Structure of S.E. (Mechanical Engineering)  
2015 Course

Semester-II

<table>
<thead>
<tr>
<th>Subject Code</th>
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<th>Teaching Scheme</th>
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<td>Fluid Mechanics</td>
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<td>202047</td>
<td>Soft Skills</td>
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<tr>
<td>202048</td>
<td>Theory of Machines – I</td>
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<td>202049</td>
<td>Engineering Metallurgy</td>
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<td>202050</td>
<td>Applied Thermodynamics</td>
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<tr>
<td>203152</td>
<td>Electrical and Electronics Engineering</td>
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<td>202053</td>
<td>Machine Shop – I</td>
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<td><strong>250</strong></td>
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| Total of Part-II | 30 Hrs | 750 |

**Note:** Theory of Machine-I and Engineering Metallurgy practical may be carried out fortnightly for two hours, so that the tutorial hours may be used as practical.
## 202045: Fluid Mechanics

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### Prerequisites:
- 1. Engineering Mathematics
- 2. Engineering Physics

### Course Objectives:
- To understand of various properties of fluids
- To learn fluid statics and dynamics.
- To understand of Boundary layer, Drag, and Lift
- To understand of Bernoulli’s equation
- To Know of various applications of Bernoulli’s equation

### Course Outcomes:
On completion of the course, learner will be able to–
- Use of various properties in solving the problems in fluids
- Use of Bernoulli’s equation for solutions in fluids
- Determination of forces drag and lift on immersed bodies

### Course Contents

#### Unit I Fundamentals of Fluid Mechanics (8 Hrs)

**Properties of Fluids:** Definition of fluid, concept of continuum, Density, Specific Weight, Specific Gravity, Dynamic Viscosity, Kinematic Viscosity, Newton’s law of viscosity, types of fluid, Rheological diagram, Surface Tension, Capillarity, Compressibility, Vapour pressure

**Fluid Statics:** Pascal’s Law, Pressure at a point, Total Pressure & Centre of pressure for inclined flat plate, Buoyancy, metacenter and floatation.

(No numerical treatment for Buoyancy, metacenter and floatation)
**Unit II: Kinematics of Fluid Motion** *(8 Hrs)*
Eulerian and Lagrangian approach of fluid flow, total or material derivative for velocity field, Continuity equation, types of flows (One, two, three dimensional, steady unsteady, uniform, non-uniform, laminar, turbulent, compressible, incompressible, rotational, Irrotational). Visualization of flow field (Stream, Path and Streak line), vorticity in two dimensional flow, stream function and velocity potential function.

**Unit III: Fluid Dynamics** *(8 Hrs)*
Introduction to flow models- control volume and infinitesimally small element, Linear momentum Equation using differential Approach, Introduction to Navier – Stokes Equation, Euler equation of motion, derivation of Bernoulli’s equation along stream line, concept of HGL and THL or TEL, application of Bernoulli’s equation to venture meter, Pitot tube, Submerged Orifices, Orifice meter, V-notch.

**Unit IV: Internal Flow** *(8 Hrs)*
Laminar and Turbulent flow physics, entrance region and fully developed flow. Velocity and shear Stress distribution for laminar flow in a pipe, fixed parallel plates and Couette flow, hydrodynamically smooth and rough boundaries, Velocity profile of Turbulent flow.

**Unit V: Flow through Pipes** *(8 Hrs)*
Energy losses through pipe-Major and Minor losses, Darcy-Weisbach equation, pipes in series, pipes in parallel and concept of equivalent pipe, Moody’s diagram, Siphons, Transmission of power, (No derivations for minor losses)

Dimensional Analysis: Dimensions of Physical Quantities, dimensional homogeneity, Buckingham $\pi$ Theorem and important dimensionless numbers.

**Unit VI: External flows** *(8 Hrs)*
Boundary layer formation for flow over Flat plate, boundary layer thickness:-displacement, momentum and energy, Separation of Boundary Layer and Methods of Controlling Forces on immersed bodies: -Lift and Drag (No derivation on lift), flow around cylinder and aerofoil (Pressure distribution and Circulation).

**Books:**
Text:
1. Fundamentals of Fluid Mechanics- Munson, Young and Okiishi- Wiley India
2. Fluid Mechanics- Potter Wiggert –Cengage Learning
3. Introduction to Fluid Mechanics- Fox, Pichard , McDonald- Wiley
4. Fluid Mechanics,- Dr. R.K. Bansal- Laxmi Publication (P) Ltd. New Delhi

Reference:
1. Fluid Mechanics- Kundu, Cohen, Dowling- Elsevier India

List of Practical
(Any ten of the following out of which experiment number 3 is compulsory)
1. Pressure measurement using any two types of manometer.
2. Determination of viscosity of liquids and its variation with temperature.
3. Determination of metacentric height of floating object.
4. Laminar and Turbulent flow by Reynolds’s apparatus.
6. Verification of modified Bernoulli’s equation.
9. Calibration of V-notch
10. Determination of minor losses due to pipe fittings.
11. Determination of Major losses through metal & non-metal pipes.

Notes:
3. Minimum 10 experiments should be performed.
4. Experiment No. 3 is compulsory.
### 202047: Soft Skills

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<td>TH: -- hr/week</td>
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#### Course Objectives:
- To develop students overall personality.
- To understand and aware about importance, role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice. To improve his writing and documentation skills.

#### Course Outcomes:
On completion of the course, learner will be able to–
- Improved communication, interaction and presentation of ideas.
- Right attitudinal and behavioural change
- Developed right-attitudinal and behavioral change

#### Course Contents

**Term Work/Assignments**
Term work will consist the record of any 6 assignments of following exercises

1. **SWOT analysis**
   Student should do his/her SWOT analysis & submit the report.
   **Method of Execution**
   Explain the meaning & benefits of SWOT analysis to students. Give them time to think on their strength, weaknesses, opportunities & threats. Ask them to write their own SWOT analysis

2. **Listening Skills**
   Listen to a short audio book and make notes out of it & make a report.
   **Method of Execution**
   Ask every student to download any freely available English audio book of one hour duration. Also ask them to listen it carefully and write it’s review on journal paper
### 3. Oral presentation skills/Speaking Skills (4 Hrs)

**Method of Execution**

Hold the poster of any inspirational personality & speak about his/her life for five minutes.

The personality can be from the fields like sports, politics, literature, entertainment etc. Ask every students to read & study about therespective personality & deliver the oral presentation infront of his/her batchmates.

### 4. Resume writing (4 Hrs)

**Method of Execution**

Design a cover letter & resume for yourself.

Show some of the different resumes according to respective job profiles to students & ask them to prepare their own resume. Also guide them to write a cover letter for any job application.

### 5. Corporate / Business Etiquettes (4 Hrs)

**Method of Execution**: Tell students about any five recent internship openings & ask them to apply for same through email with resume as an attachment. Ask students to take a sent mail print for submission record.

Apply to any five internship openings over internet by writing an email to the company HR. Students must submit email print.

### 6. Group Discussion (4 Hrs)

**Method of Execution**: Take some of the current topics for group discussion, divide students in two batches of ten students in each, Allot 10 minutes time & one topic for discussion, meanwhile instructor have to assess each student’s performance & give feedback to respective student. Also ask students to write the minutes of the meeting from same GD.

Organize the group discussion on current topics in a batch of ten students & ask every student to make minutes of meeting & submit.

### 7. Team Activity (4 Hrs)

**Method of Execution**: Make a group of four students & guide them to choose a topic for making a video documentaty. Video can be posted on facebook, twitter or youtube. The video can be recorded on cellphone as well.

Make a 20 minutes english video documentary & post it on a social media. Also provide the link of the same as submission record.

### Books:

<table>
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<th>Text:</th>
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<tbody>
<tr>
<td>1. Basics Of Communication In English : Francis Sounderaj, MacMillan India Ltd.2</td>
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<th>Reference:</th>
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<tr>
<td>2. Cambridge English For Job Hunting : ColmDownes, Cambridge University Press</td>
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<tr>
<td>3. The Complete Letter Writer :MacMillan India Ltd</td>
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<tr>
<td>4. E Writing – 21st Century Tools for Effective Communication :Booher , MacMillan India Ltd</td>
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<tr>
<td>5. NASSCOM-Global Business Foundation Skills: Cambridge University Press</td>
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# 202048: Theory of Machines – I

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**Prerequisites:**
- 1. Engineering Mathematics
- 2. Engineering Physics

**Course Objectives:**
- To make the student conversant with commonly used mechanism for industrial application.
- To develop competency in drawing velocity and acceleration diagram for simple and complex mechanism.
- To develop analytical competency in solving kinematic problems using complex algebra method.
- To develop competency in graphical and analytical method for solving problems in static and dynamic force analysis.
- To develop competency in conducting laboratory experiments for finding moment of inertia of rigid bodies.

**Course Outcomes:**
On completion of the course, learner will be able to—
- Identify mechanisms in real life applications.
- Perform kinematic analysis of simple mechanisms.
- Perform static and dynamic force analysis of slider crank mechanism.
- Determine moment of inertia of rigid bodies experimentally.
- Analyze velocity and acceleration of mechanisms by vector and complex algebra method.
- Analyze velocity and acceleration of mechanisms by graphical methods.
### Course Contents

**Unit I: Fundamentals of Kinematics and Mechanisms** (10 Hrs)

- Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach crieterion, Grubler’s criterion. Four bar chain and its inversions, Grashoff’s law, Slider crank chain and its inversions, Double slider crank chain and its inversions. Straight line mechanisms such as: Peaucellier Mechanism, Scott Russell Mechanism, Grasshopper Mechanism, watt mechanism. Equivalent linkage of mechanisms, Steering gear mechanisms: Condition for correct steering, Davis steering gear mechanism, Ackermann steering gear mechanism.

**Unit II: Static and Dynamic Force Analysis** (8 Hrs)

- Theory and analysis of Compound Pendulum, Concept of equivalent length of simple pendulum, Bifilar suspension, Trifilar suspension.
- Dynamics of reciprocating engines: Two mass statically and dynamically equivalent system, correction couple, static and dynamic force analysis of reciprocating engine mechanism (analytical method only), Crank shaft torque, Introduction to T-θ diagram.
- Friction: Friction in turning pair, friction circle, friction axis, friction in slider crank mechanism.

**Unit III: Friction Clutches, Brakes and Dynamometer** (8 Hrs)

- Pivot and collar friction, Classification of Clutches, torque transmitting capacity of - plate clutch, cone clutch and centrifugal clutch, Classification of brakes, braking torque of - shoe brakes, internal shoe brake, disc brake, brake power of absorption and transmission type dynamometers – prony brake, rope brake, belt transmission, epicyclic train and Bevis-Gibson torsion

**Unit IV: Kinematic Analysis of Mechanisms: Analytical Method** (8 Hrs)

- Analytical method for displacement, velocity and acceleration analysis of slider crank Mechanism.
- Position analysis of links with vector and complex algebra methods, Loop closure equation, Chase solution, Velocity and acceleration analysis of four bar and slider crank mechanisms using vector and complex algebra methods.
- Hooke’s joint, Double Hooke’s joint.
Unit V: Velocity and Acceleration Analysis of Simple Mechanisms: Graphical Methods-I
(8 Hrs)
Relative velocity method: Relative velocity of a point on a link, Angular velocity of a link, Sliding velocity, Velocity polygons for simple mechanisms.
Relative acceleration method: Relative acceleration of a point on a link, Angular acceleration of a link, Acceleration polygons for simple mechanisms.
(limit to only 4 link mechanisms)
Instantaneous center of rotation (ICR) method: Definition of ICR, Types of ICRs, Methods of locating ICRs (limit to only 6 link mechanisms), Kennedy’s Theorem, Body and space centrode.
Unit VI: Velocity and Acceleration Analysis of Mechanisms: Graphical Methods-II
(8 Hrs)
Velocity and acceleration diagrams for the mechanisms involving Coriolis component of acceleration. (limit to only 4 link mechanisms) Klein’s construction.

Books:

<table>
<thead>
<tr>
<th>Text:</th>
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<tbody>
<tr>
<td>5. Thomas Bevan, “Theory of Machines” CBS Publisher and Distributors, Delhi.</td>
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<th>Reference:</th>
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<tr>
<td>4. Wilson C.E., Sandler J. P. Kinematics and Dynamics of Machinery”, Person Education.</td>
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</table>

Term Work based on following Tutorials to be submitted in the form of Journal:

1. Draw (any 4) configurations of mechanisms and determine types of pairs, links, degree of freedom.

2. To determine experimentally the mass moment of inertia of a connecting rod using a compound pendulum method.

3. To determine experimentally the mass moment of inertia of a flat bar using bifilar suspension method or to determine experimentally the mass moment of inertia of a flywheel/gear/circular disc using trifilar suspension method.

4. Numerical based on Friction Clutches, Brakes and Dynamometer Or to measure torque transmitting capacity of friction clutch experimentally.

5. Numerical based on - single and double Hooke’s joint.

6. One problem on velocity and acceleration analysis using: Vector algebra and Complex algebra and comparison of results.

7. Two problems on velocity and acceleration analysis using relative velocity and acceleration method.

8. Two problems on velocity analysis using ICR method.

9. Two problems on velocity and acceleration analysis using relative velocity and acceleration method involving Coriolis component.

10. Problems on velocity and acceleration analysis using Klein’s construction for uniform and non-uniform crank velocity.

Note: 1. Sr. No. 1,7,8,9 and 10 Problems based on Graphical methods are to be solved on half imperial drawing sheets.

2. Oral based on above Term work conducted in the tutorial class.
# 202048: Engineering Metallurgy

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## Course Objectives:

- To acquaint students with the basic concepts of Metal Structure
- To impart a fundamental knowledge of Ferrous & Non Ferrous Metal Processing
- Selection and application of different Metals & Alloys
- To Know Fundamentals of Metallography
- To develop futuristic insight into Metals

## Course Outcomes:

On completion of the course, learner will be able to–

- describe how metals and alloys formed and how the properties change due to microstructure
- apply core concepts in Engineering Metallurgy to solve engineering problems.
- conduct experiments, as well as to analyze and interpret data
- select materials for design and construction.
- possess the skills and techniques necessary for modern materials engineering practice
- recognize how metals can be strengthened by alloying, cold-working, and heat treatment

## Course Contents

### Unit I Overview of Metallurgy

(6 Hrs)

Methods of metal extraction (Principle only of pyro, hydro & electro metallurgy), cast v/s wrought products, Related terms and their definitions : System, Phase, Variable, Component, Alloy, Solid solution, Hume Ruther's rule of solid solubility, Allotropy and polymorphism, Concept of solidification of pure metals & alloys, Nucleation : homogeneous and heterogeneous, Dendritic growth, super cooling, equiaxed and columnar grains, grain & grain boundary effect.

Cooling curves, Plotting of Equilibrium diagrams, Lever rule, Coring, Eutectic system, Partial eutectic and isomorphous system.
Unit II: Micro & macroscopic study of Metals (6 Hrs)
Classification of metal observations: their definition, difference & importance.

Microscopy: Various sampling techniques, specimen preparation, specimen mounting (hot & cold mounting) electrolytic polishing, etching procedure and reagents, electrolytic etching.

Microscopic techniques: optical microscopy, electron microscopy, transmission electron microscopy (TEM), scanning electron microscopy (SEM), scanning probe microscopy (SPM), AFM etc. (principal & application only)
Study of Metallurgical microscope. Measurement of grain size by different methods & effect of grain size on various mechanical properties.
Macroscopy: Sulphur printing, flow line observations, spark test.

Unit III: Iron-Carbon alloy system & Cast Iron (8 Hrs.)
Iron-iron carbide equilibrium diagram, critical temperatures, solidification and microstructure of slowly cooled steels, structure & property relationship, classification and application of steels.

Cast Irons: Classification, Manufacturing, Composition, Properties & applications of white C.I., Grey cast iron, malleable C.I., S.G. cast iron, chilled and alloy cast iron, effect of various parameters on structure and properties of cast irons. Specific applications such as machine tools, automobiles, pumps, valves etc.

Introduction to non-equilibrium cooling of steels, widmanstatten structure

Unit IV: Heat-treatment Of Steels (6 Hrs)
Transformation products of Austenite, Time Temperature Transformation diagrams, critical cooling rate, continuous cooling transformation diagrams. Heat treatment of steels: Annealing, Normalising, Hardening & Tempering, quenching media, other treatments such as Martempering, Austempering, Patenting, Ausforming. Retention of austenite, effects of retained austenite. Elimination of retained austenite (Subzero treatment). Secondary hardening, temper embrittlement, quench cracks, Hardenability & hardenability testing, Defects due to heat treatment and remedial measures.

Classification of surface hardening treatments, Carburising, heat treatment after Carburizing, Nitriding, Carbo-nitriding, Flame hardening, and Induction hardening.

Unit V: Engineering Alloy Steels & designation (4 Hrs)
Classification of alloy steels & Effect of alloying elements, examples of alloy steels, stainless steels, sensitization & weld decay of stainless steel, tool steels, heat treatment of high speed steel, special purpose steels with applications, super alloys. Heat affected zone. Designation (for plane & alloy steels): IS, AISI, SAE, DIN etc.
### Unit VI: Non Ferrous Metals

| Classification of nonferrous metals. Importance of nonferrous metals in engineering applications & compositions, study of different mechanical properties: Cu & Cu based alloys, Al and Al based alloys, Ni and Ni based alloys, Co and Co based alloys, Titanium & its alloys, Tin & Lead base alloys, Bearing materials: important properties & applications. |

### Books:

**Text:**
“Material Science & Metallurgy For Engineers”, Dr. V.D. Kodgire & S. V. Kodgire, Everest Publication.

**Reference:**
4. Engineering Metallurgy Dr. O.P. Khanna

### Term Work based on following

1. Study & Demonstration of Specimen Preparation for microscopic examination.
2. Study of Optical Metallurgical microscope.
3. Study and Drawing of Microstructure of Steels of various compositions.
4. Study and Drawing of Microstructure of Cast Irons.
5. Study and Drawing of Microstructure of Non Ferrous Metals.
7. Study and Drawing of Microstructure of Heat Affected Zone in Welding.
8. Jominy End Quench Test for hardenability.
10. Sulfur Printing Test.
12. Characterization techniques like SEM, TEM.

**Note:** Out of above Twelve practical, any Eight practical should be conducted.
# 202050: Applied Thermodynamics

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<th>Prerequisites:</th>
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<td>1. Engineering Thermodynamics.</td>
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<td>2. Engineering Mathematics</td>
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**Course Objectives:**
- To study Combustion in SI and CI engines and its controlling factor in order to extract maximum power.
- To study emission from IC Engines and its controlling method, Various emission norms.
- Perform Testing of I. C. Engines and methods to estimate Indicated, Brake and Frictional Power and efficiencies
- To understand theory and performance Calculation of Positive displacement compressor.

**Course Outcomes:**
On completion of the course, learner will be able to–

- Classify various types of Engines, Compare Air standard, Fuel Air and Actual cycles and make out various losses in real cycles.
- Understand Theory of Carburetion, Modern Carburetor, Stages of Combustion in S. I. Engines and Theory of Detonation, Pre-ignition and factors affecting detonation.
- Understand Fuel Supply system, Types of Injectors and Injection Pumps, Stages of Combustion in CI Engines, Theory of Detonation in CI Engines and Comparison of SI and CI Combustion and Knocking and Factors affecting, Criteria for good combustion chamber and types.
- Carry out Testing of I. C. Engines and analyze its performance.
- Describe construction and working of various I. C. Engine systems (Cooling, Lubrication, Ignition, Governing, and Starting) also various harmful gases emitted from exhaust and different devices to control pollution and emission norms for pollution control.
- Describe construction, working of various types of reciprocating and rotary compressors with performance calculations of positive displacement compressors.
## Course Contents

<table>
<thead>
<tr>
<th>Unit I Basics of IC Engines</th>
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**Fuel Air Cycle and Actual Cycle** (5 Hrs)
Fuel air cycle, Assumptions, Comparison with air standard cycle, Effect of variables on performance,
Actual cycle and various losses, Comparison of Air standard Vs Fuel Vs Actual cycle.

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<tr>
<th>Unit II SI Engines</th>
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<tr>
<th>Unit III CI Engines</th>
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<tr>
<th>Unit IV Testing of IC Engines</th>
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<tr>
<td>Objective of testing, Various performance parameters for I.C. Engine - Indicated power, brake power, friction power, SFC, AF ratio etc. Methods to determine various performance parameters, characteristic curves, heat balance sheet.</td>
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**Supercharging** (2 Hrs)
Supercharging and turbo-charging methods and their limitations

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<th>Unit V I.C. Engine Systems</th>
<th>(6 Hrs)</th>
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<tbody>
<tr>
<td>Cooling System, Lubrication System, Ignition System, Governing system, Starting System</td>
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**I.C. Engine Emissions and Control** (4 Hrs)
Air pollution due to IC engine and its effect, Emissions from petrol/gas and diesel engines, Sources of emissions, Euro norms, Bharat stage norms, Emission control methods for SI and CI engines
## Unit VI Positive Displacement Compressors (Reciprocating and Rotary)  
(10 Hrs)

**Reciprocating Compressor** - Single stage compressor – computation of work done, isothermal efficiency, effect of clearance volume, volumetric efficiency, Free air delivery, Theoretical and actual indicator diagram, Multistaging of compressor, Computation of work done, Volumetric efficiency, Condition for maximum efficiency, Inter-cooling and after cooling, Capacity control of compressors

**Rotary Compressor** – Introduction, vane compressors, roots blower, screw compressor.  
*(Numerical treatment on Reciprocating compressor single stage and multistage only)*

### Books:

**Text:**
1. V. Ganesan: Internal Combustion Engines, Tata McGraw-Hill  

**Reference:**
2. Domkundwar & Domkundwar: Internal Combustion Engine, Dhanpat Rai  

### List of Practical’s:
1. Study of Carburetor  
2. Study of Fuel pump and injector  
3. Study of Ignition System  
4. Demonstration & study of commercial exhaust gas analyzers.  
5. Morse Test on Multi cylinder Petrol/Diesel engine for determination of Friction power.  
6. Variable load test on diesel engine to determine various efficiencies, SFC and Heat balance sheet.  
7. Test on variable compression ratio engine.  
8. Visit to Automobile service station  
9. Test on Positive Displacement Air Compressor  
10. Assignment on any one advanced technology related to I.C. Engine such as VVT, VGT, HCCI  
11. Assignment on alternative fuels used in I.C. Engines.

### Notes:
1. Minimum 8 experiments should be performed.  
2. Perform any 3 from 1 to 4.  
3. Perform any 2 from 5, 6, and 7.  
4. Experiment 8 and 9 are compulsory.
203152: Electrical and Electronics Engineering

Teaching Scheme:  
 Credits  
 Examination Scheme:  

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Prerequisites: - 1. Basic Electrical Engineering 2. Basic Electronics Engineering

Course Objectives:
To understand
1. Principle of operation and speed control of DC machines
2. Induction motor principle and its applications
3. Working principle of special purpose motors
4. Microcontrollers
5. Embedded systems terminologies and sensors
6. Data acquisition system for mechanical applications

Course Outcomes:
Student should be able to
1. Develop the capability to identify and select suitable DC motor / induction motor / special purpose motor and its speed control method for given industrial application.
2. Program Arduino IDE using conditional statements
3. Interfacing sensors with Arduino IDE

Course Contents

Electrical Engineering

Unit I D. C. Machines (6Hrs)

Unit II Three Phase Induction Motors (6Hrs)
Constructional feature, working principle of three phase induction motors, types; torque equation, torque slip characteristics; power stages; efficiency, starters (auto transformer starter, star delta starter); methods of speed control and industrial applications.
### Unit III Special Purpose Motors (6 Hrs)
Construction, working principle, characteristic and applications of stepper motors, A.C. and D.C servomotors, universal motors, industrial applications, brushless DC motors, linear induction motors, single phase induction motors,(types, construction, working principle of split phase and shaded pole type induction motors), descriptive treatment for AC series motor (difference between AC series and DC series motor, construction and working).

### Electronics Engineering

### Unit IV Introduction to Microcontrollers (6 Hrs)
Introduction to microcontroller and microprocessors, role of embedded systems, open source embedded platforms, Atmega 328P- features, architecture, portstructure, sensors and actuators, data acquisition systems, introduction to Arduino IDE- features, IDE overview, programming concepts: variables, functions, conditional statements.

### Unit V Peripheral Interface-1 (6 Hrs)
Concept of GPIO in Atmega 328P based Arduino board, digital input and output, UART concept, timers, interfacing with LED, LCD and keypad, serial communication using Arduino IDE

### Unit VI Peripheral Interface-2 (6 Hrs)
Concept of ADC in Atmega 328P based Arduino board, interfacing with temperature sensor (LM35), LVDT, strain gauge, accelerometer, concept of PWM, DC motor interface using PWM

### Books:

**Text:**

[T7] Arduino microcontroller processing for everyone-Steven F Barret,Morgan and Claypool Publisher.
[T8] C programming with ardino-Warwick Smith Elektor Publication.
Reference:
[R3] Permanent Magnet Synchronous and Brushless DC Motor Drives, R. Krishnan, CRC press.
[R6] Started with Arduino by Massimo Banzi and Michael Shiloh Published by Maker Media, Inc.
[R7] Getting Started With Arduino: A Beginner's Guide by by Brad Kendall (Author), Justin Pot (Editor), Angela Alcorn (Editor)

Web References
1) www.alldatasheet.com
2) www.atmel.com/products
**List of Practicals:**
(Any 4 out of 1 to 6 and any 4 out of 7 to 12)

**Electrical Engineering**
1) Speed control of DC shunt motor.
2) Brake test on DC shunt motor.
3) No load and blocked rotor test on 3 phase Induction Motor.
4) Load test on 3 phase Induction Motor.
5) Load test on single phase Induction Motor.
6) Study of starters for AC and DC motors.

**Electronics Engineering**
7) Interfacing of LED to blink after every 1 sec.
8) Display data using serial communication.
9) Interfacing of LCD to display the message and interface with keypad to display the key pressed.
10) Interfacing of temperature sensor (LM35) and show output on LCD/serial terminal.
11) Interfacing of strain gauge sensor and LVDT to measure the parameters.
12) Study of interfacing accelerometer to change the speed of DC Motor.

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**Guidelines for Instructor's Manual**

Practical Sessions -

- The Instructor’s Manual should contain following related to every experiment –
  - Brief theory related to the experiment.
  - Connection diagram /circuit diagram
  - Observation table
  - Sample calculations for one reading
  - Result table
  - Graph and Conclusions.
  - Data sheets of the ICs used (if any)
### Guidelines for Student's Lab Journal

#### For Electrical Practical

1. Lab journal should be hand written
2. All the diagrams should be drawn on graph paper
3. Specifications of the instrument used for conduction of practical should be mentioned in respective write up.

#### For Electronics Practical:

1. Title of the program.
2. The program has to be written in the following format.
   Address- Instruction- Comment
3. Input data has to be specified.
4. Result of the program.
5. Flow Chart for each program has to be drawn on separate page.

### Guidelines for Lab / TW Assessment

1. There is **Term Work** for the subject, so continuous assessment should be carried out such as checking of previous experiment.
2. While assessment, teacher should put the remark by writing word “Complete” and not simply “C”. Put the signature along with date at the end of experiment and in the index.
3. Assign 10 marks for each experiment as per following format.
   - Timely completion = 03 marks
   - Neat and clean writing = 02 marks
   - Depth of understanding = 03 marks
   - Regular attendance = 02 marks

Maintain continuous assessment sheet. At the end of semester, convert these marks out of as prescribed in syllabus structure.
### Guidelines for Laboratory Conduction

#### Electrical Engineering Practicals

1. Check whether the MCB / ELCB / main switch is off.

2. Make connections as per circuit diagram. Use flexible wire for connection of voltmeter and pressure coil connection of wattmeter. For rest of the connections, use thick wire. Do not keep loose connection. Get it checked from teacher / Lab Assistant.

3. Perform the experiment only in presence of teacher or Lab Assistant.
4. Do the calculations and get it checked from the teacher.

5. After completion of experiment, switch off the MCB / ELCB / main switch.
6. Write the experiment in the journal and get it checked within the week.

#### Electronics Engineering Practicals

1. The instructor is expected to shortlist necessary experiments from the suggested list of experiments.
2. During the practical session the instructor may divide the total students in groups of 4 to 5 students and assign them with different experiments to be performed.
3. Each student within the group has to enter and execute the program turn wise.
4. Staff member has to check the result of all the groups after the execution of the program.
# 203153 : Machine Shop - I

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**List of Practical’s:**
1. Manufacture of spur gear on milling machine using indexing head.
2. Surface grinding using table grinder.
3. Manufacturing any one sheet metal component involving minimum three different operation (use dies and press).
4. Any two plastic component like bottle, bottle caps, machine handles, etc.
Structural engineering is a field of engineering dealing with the analysis and design of structures that support or resist loads. Structural engineering is usually considered a specialty within civil engineering, but it can also be studied in its own right. Structural engineers are most commonly involved in the design of buildings and large nonbuilding structures but they can also be involved in the design of machinery, medical equipment, vehicles or any item where structural integrity affects the structure of the object.

Mechanical engineering careers in consulting. More experienced mechanical engineers may choose to pursue consulting roles, working either as part of a consultancy or as an independent contractor. This means the opportunity to work on a variety of different projects at different types of organization, providing expert advice, and perhaps also taking on project management duties. Other sectors offering lots of roles for mechanical engineers include pharmaceuticals, marine transportation, electronics, construction, new materials development, energy, chemicals and a wide range of manufacturing sectors.