

**SEMESTER V**

<b>CODE</b>	<b>COURSE OF STUDY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
ME301	Engineering Measurements	3	0	0	3
ME303	Mechatronics	3	0	0	3
ME305	Thermal Engineering-I	3	1	0	4
ME307	Automobile Engineering	3	0	0	3
ME309	Mechanics of Machines - II	3	1	0	4
ME311	Analysis and Design of Machine Components	3	0	0	3
ME313	Production Drawing and Cost Estimation	0	0	3	2
<b>Practical</b>					
ME315	Measurements and Metrology Lab	0	0	3	2
ME317	Dynamics Lab	0	0	3	2
	<b>Total</b>	<b>18</b>	<b>2</b>	<b>9</b>	<b>26</b>

## **SEMESTER V**

### **ME301 Engineering Measurements**

#### **UNIT-I**

Basic detector transducer elements, intermediate modifying systems, terminating devices and methods. Classification of instruments as indicators, recorders and integrators- their working principles, precision and accuracy, measurement of error and analysis, properties of errors.

#### **UNIT-II**

Pressure measurement: Gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, measurement of high and low pressure, dynamic characteristics of pressure measuring devices. Strain measurement: Strain gauges, types, Wheatstone circuit, temperature compensation, Gauge rosettes, Calibration.

#### **UNIT-III**

Measurement of displacement-LVDT-Hall effect devices. Vibration-characteristics, analysis of vibration sensing devices, accelerometer-types-signal conditioner- voltage and charge amplifiers-vibration exciters-calibration. Speed Measurement – Stroboscope - Force measurement: scales and balance, elastic force meter, strain gauge, load cells, hydraulic and pneumatic load cells. Temperature measurement: Bimetallic, pressure and resistance thermometers, thermocouples, pyrometers and thermistors, calibration. Fourier transform analysis – FFT Analyser-concepts and techniques.

#### **UNIT-IV**

Standards-Errors in measurements-Calibration - Length measurements, Angle measurements, Limits and tolerances. Surface finish; terminology and measurements - Optical measuring instruments. Measurement of screw thread and gear elements - Acceptance test for machines. Statistical Quality Control - Control charts - Sampling plans.

#### **UNIT-V**

Introduction TQM - Quality circle concepts – concepts, objectives and functions of quality circles – Benefits of the organization – Tools and Techniques – The seven management tools -

Technique for analyzing a quality process – Statistical process Control – Introduction to S-S concepts – six sigma – Quality circles - Cost of quality – Taguchi’s quality loss function – House keeping concepts for industries, tool room, production shop – processing industries. Quality based product and process Design – Design for reliability – Design for maintainability –QFD - Concepts and applications – case studies. KAIZEN Concepts – Kaizen by TQC – POKA YOKE ISO 9000 certification system – 9001 to 9004 systems – procedures, audits and reviews – case studies.

### **Text Books:**

1. Thomas G Beckwith, N Lewis Buck and Roy D Marargoni, “Mechanical Measurements”, Narosa publishing house, 1989.
2. Harshavardhan, “Measurements – Principles and Practice”, Macmillan India Limited, 1993
3. Gupta, I.C., Engineering Metrology, Dhanpat Rai & Sons, 2004.
4. Grant, E.L., Statistical Quality Control, McGraw-Hill, 2004.
5. S.M.Sundara Raja, Total Quality Management Tata McGraw Hill, 1998.
6. Patrick.J.Sweeney (editor), TQM for Engineering, Quality Resources, Newyork, 1993.

### **Reference Books:**

1. Turner, J.D., “Instrumentation for Engineers”, Springer – Verlag, New yorkinc., 1988.
2. B.C.Nakra and Chaudhry, K.K., “Instrumentation and Analysis”, TMH, 1985.
3. Doebelin E.O., Measurement Systems, McGraw-Hill, 2004.
4. John Bank, The Essence of Total Quality Management, Prentice Hall of India, 1998.
5. James I Bossert, Quality Function Deployment, ASQC quality press, Wisconsin, 1994.

## **ME303 Mechatronics**

### **UNIT-I**

Introduction: Introduction to Mechatronics - Systems-Measurement Systems-Control Systems-Mechatronics Approach.

### **UNIT-II**

Sensors and Transducers: Introduction-Performance, Terminology-Displacement, Position and Proximity-Velocity and Motion- Fluid Pressure-Temperature Sensors-Light Sensors-Selection of Sensors-Signal Processing.

### **UNIT-III**

8085 Microprocessor: Introduction-Architecture-Pin Configuration - Instruction set - Programming of Microprocessors using 8085 instructions-Interfacing input and output devices-Interfacing D/A converters and A/D converters-Applications- Temperature control-Stepper motor control-Traffic light controller.

### **UNIT-IV**

Programmable Logic Controllers: Introduction-Basic structure-Input/Output Processing-Programming-Mnemonics-Timers, Internal relays and counters-Data handling-Analog Input/Output-Selection of a PLC.

### **UNIT-V**

Design and Mechatronics: Stages in Designing mechatronic systems - Traditional and Mechatronic design -Possible design solutions-Case studies of mechatronic systems - Pick and place robot - automatic car park system -engine management system.

### **Text Books:**

1. W.Bolton, Mechatronics,Longman, Second Edition, 1999.
2. Michael B. Histan and David G.Alciatore, " Introduction to Mechatronics and Measurement Systems ", McGraw Hill International Editions, 1999.

3. David G.Alciatore and Mecheal.B.Histand, Introduction of Mechatronics and Measurement Systems, McGraw Hill International Edition, 1999.
4. HMT, Mechatronics, Tata McGraw Hill Publishing Company Ltd., 1998.
5. Lawrence J.Kamm, Understanding Electro – Mechanical Engineering, An Introduction to Mechatronics, Prentice Hall, 20001

**Reference Books:**

1. DanNecsulescu, "Mechatronics", Pearson Education Asia, 2002(Indian reprint).
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.
3. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
4. Smaili.A and Mrad.F ,“Mechatronics Integrated Technologies for Intelligent Machines”, Oxford University Press, 2007
5. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.
6. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007.
7. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

## **ME305 Thermal Engineering-I**

### **UNIT-I**

Reciprocating air compressors - types - construction - work of compression without clearance - effect of clearance – Multistaging - optimum intermediate pressure for perfect intercooling - Compressor efficiencies and mean effective pressure.

### **UNIT-II**

Working of two and four stroke engines - valve and port timing diagrams – I.C. engines fuels and rating -SI engine air fuel mixture requirements - Performance curve of an automobile carburetor - Diesel injection systems - types - Jerk type pump – Injection pump governors. Types of nozzles - Introduction to petrol injection.

### **UNIT-III**

Battery Ignition - magneto ignition and transistorized coil ignition - Combustion in SI engines - Knock in SI engines - effect of engine variable on knock - Combustion in CI engines - knock in CI engines - combustion chambers for SI and CI engines.

### **UNIT - IV**

Engine testing - Measurement of friction power - Indicated power – Electronic Indicator- Brake power - dynamometers - Instruments for measuring emission of NO<sub>x</sub> , CO, Unburnt HC and smoke - engine efficiencies - Heat balance - Scavenging in two stroke engines.

### **UNIT -V**

Governing equations for inviscid-compressible flows - static and stagnation properties -speed of sound and Mach number. Isentropic flow through variable area passage ducts. Choking of flow. Normal and oblique shocks - Prandtl-Meyer flows. Fanno flow - Rayleigh flow. Fundamentals of jet propulsion - Propulsion cycle - Power and efficiency calculations. Turbojet, turbofan, and turboprop engines - Fundamentals of rocket propulsion.

**Text Books:**

1. Ganesan, V., Internal Combustion Engines, Tata McGraw-Hill, 2003.
2. Heywood, J.B., Fundamentals of Internal Combustion Engines, McGraw-Hill, 1988.
3. Yahya, S.M., Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion, 3rd ed., New Age International Publishers, 2003.
4. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2000
5. Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, "Dhanpat Rai & sons , 2002

**Reference Books:**

1. Ballaney, P.L., Thermal Engineering, Khanna Publishers, 1996.
2. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007
3. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003
4. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.

## **ME307 Automobile Engineering**

### **UNIT-I**

General classification of vehicles - Power unit - All components of power unit.

### **UNIT-II**

Steering systems - Power steering - Wheel and suspension systems - Transmission system; clutches, couplings, gear boxes, and torque converters.

### **UNIT-III**

Axles - Differentials - Mechanical, hydraulic, and pneumatic brakes - Power brakes - Four wheel drive.

### **UNIT-IV**

Electrical systems; construction, operation, and maintenance of batteries - Starter motors. Lighting and electrical accessories .

### **UNIT-V**

Panel board instruments - Automobile air conditioning -Troubleshooting.

### **Text Books:**

1. Heitner, J. Automotive Mechanics Principle and Practice, 2nd ed., Affiliated East-West Press Ltd., 1974. Newton, K., Steeds, W., and Garrett, T.K., The Motor Vehicle, Butterworths, 1989.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, NewDelhi, 2002
3. W.H.Crouse, Automotive Mechanics, Tata McGraw Hill Publishing Co., 1995.
4. V.L.Maleev, Internal Combustion Engines, McGraw Hill, 1987.

### **Reference Books:**

1. Kirpal Singh, Automotive Engineering, Vol. I & II, Standard Publishers, New Delhi, 2002.
2. Joseph Heitner, Automotive Mechanics, CBS Publishers & Distributors, 1987.



3. R.B.Gupta , Automobile Engineering, Satya Prakashan, New Delhi, 1997.
4. R.B.Gupta., Auto Design, Satya Prakashan, New Delhi, 1995

## **ME309 Mechanics of Machines – II**

### **UNIT-I**

Static and dynamic force analysis of mechanisms - Flywheel function and design.

### **UNIT-II**

Balancing of rotating masses in one and in several planes

### **UNIT-III**

Balancing of reciprocating masses– Single and multi-cylinder engines.

### **UNIT-IV**

Governors; gravity and spring controlled governors - Gyroscopic effect.

### **UNIT-V**

Vibration; free and forced vibrations - Single degree and multi-degree freedom systems.

Vibration control - Passive and active control.

### **Text Books:**

1. Shigley, J.E., Uicker, J.J., Theory of Machines and Mechanisms, McGraw-Hill, 1995.
2. Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms” ,3rd Edition, Oxford University Press, 2009.
3. Rattan, S.S, “Theory of Machines”, 3rd Edition, Tata McGraw-Hill, 2009
4. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.

### **Reference Books:**

1. Rao, J.S., and Duggipati, R.Y., Mechanism and Machine Theory, 2nd ed., Wiley Eastern Ltd., 1995.
2. Cleghorn. W. L, “Mechanisms of Machines”, Oxford University Press, 2005
3. Benson H. Tongue, ”Principles of Vibrations”, Oxford University Press, 2nd Edition, 2007

4. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
5. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
6. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt.Ltd., New Delhi, 1988.
7. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
8. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 1996
9. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
10. Khurmi, R.S., "Theory of Machines", 14th Edition, S Chand Publications, 2005.

## **ME311 Analysis and Design of Machine Components**

### **UNIT-I**

Mechanical engineering design - Design considerations

### **UNIT-II**

Material selection - Modes of failure -Theories of failure - Endurance limit - Stress concentration  
- Factor of safety- Factors to be considered for material selection – application, life expectancy,  
risk factors etc.

### **UNIT-III**

Design of shafts and couplings - Design of cotter and knuckle joints. Helical and leaf springs.

### **UNIT-IV**

Fasteners and keys - Design of welded joints - Fillet and butt welds

### **UNIT-V**

Design of riveted joints. Design of sliding contact bearings - Selection of rolling contact bearings.

### **Text Books:**

1. Sundararajamoorthy, T.V. and Shanmugam, N., *Machine Design*, Anuradha Agencies, 2003.

**Reference Books:**

2. Shigley, J.E., Charles, R.M. and Richard, G.B., *Mechanical Engineering Design*, 7th ed., McGraw-Hill, 2004.

**ME313 Production Drawing and Cost Estimation****UNIT-I**

Conventional Representation of Machine elements - International Standards (ISD) and Indian Standards (IS).

**UNIT-II**

Limits and Fits - IT system of tolerances, deviations and fits.

**UNIT-III**

Geometric Dimensioning and Representation - Tolerancing, Tolerancing of form, orientation, location and run-outs, Datums and Datum Systems.

**UNIT-IV**

Surface texture indication on drawing. Welds - Symbolic representing of drawings. Preparation of process - Chart for a given component.

**UNIT-V**

Cost Estimation of setting time and machining time - estimation of material cost, labour cost and overhead cost based on supplied data. Given a sub-assembly /assembly to prepare production drawings of components as per current drawing office practice. At least ten subassemblies/assemblies are to be completed on A4 sheets.

**Text Books:**

1. T.R.Banga and S.C.Sharma, Mechanical estimating and costing including contracting, Khanna Publishers,

2. Indian Standards : 10714,10715,10716,10717,10719, 813,919,2709,8000 , pt.1 to 4 : 10721, 11158 corresponding to ISO's

3.PSG Design Data Book, PSG Book Depot, 2010.

### **Reference Books:**

1. Khan M.Y. & Jain P.K., Cost Management, TMH outline series, 2nd ed., 2000.

### **ME315 Measurements & Metrology Lab**

1. Calibration of Micrometer.
2. Measurement of taper using Sine Bar.
3. Calibration of Plain Plug Gauge.
4. Straightness and Flatness Measurement using Autocollimator.
5. Surface Roughness Measurement (Talysurf method)
6. Inspection of Screw Threads (Effective Diameter).
7. Calibration of Inclined Tube Manometer.
8. Measurement of Pressure using Strain Gauges.
9. Determination of the Time Constant of Thermocouples.
10. Measurement of Force using Transducers.
11. Measurement of Strain using Strain Gauges.
12. Study of Displacement using LVDT and RVDT.
13. Vibration Measurement using Accelerometer.
14. Measurement of speed using stroboscope
15. Inspection of gear tooth profile using profile projectors
16. Tool Maker Microscope (inspection of screws)
17. Inspection of internal and external surfaces (C M M)
18. Statistical Quality Control charts.

### **ME317 Dynamics Lab**

1. Natural frequency of single mass, single helical spring system.
2. Natural frequency of combination of springs – springs in parallel, springs in series
3. Natural frequency of undamped torsional single rotor, double rotor system. Effect of inertia ( $I$ ) and stiffness ( $k_t$ ).
4. Determination of radius of gyration of a given compound pendulum
5. Determination of radius of gyration, moment of inertia – bifilar suspension method –

trifilar suspension method

6. Damping coefficient of torsional single rotor system – Effect of depth of immersion in oil and damping ratio
7. Resonance frequency of equivalent spring mass system – undamped and damped condition. To plot amplitude Vs frequency graph for different damping.
8. Determination of characteristic curves of Watt, Porter, Proell and spring loaded governors.
9. Static and Dynamic balancing.
10. Journal bearing – pressure distribution of different loads at different Speeds.
12. Cam motion analysis.