Credits Mechanical Engineering - 2 Credits Basic Electrical Science - 5 Credits Computer Programming - 4 Credits
3.	Humanities and Languages (HL)	9	Professional Communication - 3 Credits Economics - 3 Credits Management - 3 Credits
4.	Technical Arts (TA)	5	Engineering Drawing - 3 Credits Workshop - 2 Credits
5.	Professional Theory and Practice (PT)	110	
6.	Others (*Not counted for final CGPA)	6*	Environmental Studies - 3 Credits Professional Communication -II and Language Lab - 3 Credits Physical Education - 1 Credits Value Education - 1 Credits
<b>Total Credits</b>		<b>171</b>	<b>165 credits are counted for CGPA</b>

### Semester-wise Credit Distribution

Semester	Total Credits
I	22
II	21+1
III	23
IV	22+1
V	20+1
VI	21+3
VII	18
VIII	18
<b>Total Credits</b>	<b>165+6</b>

## Semester-wise Distribution of the Courses I Semester Details

Sl. No	Sub. Code	Subjects	L-T- P	Credits
1	MA100	Mathematics-I	4-0-0	4
2	PH100	Physics	3-0-0	3
3	ME100	Engineering Mechanics	3-0-0	3
4	CS100	Computer Programming and Problem Solving	2-0-3	4
5	HU100	Professional Communication	2-0-2	3
6	ME101	Engineering Drawing	1-0-3	3
7	PH101	Physics Laboratory	0-0-3	2
		<b>Total Credits</b>		<b>22</b>

## II Semester Details

Sl. No	Sub. Code	Subjects	L-T- P	Credits
1	MA150	Mathematics-II	4-0-0	4
2	PH150	Material Science	3-0-0	3
3	CY150	Chemistry	3-0-0	3
4	ME150	Elements of Mechanical Engineering	2-0-0	2
5	EE151	Basic Electrical Science	3-0-0	3
6	ME151	Workshop Practices	0-0-3	2
7	CY151	Chemistry Laboratory	0-0-3	2
8	EE152	Basic Electrical Science Lab	0-0-3	2
9	PE150	Physical Education	1-0-0	1
		<b>Total Credits</b>		<b>22</b>

### III Semester Details

SI No	Course Code	Course Name	L-T-P	Credits
1	ME200	Mechanics of Solids	3-0-0	3
2	ME201	Materials and Metallurgical Engineering	3-0-0	3
3	ME202	Fluid Mechanics	3-0-0	3
4	ME203	Electrical and Electronics Technology	3-0-0	3
5	ME204	Basic Thermodynamics	3-0-0	3
6	ME205	Machine Drawing	1-0-3	3
7	MA200	Mathematics -III	3-0-0	3
8	ME206	Electrical and Electronics Technology Lab	0-0-3	2
<b>Total Credits</b>				<b>23</b>

### IV Semester Details

SI No	Course Code	Course Name	L-T-P	Credits
1	ME250	Applied Thermodynamics	3-0-0	3
2	ME251	Power Plant Engineering	3-0-0	3
3	ME252	Manufacturing Technology -I	3-0-0	3
4	ME253	Mechanics of Machinery	3-0-0	3
5	ME254	Measurements and Metrology	3-0-0	3
6	MA250	Mathematics-IV (Numerical Methods and Statistics)	3-0-0	3
7	ME255	Mechanics of Solids Lab	0-0-3	2
8	ME256	Fluid Mechanics Lab	0-0-3	2
9	VE200	Value Education	1-0-0	1
<b>Total Credits</b>				<b>22+1</b>

### V Semester Details

Sl No	Course Code	Course Name	L-T-P	Credits
1	ME300	Manufacturing Technology- II	3-0-0	3
2	ME301	CAD/CAM	3-0-0	3
3	ME302	Turbo Machinery	3-0-0	3
4	ME303	Machine Design –I	3-0-0	3
5	ES300	Environmental Studies	1-0-0	1
6	HS300	Economics	3-0-0	3
7	ME304	Mechanical Lab-1	0-0-3	2
8	ME305	Measurements and Metrology Lab	0-0-3	2
9	ME306	Mechanical Workshop-I	0-0-3	1
<b>Total Credits</b>				<b>20+1</b>

### VI Semester Details

Sl No	Course Code	Course Name	L-T-P	Credits
1	ME350	Heat Transfer	3-0-0	3
2	ME351	Automobile Engineering	3-0-0	3
3	ME352	Machine Design –II	3-0-0	3
4	ME5**	Elective-I	3-0-0	3
5	HS350	Management	3-0-0	3
6	HU350	Professional Communication-II and Languages Lab	2-0-3	3
7	ME353	Mechanical workshop-II	0-0-3	1
8	ME354	Mechanical Lab-II	0-0-3	2
9	ME355	CAD/CAM Lab	0-0-3	2
10	ME356	Mini Project/Industrial training	0-0-3	1
<b>Total Credits</b>				<b>21+3</b>

## VII Semester Details

Sl. No	Sub. Code	Subjects	L-T- P	Credits
1	ME400	Production and Operations Management	3-0-0	3
2	ME401	Automatic Control	3-0-0	3
3	ME5**	Elective-II	3-0-0	3
4	ME5**	Elective-III	3-0-0	3
5	ME402	Seminar	0-0-2	2
6	ME449	Major Project-I	0-0-4	4
		<b>Total Credits</b>		<b>18</b>

## VIII Semester Details

Sl. No	Sub. Code	Subjects	L-T- P	Credits
1	ME450	IE and OR	3-0-0	3
2	ME5**	Elective- IV	3-0-0	3
3	ME5**	Elective- V	3-0-0	3
4	ME5**	Elective- VI	3-0-0	3
5	ME499	Major Project – II	0-0-6	6
		<b>Total Credits</b>		<b>18</b>

## List of Electives

Sl. No	Course. Code	Course Name	L-T- P	Credits
1	ME500	Metal Removal Processes	3-0-0	3
2	ME501	Metal Casting	3-0-0	3
3	ME502	Material Joining	3-0-0	3
4	ME503	Material Forming	3-0-0	3
5	ME504	Composite Materials	3-0-0	3
6	ME505	Computer Integrated Manufacturing	3-0-0	3
7	ME506	Non-Destructive Testing	3-0-0	3
8	ME507	Quality and Reliability	3-0-0	3
9	ME508	Supply Chain Management	3-0-0	3
10	ME509	Optimization Techniques	3-0-0	3
11	ME510	Industrial Safety	3-0-0	3
12	ME511	Maintenance Engineering and Manage	3-0-0	3
13	ME512	Lean Manufacturing	3-0-0	3
14	ME513	Fluid Power Control	3-0-0	3
15	ME514	Mechatronics Engineering	3-0-0	3
16	ME515	Integrated Product Design and Prototy	3-0-0	3
17	ME516	Micro Electro Mechanical Systems	3-0-0	3
18	ME517	Automation Technologies	3-0-0	3
19	ME518	Synthesis of Mechanisms	3-0-0	3
20	ME519	Industrial Robotics	3-0-0	3
21	ME520	Tribology	3-0-0	3
22	ME521	Machine Dynamics	3-0-0	3
23	ME522	Fracture Mechanics	3-0-0	3
24	ME523	Finite Element Methods	3-0-0	3
25	ME524	Refrigeration and Air Conditioning	3-0-0	3
26	ME525	Cryogenic Engineering	3-0-0	3
27	ME526	Computational Fluid Dynamics	3-0-0	3
28	ME527	Renewable Energy Systems	3-0-0	3
29	ME528	Internal Combustion Engines	3-0-0	3
30	ME529	Energy Audit and Management	3-0-0	3

## Classification of Electives into Streams

<b>Manufacturing and Industrial Engineering</b>	<b>Automation/ Mechatronics</b>	<b>Design</b>	<b>Thermal</b>
ME500	ME513	ME518	ME524
ME501	ME514	ME519	ME525
ME502	ME515	ME520	ME526
ME503	ME516	ME521	ME527
ME504	ME517	ME522	ME528
ME505		ME523	ME529
ME506			
ME507			
ME508			
ME509			
ME510			
ME511			
ME512			



# **Detailed Syllabus of Courses**

## **ME100 ENGINEERING MECHANICS**

**3(3-0-0)**

### **Fundamentals of mechanics**

Idealizations of mechanics, vector and scalar quantities, equality and equivalence of vectors, laws of

mechanics, Elements of vector algebra. Systems of forces: Position vector, moment of a force about a point, moment of a force about an axis, the couple and couple moment, couple moment as a free vector, moment of a couple about a line. Equivalent force systems: Translation of a force to a parallel position, resultant of a force system, simplest resultant of special force systems, distributed force systems.

### **Equations of equilibrium**

Free body diagram, free bodies involving interior sections, general equations of equilibrium, problems of equilibrium, static indeterminacy.

**Properties of surfaces:** First moment, centroid, second moments and the product of a plane area, transfer theorems, rotation of axes and polar moment of area, principal axes and concept of second order tensor transformation.

### **Kinematics of a particle**

Introduction, general notions, differentiation of a vector with respect to time, velocity and

acceleration calculations, rectangular components, velocity and acceleration in terms of cylindrical coordinates, simple kinematical relations and applications.

### **Particle Dynamics**

Introduction, rectangular coordinates, rectilinear translation, Newton's law for rectangular

coordinates, rectilinear translation, cylindrical coordinates, Newton's law for cylindrical coordinates.

### **Kinetics of Plane Motion of Rigid Bodies**

Moment of momentum equations, Pure rotation of a rigid body of revolution about its axis, Pure

rotation of slablike bodies. General plane motion of rigid bodies

### **Energy and momentum methods for a particle**

Analysis for a single particle, conservative force field, conservation of mechanical energy,

alternative form of work-energy equation, Linear momentum, impulse and momentum relations, moment of momentum, Method of momentum for particles.

### **Text and Reference Books**

1. Irving H. Shames, *Engineering Mechanics Statics And Dynamics*, Pearson, 2005.
2. Beer & Johnston, *Mechanics for Engineers*, McGraw – Hill, 2009.
3. Timoshenko, S.P., Young, D.H., Rao, J. V. *Engineering Mechanics*, McGraw-Hill, 2006
4. Merian, J.L, Kraige, L.G. *Engineering Mechanics – Statics*, Wiley Publishers, 2002.

## **ME101 ENGINEERING DRAWING**

**3(1-0-3)**

### **Introduction to Engineering Graphics**

Drawing instruments and their use – Different types of lines - Lettering & dimensioning. Projection of points.

### **Orthographic Projections**

Introduction to orthographic projections- Horizontal, vertical and profile planes – First angle and third angle projections.

### **Projection of lines**

Projections of lines inclined to one of the reference planes. Projections of lines inclined to both the planes – True lengths of the lines and their angles of inclination with the reference planes – Traces of lines.

### **Projection of planes**

Projection of plane lamina of geometric shapes inclined to one of the reference planes – inclined to both the planes, Traces of planes

### **Projection of solids**

Projection of solids with axis parallel to one of the planes and parallel or perpendicular to the other plane-Projections with the axis inclined to one of the planes. Projections of solids with axis inclined to both the planes. Isometric projection.

### **Sections of Solids**

Sections of cylinders, Sections of prisms

### **Computer Aided Drafting**

Introduction to Auto CAD, Basic 2-D drawing, editing and viewing tools, Dimensioning. Orthographic and Isometric Projections.

### **Text and Reference Books**

1. Bhatt N D., *Engineering Drawing*, Charotar Publication, 2006
2. Gopalkrishna K R, *Engineering Graphics* (Ist angle projection), Subhas Publication, 2002
3. *Engineering Drawing and Design* – Cencil Jensen, Jay D. Helsel, and Dennis R. Short, Tata McGraw Hills Publication, 2010.

## **ME150 ELEMENTS OF MECHANICAL ENGINEERING**

**2(2-0-0)**

Introduction to Mechanical Engineering, Emerging trends & its role, Mechanics in Mechanical Engineering:

Materials and Stresses: Mechanical design concept, Stress- Strain relationship, Shear force and Bending Moment Diagrams Types of drives, Friction and wear

Prime movers- I.C. Engines, Turbines, Introduction to refrigeration, centrifugal pumps and compressors. Sources of energies: conventional and renewable.  
Manufacturing Processes: Basic processes like machining, casting, forging etc. welding, brazing and soldering. Manufacturing Systems  
Introduction to Mechatronics, electro-mechanical elements, working principles, construction and their applications (Sensors & actuators).

### **Text and Reference Books**

1. An introduction to Mechanical Engineering, J. Wickert, Cengage Learning, 2nd edn. 2006
2. Gopalkrishna K.R., Mechanical Engineering Sciences. Subhas Publications, Bangalore. 1999
3. Roy and Choudhary, Elements of Mechanical Engineering. Media Promoters and Publishers, Bombay, 1975
4. Gupta, P.N., and Poona, M.P., Elements of Mechanical Engineering. 4<sup>th</sup> Edition, Standard Publications Ltd, 2009.

### **ME151 WORKSHOP PRACTICES**

**2(0-0-3)**

Carpentry: Demonstration of wood cutting machines, tools, and equipments, planning, chiseling,

marking and sawing practice, Different joints

Fitting: Demonstration of various tools and equipments used in fitting shop, chipping, filing, cutting, tapping, male and female joints, stepped joints

Welding: Demonstration of various welding machines and equipments, Butt joint and Lap joint using electric arc welding

Turning: Demonstration of lathe, drilling machines, grinding machines, milling machines.

### **Text and Reference Books**

1. *Elements of Workshop Technology*, S. K. Hajra Choudhary, S. K. Bose, A. K. Hajra Choudhary, Media promoters and publishers pvt. ltd., 2007

### **ME200 MECHANICS OF SOLIDS**

**3(3-0-0)**

Simple flexure theory, Bending stress and shearing stress distribution across sections  
Macaulay's method for deflection of statically determinate beams. Compound stresses - Analytical Method, Graphical Method

-Mohr's Circle. Torsion, Transmission of Power through hollow and solid shafts. Beams of Uniform strength, Springs, combined bending and Torsion, Strain energy. Thick and Thin pressure vessels

### **Text and Reference Books**

1. Singer, F.L. *Strength of Materials*, 3rd Edition, Harper and Row Publishers, New York, 1980.
2. Hearn, E.J., *Mechanics of Materials*, Pergamon Press, England, 1972.
3. Beer and Johnston E. R. *Mechanics of Materials*, 3rd Edition, Tata McGraw Hill, New-Delhi, 2007

**ME201 MATERIALS METALLURGICAL ENGINEERING****3(3-0-0)**

Metals - Solidification, Alloys and Phase diagrams, Iron carbon equilibrium diagram, Heat treatment of ferrous and non-ferrous alloys, Ceramics, Polymers and composite materials, Testing of Engineering materials, Fracture and failure of materials, Structure- property correlation of Engineering materials

**Text and Reference Books**

1. Avner H., *Introduction to Physical Metallurgy*– McGraw Hill, New York, 1987.
2. Raymond A. Higgins, *Engineering Metallurgy –Part 1: Applied Physical Metallurgy*, ELBS, London, 1988.
3. Callister W.D., *Material Science and Engineering-An Introduction*, John Wiley & Sons, Inc., New York, 2003.

**ME202 FLUID MECHANICS****3(3-0-0)**

Fundamentals of fluid properties, pressure measurement, hydrostatic forces on surfaces, Buoyancy and floatation, Kinematics of fluid flow, Fluid dynamics, Compressible flow, gas nozzles, Flow of real fluids, Boundary layer theory, Flow around immersed bodies, Flow through pipes, Impact of jets, Hydraulic Machines, pumps, Turbines, Hydraulic systems.

**Text and Reference Books**

1. Kumar K.L. *Fluid Mechanics*, Eurasis Publishing House, New Delhi, 1995.
2. Yahya S.M., *Turbomachines*, Satya Prakashan, New Delhi, 1972.
3. F.M. White, *Fluid Mechanics*, Springer-Verlag, New York. 1999.

**ME203 ELECTRICAL AND ELECTRONICS TECHNOLOGY****3(3-0-0)**

Transformers : Principle, construction (single phase, three phase), development of equivalent circuit through coupled circuit approach, phasor diagram, regulation, efficiency, autotransformers, Induction machines: Principle, construction, classification, equivalent circuit, phasor diagram, characteristics, starting techniques, speed control, operation under unbalanced supply conditions and harmonics, DC Machines : Construction, classification, emf and torque equation, characteristics of DC motors, speed control, brushless DC motor, stepper motor, servomotor. Synchronous machines: Construction, prime- mover and excitation control systems. Operational Amplifier & Linear Applications: Difference amplifiers, Instrumentation amplifiers, voltage to current converters, Filters, Introduction to Microprocessor Systems:. Introduction to architecture, operation, and application of microprocessors; microprocessor programming;

**Text and Reference Books**

1. Albert E. Clayton and V.N. Hancock, *Performance and Design of Direct Current Machines*
2. Charles V Jones, *Unified theory of Electrical Machines*, Butterworth, 1967
3. O I Elgerd, Patrick D Van der Puije, *Electric Power Engineering*, 2nd edition, Chapman & Hall, 1998.
4. M.G. Say, *Performance and Design of Alternating Current Machines*, CBS, 1983.
5. Fitzgerald, Kingsley, Umans, *Electric Machinery*, 5th Edition, McGraw-Hill, 1992
6. Arthur R. Bergen, and Vijay Vittal, *Power System Analysis*, 1st Edition, Pearson Education Asia, 2001.
7. Sergio Franco, *Design with OPAMPS and Linear Integrated circuits*, Tata McGraw Hill, 2002.
8. Sedra and Smith, *Microelectronics Circuits*, Oxford Univ. Press, 2004

9. Coughlin, Driscoll, *OP-AMPS and Linear Integrated Circuits*, Prentice Hall, 2001.
10. Douglas V. Hall, *Microprocessors & Interfacing*, McGraw Hill International Edition, 1992.
11. Jonathan W Valvano, *Embedded Microcomputer Systems: Real Time Interfacing*, Cengage Learning, Jan- 2011.
12. Steve Furber, *ARM System Architecture*, Edison Wesley Longman, 1996.
13. William Hohl, *ARM Assembly Language- Fundamentals and Techniques*, CRC Press, 2009

### **ME204 BASIC THERMODYNAMICS**

**3(3-0-0)**

Thermodynamics: Introduction and Basic Concepts, Application Areas of Thermodynamics, Systems and Control Volumes, Properties of a System, State and Equilibrium, Processes and Cycles, Temperature and the Zeroth Law of Thermodynamics, Pressure. Energy Conversion and General Energy Analysis: Forms of Energy, Energy Transfer by Heat, Energy Transfer by Work, the First Law of Thermodynamics.

Moving Boundary Work, Energy Balance for Closed Systems, Specific Heats, Internal Energy, Enthalpy, and Specific Heats of Ideal Gases, Solids and Liquids. The Second Law of Thermodynamics: Thermal Energy Reservoirs, Heat Engines, Refrigerators and Heat Pumps, Perpetual-Motion Machines, Reversible and Irreversible Processes, the Carnot Cycle, Pure substance, Entropy, Available and unavailable energy , Analysis of cycles, Helmholtz and Gibbs Functions and its applications, Ideal and Real gases, Non reactive mixtures, properties of air and water vapour.

#### **Text and Reference Books**

1. Spalding and Cole, *Engineering Thermodynamics*, ELBS Edition Longmans, 1987.
2. Arora C.P. *Thermodynamics*, TMH, 1998.
3. Gordan J. Van Wylen and Richard E.Sountag, *Fundamentals of Classical Thermodynamics*, 4th Edition, Wiley, 1994.
4. P. K. Nag, *Basic and Applied Thermodynamics*, Tata McGraw Hill. 3rd Edition, 2005.
5. Yunus A Cengel and Michael A. Boles, *Thermodynamics : An Engineering approach* , Tata Mcgraw Hill, 7th Edition .

### **ME205 MACHINE DRAWING**

**3(1-0-3)**

Machine components done using conventional drawing board and AutoCAD, Assembly drawing from working drawing: Swivel bearing, Machine Swivel vice, Tool head of shaper, Tailstock, Fuel pump, Fuel Injector, Rams bottom safety valve, Stop valve, Blow-off cock, Screw Jack, Centrifugal pump. Part drawing from assembly drawing: Foot step bearing, Eccentric, connecting rod, square tool post, Drill jig, Feed check valve.

#### **Text and Reference Books**

1. Bhat N. D, *Machine Drawing*, Charotar Publishing House, Anand, India, 1984.
2. Gopalkrishna K. R. *Machine Drawing*, Subhas Publication, Bangalore, 1999.
3. Narayana K. L, Kannaiyah P, Venkat Reddy K, *Machine Drawing* 3rd Edition, New Age International Ltd, 2006.
4. Goutam Pohit, Goutam Ghosh, *Machine drawing with AutoCAD*, Pearson Education, 2007

### **MA200 MATHS III**

**3(3-0-3)**

**Complex Analysis:** Complex Numbers, geometric representation, powers and roots of complex numbers, Functions of a

complex variable, Analytic functions, Cauchy-Riemann equations; elementary functions, Conformal mapping (for linear transformation); Contours and contour integration, Cauchy's theorem, Cauchy integral formula; Power Series and properties, Taylor series, Laurent series, Zeros, singularities, poles, essential singularities, Residue theorem, Evaluation of real integrals and improper integrals

**Power Series Solutions:** Differential Equations Power Series Method - application to Legendre equation, Legendre Polynomials,

Frobenius Method, Bessel equation, Properties of Bessel functions, Sturm- Liouville BVPs, Orthogonal functions

**Partial Differential Equations:** Introduction to PDE, basic concepts, second order PDE and classification, D'Alembert's formula and

Duhamel's principle for one dimensional wave equation, Laplace's and Poisson's equations, Laplace, Wave, and Heat equations using separation of variables. Vibration of a circular membrane. Heat equation in the half space.

#### **Text and Reference Books**

1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999)
2. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8<sup>th</sup> Edition), John Wiley (2005).
3. R. V. Churchill and J. W. Brown, Complex variables and applications (7th Edition), McGraw-Hill (2003).

#### **ME206 ELECTRICAL AND ELECTRONICS LAB**

**2(0-0-3)**

Experiments on OPAMPS Linear application: Voltage follower, Non-inverting amplifier and Non-inverting summing amplifier, Inverting amplifier, Inverting summing amplifier, Difference amplifier, Instrumentation amplifier, Voltage to current converter. Inverting integrator, Filters, Use of electrical meters, Load test on different Electrical motors and generators, Load test on transformers

#### **Text and Reference Books**

1. Albert E. Clayton and V.N. Hancock, *Performance and Design of Direct Current Machines*
2. Charles V Jones, *Unified theory of Electrical Machines*, Butterworth, 1967
3. O I Elgerd, Patrick D Van der Puije, *Electric Power Engineering*, 2nd edition, Chapman & Hall, 1998.
4. M.G. Say, *Performance and Design of Alternating Current Machines*, CBS, 1983.
5. Fitzgerald, Kingsley, Umans, *Electric Machinery*, 5th Edition, McGraw-Hill, 1992
6. Arthur R. Bergen, and Vijay Vittal, *Power System Analysis*, 1st Edition, Pearson Education Asia, 2001.
7. Sergio Franco, *Design with OPAMPS and Linear Integrated circuits*, Tata McGraw Hill, 2002.
8. Sedra and Smith, *Microelectronics Circuits*, Oxford Univ. Press, 2004
9. Coughlin, Driscoll, *OP-AMPS and Linear Integrated Circuits*, Prentice Hall, 2001.
10. Douglas V. Hall, *Microprocessors & Interfacing*, McGraw Hill International Edition, 1992.
11. Jonathan W Valvano, *Embedded Microcomputer Systems: Real Time Interfacing*, Cengage Learning, Jan- 2011.
12. Steve Furber, *ARM System Architecture*, Edison Wesley Longman, 1996.
13. William Hohl, *ARM Assembly Language- Fundamentals and Techniques*, CRC Press,

**ME250 APPLIED THERMODYNAMICS**

**3(3-0-0)**

Compressors, reciprocating and rotary, Steam nozzles and steam turbines, Air standard cycles, Vapour power cycles, Gas turbine cycles, performance testing of IC engines, Refrigeration cycles, vapour absorption system, Psychrometric processes.

**Text and Reference Books**

- 1.Holman J. P., *Thermodynamics*, McGraw Hill International Student Edition. Newyork, 1969.
- 2.Rajput R.K, *Thermal Engineering*, Laxmi Publications (Pvt) LTd., NewDelhi. 6th Edition , 2007.
- 3.Eastop and McConkey, *Applied Engineering Thermodynamics*, ELBS, 1995.

**ME251 POWER PLANT ENGINEERING**

**3(3-0-0)**

Conventional Energy Sources: Hydel, Steam, Gas turbine, Diesel and Nuclear Power Plant, Layout, function of different components and types, Power plant Economics, Non-conventional or Renewable energy sources: Solar energy, application of solar energy, Wind, Ocean, Geothermal, Biomass Energies, Energy Conversion Principles and types.

**Text and Reference Books**

- 1.Houghton E.L., Carruthers, *Aerodynamcs for Engineers studentents*, Butterworth-Hinemann Ltd., 2006
- 2.Sukathme S.P., *Solar Energy Principles of Thermal Collection and Storage*, 2nd Ed., TMC New Delhi,1984
- 3.M.M.El.Wakil, *Power Plant Techniques*, McGraw Hill, New York, 1985.
- 4.G.D. Rai, *Non-Conventional Energy*, Dhanpat Rai & Sons, New Delhi, 1998

**ME252 MANUFACTURING TECHNOLOGY I**

**3(3-0-0)**

Metal casting processes, special casting processes, casting defects, rising and gating design, solidification mechanisms, melting practices; Metal joining process: Gas Welding, Arc Welding, Advanced Welding processes, Welding defects, Brazing, Soldering; Metal removal Processes: Introduction to machine tools and classification, Lathe, Drilling Machine, Shaping Machine, Milling Machine, Advanced machine tools.

**Text and Reference Books**

- 1.Ghosh and Mallick, *Manufacturing Science*, Prentice Hall PTR, 2001
- 2.Paul Degramo, *Materials and Processes in Manufacturing*, 9th Edition, John Wiley & sons, 2003.
- 3.Rao P. N, *Manufacturing Technology Vol I and II*, 2nd Edition, TMH education, 2006.
- 4.P .K Mishra, *Non Conventional Machining*, 6th Edition Narosa Publishing house, 1997.



### **ME253 MECHANICS OF MACHINERY**

**3(3-0-0)**

Basics of Kinematics – Links, kinematic pair, mobility, basic mechanisms and its inversions. Position, Velocity and Acceleration analysis, Static force analysis, Inertia forces in machines, Synthesis of Mechanisms: Type, number and dimensional synthesis, Coupler curves.

#### **Text and Reference Books**

- 1.R.L. Norton, *Design of Machinery*, McGraw Hill Boston, 1999
- 2.John J. Uicker, Jr, Gordon R Pennock and Joseph E Shigley, *Theory of Machines and Mechanisms*.
- 3.H.H. Mabe and C.F. Rainbotten, *Mechanism and Design*, John Wiley, 1987. V Ramamurti, *Mechanics of Machines*, Narosa, 2010
- 4.Arthur G. Erdman, George N, Sandor, *Mechanism Design –Analysis and Synthesis*, Vol. I, Prentice Hall, New Jersey, 1984

### **ME254 MEASUREMENTS AND METROLOGY**

**3(3-0-0)**

Standards, Errors in measurement, calibration, Linear, angular measurement, Quality control fundamentals, Standard deviation, normal curve pattern of variations, control charts for variables, Comparators, Limits and Tolerances, statistical aspect of tolerances and setting tolerances, Surface finish terminology and measurement, Optical measuring instruments, Measurement of screw thread and Gear elements, Acceptance test for machines.

#### **Text and Reference Books**

1. I.C. Gupta, *Engineering Metrology*, Dhanpat Rai Publications, New Delhi, 1994.
2. Grant, *Statistical Quality Control*, Mc Graw Hill Publication. 6<sup>th</sup> Edition, 1988.

### **MA250 MATHEMATICS IV**

**3(3-0-0)**

**Numerical solution of linear and nonlinear equations:** Gauss elimination method and Gauss-Seidel iterative method, sufficient conditions for convergence, power method to find the dominant Eigen value and eigenvector. Bisection method, Fixed point method, Newton- Raphson method- order of convergence, interpolation and curve fitting, method of least squares.

**Numerical solution of ordinary differential equations:** Numerical differentiation and integration. Euler's method, Euler's modified method, Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations, multistep methods, Milne's and Adams' methods.

**Numerical solution of partial differential equations:** Liebmann's method, solution of one dimensional heat flow equation, Bender - Schmidt recurrence relation, Crank-Nicolson method, solution of one dimensional wave equation

**Probability:** Introduction to Probability; Conditional Probabilities; Independence; Bayes' Theorem and application.

Concept of Random Variables; Distribution and Density Function; Joint Distributed Random of Variables; Conditional and Joint Density Distribution function; Function of Random Variables; Expected Value: Mean and Variance; conditional expectation; covariance; Some special distributions: Uniform, Gaussian, Binomial, Poisson and Weibull distributions.

**Statistics:** Elements of estimation theory; linear minimum mean-square error and Orthogonality principle in estimation; Parameter Estimation; Central Limit Theorem; Law of large numbers; Tests of significance; large and small samples; t- test; F-test; and chi-square test for goodness of fit; Estimation theory, ANOVA table and analysis, Multiple and partial correlation regression.

#### **Text and Reference Books**

1. M. K. Jain, S. R. K Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering Computation," New Age Publishers, 6<sup>th</sup> Edition, 2012.
2. E. Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, Wiley India Pvt. Ltd., 2010.
3. R. L. Burden and J. D. Faires, "Numerical Analysis", 9<sup>th</sup> Edition, Brooks/Cole, 2012.
4. S. C. Gupta, and V.K. Kapoor, "Fundamentals of Mathematical Statistics", 7<sup>th</sup> Edition, Sultan Chand and Sons, 1980.
5. A. Papoulis, and P. Unnikrishnan, "Probability, Random Variable and Stochastic Process", 4<sup>th</sup> Edition, Tata McGraw-Hill, 2002

#### **ME255 MECHANICS OF SOLIDS LAB**

**2(0-0-3)**

Tension tests on mild steel and cast iron, Compression tests on mild steel and cast iron, Shear tests, Bending test on mild steel, Torsion test, Hardness test and Impact test. Demonstration on fatigue test and springs

#### **Text and Reference Books**

1. Hearn, E.J., *Mechanics of Materials*, Pergaman Press, England, 1972.
2. Beer and Johnston E. R. *Mechanics of Materials*, 3rd Edition, Tata McGraw Hill, New-Delhi, 2007.

#### **ME256 FLUID MECHANICS LAB**

**2(0-0-3)**

Calibration of V notch, Venturimeter, Orifice meter, Water meter. Friction factor of pipes. Impact of jet on vanes. Tests on centrifugal pump, reciprocating pump, Pelton wheel turbine. Kaplan turbine

#### **Text and Reference Books**

1. Modi, P.N and Seth, S.M., *Hydraulics and Fluid Mechanics*, Standard Book House

#### **VE200 VALUE EDUCATION**

**1(1-0-0)**

##### **Ethics in Engineering**

Concepts of Values and Ethics, History and Purposes, Utilitarianism, Duties, Rights, Responsibility, Virtue, Honesty, Moral Autonomy, Obligations of Engineering Profession and moral Propriety

##### **Engineer's Moral responsibility**

Engineer's Moral responsibility for Safety and Human Rights, Risk Assessment and Communication, Product Liability, Engineers-Employers Liaison, Whistle-Blowing and Its Moral Justification

### **Computer Ethics**

Social Impact of Computer, Gender-Issues and Privacy, Cyber Crime, Ethical use of Software

### **Intellectual property**

Definition, Types, Rights and Functions, Patents, Trademark, Grant of Patent in India, Surrender and Revocation of Patents, Compulsory Licensing, Acquisition of Inventions by the Government, Contents of draft application of Patents, WTO

### **Text and Reference Books**

1. Vinod V. Sople, Managing Intellectual Property: The Strategic Imperative, PHI,2006
2. Govindarajan, Natarajan & Senthil Kumar, Engineering Ethics, PHI
3. Robin Attfield, A Theory of Value and Obligation, London: Croomhelm, 1987
4. Jones and barlett, "Cyber Ethics: Morality and Law in Cyber Space"