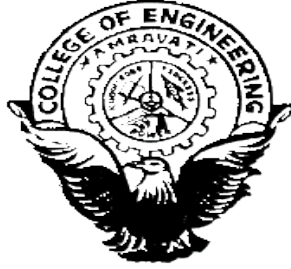


# Govt. College of Engineering Amravati

(An Autonomous Institute of Govt. of Maharashtra)



Curriculum  
for  
III and IV Semesters

of  
B. Tech. in Mechanical Engineering

Department of Mechanical Engineering

(2009-10)

## TEACHING AND EVALUATION SCHEME OF FOUR-YEAR B.Tech. (MECHANICAL)

Semester: - III												
Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						
		L	T	P	Total Hours/ Week	Theory				Practical		Credits
						Sessional		TA	ESE	Int.	Ext.	
						CT1	CT2					
ME 301	Mechanics of Materials	04	-	-	04	15	15	10	60	-	-	04
ME 302	Material science and Engineering	04	-	-	04	15	15	10	60	-	-	04
ME 303	Fluid Mechanics	04	-	-	04	15	15	10	60	-	-	04
ME 304	Engineering Thermodynamics	04	01	-	05	15	15	10	60	-	-	05
ME 305	Electrical Drives and Control	04	-	-	04	15	15	10	60	-	-	04
ME 306	General Proficiency-I	-	-	02	02	-	-	-	-	50	-	02
ME 307	Mechanics of Materials Lab.	-	-	02	02	-	-	-	-	25	25	01
ME 308	Material science Lab.	-	-	02	02	-	-	-	-	50	-	01
ME 309	Fluid Mechanics Lab.	-	-	02	02	-	-	-	-	50	-	01
ME 310	Electrical Drives & Control Lab.	-	-	02	02	-	-	-	-	25	25	01
		20	01	10	31	75	75	50	300	200	50	27
Semester: - IV												
Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						
		L	T	P	Total Hours/ Week	Theory				Practical		Credits
						Sessional		TA	ESE	Int.	Ext.	
						CT1	CT2					
ME 401	Kinematics of Machines	04	-	-	04	15	15	10	60	-	-	04
ME 402	Engineering Mathematics-III	04	01	-	05	15	15	10	60	-	-	05
ME 403	Thermal Engineering	04	-	-	04	15	15	10	60	-	-	04
ME 404	Manufacturing Processes	04	-	-	04	15	15	10	60	-	-	04
ME 405	Machine Drawing	04	-	-	04	15	15	10	60	-	-	04
ME 406	General Proficiency-II	-	-	02	02	-	-	-	-	50	-	02
ME 407	Kinematics of Machines Lab.	-	-	02	02	-	-	-	-	50	-	01
ME 408	Manufacturing Processes Lab.	-	-	04	04	-	-	-	-	25	25	02
ME 409	Computer Aided Drafting Lab.	-		02	02	-	-	-		25	25	01
		20	01	10	31	75	75	50	300	150	50	27

### Semester: - IV

Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						
		L	T	P	Total Hours/ Week	Theory				Practical		Credits
						Sessional		TA	ESE	Int.	Ext.	
						CT1	CT2					
ME 401	Kinematics of Machines	04	-	-	04	15	15	10	60	-	-	04
ME 402	Engineering Mathematics-III	04	01	-	05	15	15	10	60	-	-	05
ME 403	Thermal Engineering	04	-	-	04	15	15	10	60	-	-	04
ME 404	Manufacturing Processes	04	-	-	04	15	15	10	60	-	-	04
ME 405	Machine Drawing	04	-	-	04	15	15	10	60	-	-	04
ME 406	General Proficiency-II	-	-	02	02	-	-	-	-	50	-	02
ME 407	Kinematics of Machines Lab.	-	-	02	02	-	-	-	-	50	-	01
ME 408	Manufacturing Processes Lab.	-	-	04	04	-	-	-	-	25	25	02
ME 409	Computer Aided Drafting Lab.	-		02	02	-	-	-		25	25	01
		20	01	10	31	75	75	50	300	150	50	27

### Semester: - V

Semester: - V												
Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						
		L	T	P	Total Hours/ Week	Theory				Practical		Credits
						Sessional		TA	ESE	Int.	Ext.	
						CT1	CT2					
ME 501	Machine Design – I	04	-	-	04	15	15	10	60	-	-	04
ME 502	Dynamics of Machines	04	-	-	04	15	15	10	60	-	-	04
ME 503	Heat Transfer	04	-	-	04	15	15	10	60	-	-	04
ME 504	Measurement System	03	-	-	03	15	15	10	60	-	-	03
ME 505	Machining Processes	04	-	-	04	15	15	10	60	-	-	04
ME 506	Industrial Engineering	03	-	-	03	15	15	10	60	-	-	03
ME 507	Machine Design – I Lab.	-	-	02	02	-	-	-	-	25	-	01

ME 508	Dynamics of Machines Lab.	-	-	02	02	-	-	-	-	25	25	01
ME 509	Heat Transfer Lab.	-	-	02	02	-	-	-	-	25	25	01
ME 510	Measurement System Lab.	-	-	02	02	-	-	-	-	25	-	01
ME 511	Machining Processes Lab.			02	02	-	-	-	-	25	25	01
		<b>22</b>	<b>-</b>	<b>10</b>	<b>32</b>	<b>90</b>	<b>90</b>	<b>60</b>	<b>360</b>	<b>125</b>	<b>75</b>	<b>27</b>

### Semester: - VI

Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						
		L	T	P	Total Hours/ Week	Theory				Practical		Credits
						Sessional		TA	ESE	Int.	Ext.	
						CT1	CT2					
ME 601	Hydraulic Machines	04	-	-	04	15	15	10	60	-	-	04
ME 602	Machine Design-II	04	-	-	04	15	15	10	60	-	-	04
ME 603	Metrology and Quality Control	04	-	-	04	15	15	10	60	-	-	04
ME 604	Control Systems Engineering	04	01	-	05	15	15	10	60	-	-	05
ME 605	Energy Conversion	04	-	-	04	15	15	10	60	-	-	04
ME 606	Hydraulic Machines Lab.	-	-	02	02	-	-	-	-	25	25	01
ME 607	Machine Design-II Lab.	-	-	02	02	-	-	-	-	25	25	01
ME 608	Metrology and Quality Control Lab.	-	-	02	02	-	-	-	-	25	25	01
ME 609	Energy Conversion Lab.	-	-	02	02	-	-	-	-	25	25	01
ME 610	Minor Project	-		02	02	-	-	-	-	50	-	02
		20	01	10	31	75	75	50	300	150	100	27

### Semester: - VII

Semester: - VII												
Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						
		L	T	P	Total Hours/ Week	Theory				Practical		Credits
						Sessional		TA	ESE	Int.	Ext.	
						CT1	CT2					
ME 701	Industrial Management and costing	04	-	-	04	15	15	10	60	-	-	04
ME 702	Mechatronics	04	-	-	04	15	15	10	60	-	-	04
ME703	Automobile Engineering	04	-	-	04	15	15	10	60	-	-	04
ME704	Computer Aided Design	03	-	-	03	15	15	10	60	-	-	03
ME705	Elective-I	04	-	-	04	15	15	10	60	-	-	04
ME 706	Mechatronics Lab.	-	-	02	02	-	-	-	-	25	25	01
ME707	Computer Aided Design Lab.	-	-	04	04	-	-	-	-	25	25	02
ME708	Elective-I Lab.	-	-	02	02	-	-	-	-	25	25	01
ME709	Seminar and Project stage-I	-	-	02	02	-	-	-	-	100	-	04
		19	-	10	29	75	75	50	300	175	75	27

### Semester: - VIII

Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						
		L	T	P	Total Hours/ Week	Theory				Practical		Credits
						Sessional		TA	ESE	Int.	Ext.	
						CT1	CT2					
ME801	Computer Integrated Manufacturing	04	-	-	04	15	15	10	60	-	-	04

ME802	Operation Research Technique	04	01	-	05	15	15	10	60	-	-	05
ME803	Elective-II	04	-	-	04	15	15	10	60	-	-	04
ME804	Elective-III	04	-	-	04	15	15	10	60	-	-	04
ME805	Computer Integrated Manufacturing Lab.	-	-	02	02	-	-	-	-	25	25	01
ME806	Elective-III Lab.	-	-	02	02	-	-	-	-	25	25	01
ME807	Project	-	-	06	06	-	-	-	-	100	100	08
		<b>16</b>	<b>01</b>	<b>10</b>	<b>27</b>	<b>60</b>	<b>60</b>	<b>40</b>	<b>240</b>	<b>150</b>	<b>150</b>	<b>27</b>

**The ESE duration for all courses shall be 2hrs 30 min except courses ME405, ME501 and ME602 for which the ESE duration will be 3hrs.**

Sr. No.	ME 705 ELECTIVE-I	ME803 ELECTIVE-II	ME804 ELECTIVE-III
<b>1</b>	New and Renewable Energy Sources	Internal Combustion Engines	Refrigeration & Air Conditioning
<b>2</b>	Tool Engineering	Production planning and control	Machine Tool Design
<b>3</b>	Experimental Stress Analysis	Mechanical Vibrations	Finite Element Methods
<b>4</b>	Supply Chain Management	Production Management	Entrepreneurship Development and Project Management

### Equivalence of Courses Final Year Mechanical Engineering

Courses in Autonomy				Courses in University pattern		
Sr. No.	Sem.	Course Code	Course Name	Sem.	Course Code	Course Name
1	VII	ME 701	Industrial Management and costing	VII	7SMP3	Industrial Management and costing
2	VII	ME 702	Mechatronics	VII	7SM5	Mechatronics
3	VII	ME703	Automobile Engineering	VIII	8SM3	Automobile Engineering
4	VII	ME704	Computer Aided Design	V	5SM1	Computer Software Applications-I
			<b>Elective-I</b>			
5	VII	ME705	New and Renewable Energy Sources	VIII	7SM5	Non-Conventional Energy System
6	VII	ME705	Tool Engineering	VII	7SM5	Tool Engineering
7	VII	ME705	Experimental Stress Analysis		No Equivalence	
8	VII	ME705	Supply Chain Management		No Equivalence	
9	VII	ME 706	Mechatronics Lab.	VII	7SM5	Mechatronics Practical
10	VII	ME707	Computer Aided Design Lab.	V	5SM1	Computer Software Applications-I Practical
			<b>Elective-I Lab.</b>			
11	VII	ME708	New and Renewable Energy Sources Lab.	VIII	7SM5	Non-Conventional Energy System Practical
12	VII	ME708	Tool Engineering Lab.	VII	7SM5	Tool Engineering
13	VII	ME708	Experimental Stress Analysis Lab.		No Equivalence	
14	VII	ME708	Supply Chain Management Lab.		No Equivalence	
15	VII	ME709	Seminar and Project stage-I	VIII	8SM5	Project and Seminar
1	VIII	ME801	Computer Integrated Manufacturing	VII	7SM4	Automation Engineering
2	VIII	ME802	Operations Research Technique	VIII	8SMP4	Operations Research Techniques
			<b>Elective-II</b>			
3	VIII	ME803	Internal Combustion Engines	VIII	8SM1	Internal Combustion Engines
4	VIII	ME803	Production planning and control	VIII	8SM1	Production planning and control
5	VIII	ME803	Mechanical Vibrations		No Equivalence	
6	VIII	ME803	Production Management		No Equivalence	
			<b>Elective-III</b>			
7	VIII	ME804	Refrigeration & Air Conditioning	VIII	8SM2	Refrigeration & Air Conditioning
8	VIII	ME804	Machine Tool Design	VIII	8SM2	Machine Tool Design
9	VIII	ME804	Finite Element Methods	VIII	8SM2	Finite Element Methods
10	VIII	ME804	Entrepreneurship Development and Project Management		No Equivalence	
11	VIII	ME805	Computer Integrated Manufacturing Lab.	VII	7SM4	Automation Engineering Lab.
			<b>Elective-III Lab.</b>			
12	VIII	ME806	Refrigeration & Air Conditioning Lab.	VII	8SM2	Refrigeration & Air Conditioning Practical
13	VIII	ME806	Machine Tool Design Lab.	VIII	8SM2	Machine Tool Design Practical
14	VIII	ME806	Finite Element Methods Lab.	VIII	8SM2	Finite Element Methods Practical
15	VIII	ME806	Entrepreneurship Development and Project Management Lab.		No Equivalence	
16	VIII	ME807	Project	VIII	8SM5	Project and Seminar

## ME 301 MECHANICS OF MATERIALS

Teaching Scheme : 04 L = Total 04

Credit : 04

Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks :100

Duration of ESE: 2 hrs. 30 min

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**Mechanical Properties of Materials:** Concept of direct, bearing and shear stresses and strains, stress-strain relations, Biaxial and tri-axial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety.

**Uni-axial Stresses and Strains:** Stresses and strains in compound bars in uni-axial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

**Axial Force, Shear Force and Bending Moment Diagrams:** Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear force, bending moment and loading intensity.

**Simple or Pure Bending Theory:** Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section.

**Torsion:** Theory of torsion and assumptions, derivation of torsion equation, polar modulus, stresses in solid and hollow circular shaft, power transmitted by shaft.  
Shear stress distribution on beam cross sections.

Thin and thick cylinders and thin spherical shells subjected to internal pressures.  
Strain energy under uni-axial tension and compression impact loads and instantaneous stresses.

**Combined Direct and Bending Stresses:** Combined direct and bending stresses, applications to short columns with eccentric loads.

**Principal stresses:** Biaxial stress system, principal stresses, principal planes, and Mohr's circle of stresses, principal strains.

**Deflection of beams:** Deflection in statically determinate (simply supported, cantilever and beams with overhang) beams subjected to point loads, uniformly distributed loads, moments by double integration, McCauley's method.

### Books Recommended:

#### Text Books :

- 1) Strength of Materials, Stephen Timoshenko, CBS Publishers, Delhi, First Edition 1986.
- 2) Strength of Materials, F.L. Singer: Harper and Row, New York, Fourth Edition Reprint 1998.
- 3) Strength of Materials, Ramamruthm, Dhanpat Rai and Sons, New Delhi, Thirteenth Edition, 2000.

### Reference Books

- 1) Mechanics of Materials, E.P. Popov, Prentice Hall of India, New Delhi.
- 2) Introduction to Solid Mechanics, Irving H. Shames, Prentice Hall of India, New Delhi.
- 3) Mechanics of Materials, Beer & Johnston McGraw Hill, New Delhi, Metric Edn. 1992.
- 4) Mechanics of Materials, B.C. Punmia, A.K. Jain, Arunkumar Jain, Laxmi Publications, New Delhi, 2000.
- 5) Strength of Materials, A Practical Approach, Vol-1, D.S. Prakash Rao, First Edition University Press, Hyderabad.

## **ME 302 MATERIAL SCIENCE AND ENGINEERING**

**Teaching Scheme : 04 L = Total 04**

**Credit : 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Total Marks: 100**

**Duration of ESE: 2 hrs. 30 min**

**Solid Crystalline Structure:** Metal structure and crystallization, Nucleation and growth in metals and alloys, single and polycrystalline materials, classification of crystals, FCC, BCC, HCP lattice, lattice structure, unit cell, packing density and co-ordination number, Crystallographic directions and planes.

**Theory of Alloys and Alloy Diagrams:** Alloys, solid solutions, intermetallic compounds, binary diagrams, its construction, eutectic, peritectic, eutectoid reactions, Lever rule. Construction and study of Iron-Carbon equilibrium diagram,

**Plain carbon steels:** Microstructure and properties, effect of impurities and grain size on the properties of p.c. steels.

**Alloy Steels:** Effect of alloying elements on the structure and properties of steels, classification of alloying elements, effect on constitution of steels, effect on transformation of steels, low and high alloy engineering steels.

**High Speed Steels:** Their heat treatment and applications, ferritic, austenitic, martensitic

**Stainless Steels:** Properties and applications, weld decay in stainless steels.

**Cast Irons:** Constitution and properties of white, grey, nodular and malleable cast irons, their applications, alloy cast irons.

**Non-Ferrous Materials:** Brasses and bronzes, types, properties, applications, alloys of aluminium, lead, tin, zinc their applications. Bearing metal, season cracking, and precipitation hardening.

**Principles of Heat Treatment:** Annealing, normalising, tempering, Iso-thermal transformation diagrams (S-curves), superimposition of S-curve on continuous cooling diagram, characteristics of pearlite, bainite, martensite transformation on continuous cooling. hardenability, quenching media, severity of quench, austempering, martempering, patenting, retained austenite, sub-zero treatment.

**Methods of surface hardening:** Carburizing, nitriding, cyaniding, flame hardening, induction hardening.

**Mechanical working of metals:** Deformation of metals, slip, twinning, critical resolved shear stress, deformation in single and polycrystalline materials, stress-strain curve, Luder bands, recovery, re-crystallisation, grain growth, hot and cold working-advantages, disadvantages. fracture, creep, fatigue failures.

Strengthening mechanisms e.g. strain hardening, age hardening, precipitation hardening.

**Welding Metallurgy:** Weldability, metallurgical effects of welding, residual stresses, heat-affected zone, microstructure changes during welding, grain size, cracking, and corrosion characteristics of welds.

**Powder Metallurgy:** Manufacture of metal powders, single die, double die compaction, sintering, manufacture of porous bearings and cemented carbide tip tools, advantages, limitations, application of powder metallurgy.

### **Books Recommended:**

#### **Text Books**

1. Introduction to Material Science and Engineering, W.F. Smith, Mc-Graw Hill International, London 3<sup>rd</sup> Edn., 1989.
2. Material Science and Engineering, V. Raghavan, PHI. 3<sup>rd</sup> Edn. 1989.
3. Introduction to Physical Metallurgy, S. Avner, Tata Mc-Graw Hill, New Delhi. 3<sup>rd</sup> Edn., 1987.

#### **Reference books**

1. Mechanical Metallurgy, G.E. Dieter, Mc-Graw Hill International, London. 3<sup>rd</sup> Edn., 1999.
2. Physical Metallurgy for Engineers, Clarke and Varney, Second Edn., 1987.
3. Powder Metallurgy, A.K. Sinha First Edn., 1991.
4. Engineering Physical Metallurgy, Y. Lakhtin, Mir Publications. Second Edn., 1999.

## **ME 303 FLUID MECHANICS**

**Teaching Scheme : 04 L = Total 04**

**Credit : 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Total Marks :100**

**Duration of ESE: 2 hrs. 30 min**

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**Introduction to the study of fluid motion:** Mechanical properties of fluids and their influence on flow characteristics.

**Fluid Statics:** Fluid pressure, pressure variation in fluids, manometers, forces on plane and curved surface buoyancy. Stability of floating bodies.

**Kinematics and Dynamics of Fluid Flow:** Types of flows, streamlines, potential lines, flow net, continuity equation. one and two-dimensional motion, one-dimensional method of flow analysis. Bernoulli's equation. Venturimeter, Momentum equation for steady flow. Vortex motion.

**Dimensional Analysis:** Dimensional homogeneity and dimensionless ratios. Dimensionless parameters. Similitude and model studies.



**Motion of Viscous Fluids:** Introduction to laminar and turbulent flows, boundary layer concept, separation, drag lift on immersed bodies, Reynolds number and its significance.

**Darcy's weisbach equation:** Equation of pipe flow, friction charts and its use, minor losses in pipes and fittings, losses due to sudden enlargement and contraction, hydraulic and energy gradient lines, pipes in series and parallel. elementary concept of water hammer.

**Principles of Fluid Machinery:** Dynamic action of fluid force exerted by fluid jet on plane, curved, stationary and moving vanes. velocity diagrams, work done by impact, pressure due to deviated flow.

**General Theory of Hydrodynamic Machines:** Euler's equation, degree of reaction, classification of machines according to degree of reaction. Efficiencies, volumetric efficiency, hydraulic efficiency, mechanical efficiency and overall efficiency.

### **Books Recommended:**

#### **Text Books**

1. Hydraulics and Fluid Mechanics (SI) By Dr. P.N. Modi and S. M. Seth, 10<sup>th</sup> Edition.
2. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som and G. Biswas, Tata McGraw Hill, Second Edition.

#### **Reference Books**

1. Engineering Fluid Mechanics, R. K. Rajput, S. Chand Publications, 2<sup>nd</sup> Edition, 2005.
2. Fluid Mechanics and Machines, Kotharduraon and Rudramoorthy, New Age Internationals, Second Edition 2007.
3. Fluid Mechanics with Engineering Applications, R.L. Dougherty, T, B. Fanzine and E.J. Fennimore, Tata McGraw Hill, 2<sup>nd</sup> Edition.
4. Fluid Mechanics, Mohanty A.K., Prentice Hall of India, 2<sup>nd</sup> Edition, 2005.
5. Fluid Mechanics, By Streeter, Tata McGraw Hill (SI), 7<sup>th</sup> Edition.
6. Engineering Fluid Mechanics, K.L. Kumar, Eurasia Publication House, 2<sup>nd</sup> Edition, SI units.

## **ME 304 ENGINEERING THERMODYNAMICS**

**Teaching Scheme : 04 L + 01 T = Total 05**

**Credit : 05**

**Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Total Marks :100**

**Duration of ESE: 2 hrs. 30 min**

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**Basic concepts and properties:** Introduction, thermodynamic system, control volume, macroscopic and microscopic approaches, properties and state of a system, point and path functions, thermodynamic equilibrium, processes and cycles, quasi-static process, properties such as specific volume, pressure, temperature, zeroth law of thermodynamics, temperature scales.

**Ideal gases and vapors:** Difference between gases and vapors, ideal gases, gas laws, equation of state, gas constant, universal gas constant, work and heat, definition of work, thermodynamic work, work in compressible system, work-a path function, work done during various processes, p-v diagram, definition of heat, heat transfer a path function,

comparison of heat and work, Phase change process of a pure substance: specific heats, sensible heat and latent heat, triple point, critical point, superheat and total heat of steam.

**First law of thermodynamics:** Energy of systems, classification of energy, law of conservation of energy, first law applied to closed system undergoing a cycle, Joule experiment, energy-a property of system, internal energy: a function of temperature, enthalpy, specific heat at constant volume and constant pressure, change in internal energy and heat transfer during various non-flow processes. First law applied to flow processes: steady-state steady flow process, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, throttling valve, turbines and compressors, pumps, heat exchangers etc. Work done and heat transfer during steady flow processes.

**Second law of thermodynamics:** Limitations of first law, heat engines, refrigerators and heat pumps, Kelvin-planck and Clausius statements, their equivalence, reversible and irreversible processes, factors that render processes irreversible, Carnot cycle, two propositions regarding the efficiency of Carnot cycles, the thermodynamic temperature scale, reversed Carnot cycle, COP of heat pump and refrigeration. Thermodynamic processes – constant volume, isothermal, adiabatic, polytropic processes, throttling and free expansion- p-v and T-s diagrams-work done, heat exchanged, change in internal energy.

**Entropy:** Inequality of Clausius, entropy: a property of system, entropy change for ideal gases, entropy change of a system during irreversible process, lost work, principle of increase of entropy. Availability and irreversibility: available energy referred to cycle, decrease in available energy with heat transfer through a finite temperature differences. Tds equations, Availability in a steady flow system, irreversibility and effectiveness.

#### **Power cycles:**

Gas power cycles: Otto cycle, Diesel cycle, semi-Diesel, Sterling cycles, their efficiency and mean effective pressure calculations.

Vapors power cycles: Properties of steam, specific volume and entropy of steam, dryness fraction of steam, throttling of steam, determination of dryness fraction, steam tables and their use, T-s and H-s diagram, Rankine and modified Rankine cycle, work done and efficiency, specific steam consumption, comparison of Rankine and Carnot cycle, representation on P-v, T-s and h-s diagram.

#### **Books Recommended:**

##### **Text Books:**

1. Thermodynamics: An Engineering Approach, 3<sup>rd</sup> Edition, Yunus Çengel and Michael, Boles, Tata McGraw Hill.
2. Basic and Applied Thermodynamics, 2<sup>nd</sup> Edition, Nag P. K., Tata McGraw-Hill.

##### **Reference Books:**

1. Fundamentals of Thermodynamics, 5<sup>th</sup> Edition, Richard E. Sonntag, Claus Borgnakke and Gordon J. Van Wylen, John Wiley and Sons, Inc.
2. Thermodynamics, 4<sup>th</sup> Edition, J.P. Holman, McGraw-Hill.
3. Engineering Thermodynamics, 2<sup>nd</sup> Edition, Jones J.B. and Hawkins G.A., John Wyley and Sons.

4. Fundamentals of Engineering Thermodynamics, Moran M.S. and Shapiro H.N., John Wiley and Sons, 1988.
5. Thermodynamics, 5<sup>th</sup> Edition, K. Wark, McGraw-Hill.

# ME 305 ELECTRICAL DRIVES AND CONTROL

**Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Concept of General Electric Drives:** Classification and comparison of electric drive system, cooling and heating of electric motors, Theory and working principle of power transistors, power MOSFET, SCR.

**Basic Characteristics of DC Motors:** Torque equation, modified speed–torque characteristics, starting and braking of electric DC motors, comparison of mechanical and electric braking methods, conventional speed control methods.

**Classification of AC Motors:** Construction, types, characteristics of 3-phase IM, torque equation, applications, starting and braking of 3-phase IM, conventional speed control methods.

Thyristorised stator voltage control of 3-phase IM, (V/F) control, slip-power recovery scheme, thyristorised armature voltage control of DC motors using phase control and thyristorised chopper.

Introduction, principle, construction and working of DC servomotors, stepper motors, brushless DC motors, classification of 1-phase IM, construction, principle, working and applications, principle and working of Universal motor, linear IM

**Industrial Applications:** Classes of duty, selection of an electric drive for particular applications such as steel mill, paper mill, cement, textile mill, electric traction, coal mining, etc.

### Books Recommended:

**Text Books:**

1. Electric machines (second edition) by I. J. Nagrath and D. P. Kothari, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Electrical Technology (AC and DC drives) by B. L. Thereja, Vol-II and Vol-III. Dhanpat Rai and Sons.

### Reference Books:

1. Electric Motor Drives-modeling, analysis and control by R. Krishnan, Low price Edition, Pearson Edu.
2. Utilization of Electrical Power, R.K. Rajput, Laxmi publications.

## ME 306 – GENERAL PROFICIENCY – I

Teaching Scheme : 02 P = Total 02

Credit : 02

Evaluation Scheme : 50 Internal

Total Marks: 50

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The objective of the course is to enrich skill of the engineering students for future career, further studies through development of listening, reading, and writing and communicating. This is developed with the following methodology:

- Discussion about theoretical nature of different aspects of Communication skill.
- Practice by students for the pronouncement, public speaking and organizing meeting etc.
- Interaction for corrective measures.
- Understanding, grasping and then reporting.

**Communication:** Need, importance, types and objectives, communication process, barriers, principles of effective communication, modes of communication

Practice of effective communication through eye contact, voice modulation, audience awareness, presentation plan and non-verbal language, face to face conversation, self-analysis.

Understanding guidelines for telephonic conversation, making and receiving calls and telephone messages.

**Interviews for Employments:** Preparing self and reporting for sample questions on educational background, co-curricular activities, extra curricular activities, and experience and general knowledge, miscellaneous. Case study of Employment oriented Bio Data Profile and Case study of Planning and execution of organizing extra curricular activities in institute.

**Data Collection:** Role of communication in organizations around and experience sharing by the students. Data collection and report on latest events in Amravati city.

**Group Discussion:** Seminars and conferences, Understanding different aspects- experience sharing and reporting. Case study of report writing of organizing a seminar/ conference

**Paragraph Writing:** Understanding principles and general hints writing and analyzing paragraph writing on 3 to 5 topics. Case study on paragraph writing on latest themes on different topics of engineering.

**Report Writing and Drafting:** Understanding the principles and practices of office drafting such as circulars, notices, memos and telex/ telegraph/ fax/e-mail messages. Case study of report writing on organizing a meeting with Principal / HOD of institute.

### Text Books:

1. Developing Communication Skills, Krishna Mohan and Meera Banerjee, McMillan Publishers.
2. A Course in Listening and Speaking II, V. Sasikumar, P.Kiranmani Dutt and Geeta Rajeevan, Cambridge University Press.

3. English for Science and Technology, Thiruvengataswami and Kiranmani Dutt, Cambridge University Press.

### **ME 307 MECHANICS OF MATERIALS LAB**

**Teaching Scheme : 02 P = Total 02**

**Credit : 01**

**Evaluation Scheme : 25 Internal + 25 External = 50 Total**

**Total Marks: 100**

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#### **List of the Experiments**

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Buckling of columns.
10. Deflection of springs

### **ME 308 -MATERIAL SCIENCE AND ENGINEERING LAB**

**Teaching Scheme : 02 P = Total 02**

**Credit: 01**

**Evaluation Scheme : 50 Internal**

**Total Marks: 50**

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#### **List of Experiments:**

1. Study of metallurgical microscope.
2. Preparation of specimen for micro-examination.
3. Molding of specimen for micro-examination.
4. Study of microstructure of annealed and normalized steels.
5. To carry out hardening and tempering of steel.
6. To study Jominy end quench test for harden ability.
7. To study Rockwell hardness test.
8. To study microstructures of various cast irons.
9. To study microstructures of various non –ferrous metals and alloys.
10. To study impact test.
11. To study Brinell hardness test.

### **ME 309 FLUID MECHANICS LAB**

**Teaching Scheme : 2 P = Total 02**

**Credit: 01**

**Evaluation Scheme : 50 Internal**

**Total Marks: 50**

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#### **List of Experiments:**

At least NINE experiments may be performed.

1. Measurement of fluid pressure by manometer.
2. Determination of metacentric height.
3. Verification of Bernoulli's equation.
4. Flow measurement by venturimeter.
5. Determination of Reynolds number
6. Study of velocity distribution in Boundary layer and its thickness
7. Determination of co-efficient of friction for pipes.
8. Determination of head loss due to sudden enlargement.
9. Determination of head loss due to sudden contraction.
10. Determination of losses in bends and elbows.
11. Study of flow through pipes in series and parallel.

### **ME 310 - ELECTRICAL DRIVES AND CONTROL LAB**

**Teaching Scheme : 02 P Total 02**

**Credit: 01**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

#### **List of the Experiments**

1. To perform speed control of d. c. shunt motor.
2. Speed control of 3-phase induction motor by changing rotor resistance.
3. To perform load test on D.C. series motor.
4. Rheostatic speed braking of D.C. shunt motor.
5. To study single-phase induction motor.
6. To identify different parts and understand working of starters used for 3-phase I.M.
7. Study of D.C. motor starters.
8. To study different types of heating.
9. To study power mosfet.

### **ME 401 KINEMATICS OF MACHINES**

**Teaching Scheme : 04 L = Total 04**

**Credit : 04**

**Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Total Marks: 100**

**Duration of ESE: 2 hrs. 30 min**

**Basic Concepts:** Classification of mechanisms, Grashof's law, Class-I and Class-II mechanisms. Different four bar mechanisms, Inversions of single slider, double slider kinematics' chain, Grubler's criterion Kutrbach's theory.

**Kinematics Analysis of Mechanisms:** Displacement analysis, Transmission angle, coupler curve and their properties, radius of curvature of coupler curves, body and space centriods. Velocity analysis: Relative Velocity method, instantaneous center of rotation method, transmission ratio. Acceleration analysis: Relative acceleration method, Coriolis component of acceleration, analytical method for slider crank mechanism, Klein's construction for slider crank mechanism and four bar mechanism.

**Synthesis of Mechanism:** Introduction to type, Number and dimensional synthesis, graphical method of two positions, three position and four position, synthesis for Input output co-ordination. Overlay's method, Freudentein's equation.

**Friction:** Friction angle, friction circles and friction axis. Pivot and collar bearings. Brakes, clutches, types, constructional details, operation and calculation of leading dimensions.

**Special Purpose Mechanisms:** Straight-line mechanism, steering mechanism, quick return, and toggle mechanism.

**Cams:** Introduction, types of cam and follower, different motions of followers, graphical layout of cam profiles, pressure angle, cam with specified contours.

**Gear:** Introduction terminology, gear tooth profiles, interference, spur, helical gears, spiral gears, and its efficiency, bevel and worm gears.

**Gear Trains:** Types of gear trains, speed ratio, applications.

### **BOOKS RECOMMENDED:**

#### **Text Books:**

1. Theory of Machines and Mechanisms, P.L. Ballaney, Khanna Publishers Delhi, 3<sup>rd</sup> Edition, 2000.
2. Theory of Machines, S.S. Rattan, Tata Mc-Graw Hill Company, New Delhi, 2<sup>nd</sup> Edition, 2005.

#### **Reference Books:**

1. The Theory of Machines, Thomas Baven, CBS Publishers and Distributors, 3<sup>rd</sup> Edition, 2000.
2. Theory of Machines and Mechanisms, Joseph Edward Shigley and Johan Joseph Uicker Jr., McGraw-Hill, Inc.- 2<sup>nd</sup> Editions, 1995.

### **ME 402-ENGINEERING MATHEMATICS-III**

**Teaching Scheme : 04 L + 01 T Total 05**

**Credit : 05**

**Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Total Marks :100**

**Duration of ESE: 2 hrs. 30 min**

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**Ordinary Differential Equations:** Linear differential equations with constant coefficients, Complete solution, Complementary function, Particular integral, Rules to find Particular integral, Variations of parameters methods, Cauchy's homogeneous and Legendre's linear differential equations.

**Laplace Transform:** Definition, standard forms, Properties of Laplace transform, Inverse Laplace transform, Convolution theorem, Laplace transform of impulse function, Laplace transform of periodic function, Unit step function, Solution of Linear differential equations with constant coefficients by laplace transform techniques.

**Vector Calculus:** Scalar and vector point function, Differentiation of vectors, curves in space, Gradient of Scalar point function, Divergence and curl of vectors and their physical meaning, Expansion formulae (without proof), Line, surface, volume integrals, irrotational and solenoidal vector fields,

**Complex Variables:** Analytic function, Cauchy-Riemann equations, Harmonic Conjugate, Milne's methods, conformal mapping, mapping by elementary functions, bilinear transformations,

**Partial Differential Equations:** PDE of first order and first degree of types i)  $f(p, q) = 0$ , ii)  $f(p, q, z) = 0$ , iii)  $f(p, q, y, z) = 0$ , iv)  $f(p, q, y) = 0$ , v) Lagrange's form  $Pp + Qq = R$ , Clairaut's form  $z = p + qy + f(p, q)$ .

**Numerical Methods:**

i) Solution of system of linear equations by Crout's method, Gauss Elimination method, Gauss Jordan method, Gauss Siedal method.

ii) Numerical solution of ordinary differential equations: Picard's method, Taylor's series method, modified Euler's methods, Runge-Kutta method, Milne's Predictor-Corrector method.

**BOOKS RECOMMENDED:**

**Text Books:**

1. Text book on Applied Engineering Mathematics, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
2. Higher Engineering Mathematics, B.S Grewal, Himalaya Publishing House.

**Reference Books:**

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley.
2. Engineering Mathematics, Bali, Gupta, Mahalaxmi Publications.
3. Advanced Engineering Mathematics, H.K. Dass, S. Chand and Sons.

**ME403 THERMAL ENGINEERING**

**Teaching Scheme : 04 L + 00 T Total 04**

**Credit : 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Total Marks :100**

**Duration of ESE: 2 hrs. 30 min**

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Flow diagram for steam power plant with basic units such as steam generator, turbine, condenser and pump. Boilers Classification; working of Babcock Wilcox water tube and Horizontal return tube fire tube boilers. Boiler mountings and Accessories. H.P.Boilers; Loeffler, Benson, La-Mont Boilers, Principle of fluidized bed combustion. Boiler performance- Boiler rating, boiler power, equivalent evaporation, efficiency. Effect of accessories on boiler efficiency and heat balance.

**Fuel and Ash Handling:** Elementary treatment on coal, coal transportation from mine to site and site to boiler house. Fuel bed firing and suspension firing, Equipments of Mechanical grate firing, pulverized coal firing including crushers and pulverizes and burners. Oil handling system, and burner equipment, Elementary treatment on ash handling. Type of dust collectors and disposal of dust. Analysis of flue gas. Steam power plant: General features, representation of Rankin cycle on phase diagrams. Layout, site selection, concept of co-generation.

**Condensers:** Need, Types of condensers, quantity of cooling water required. Dalton's law of partial pressure, condenser and vacuum efficiency. Sources of air in condensers and its



effect on performance. Condensate pump and air extraction pumps, air ejectors Cooling water system: cooling ponds, spray tanks, cooling towers: Natural and mechanical wet type cooling tower.

**Steam nozzles:** Flow of steam through nozzles and diffusers, Maximum discharge, critical pressure ratio, Effect of friction. Determination of throat and exit areas, Nozzle efficiency, no numerical on concept of super saturated flow and Wilson line

**Steam Turbines:** Principle of working, Types of steam turbines such as impulse, reaction, axial and radial flow, back pressure and condensing turbines. Compounding. Reheat, regenerative cycles, bleeding. Analysis limited to two stages only. Velocity diagrams. Graphical and analytical methods for work and power developed, axial thrust and efficiency. Governing of steam turbines.

**Nuclear Power:** Fusion, fission, Chain reaction, conversion and breeding in nuclear fission, components of reactor, coolants, moderators etc.  
Different type of reactors such as boiling water, pressurized water, gas cooled, liquidized metal cooled thermal reactors.

### **Text Books**

- 1 Basic and Applied Thermodynamics, P.K. Nag, Tata Mc-Graw Hill Pub., 2/e, 2002.
2. Power Plant Engineering, P.K. Nag, Tata Mc-Graw Hill Publishing 2/e 2002.

### **Reference Books:**

- 1 Principal of Thermodynamics, J. H. Hsieh Tata Mc-Graw Hill 1999.
- 2 Advanced Engineering Thermodynamics, R. W. Benson, Pergamon Press London 2000
- 3 Thermodynamics-An Engineering Approach, Y. A. Cengel, Tata Mc-Graw Hill 1999
4. Applied Thermodynamics, Onkar Singh, New Age International Publishing, 2003.
5. Thermal Power Engineering, R.K. Rajput, Laxmi Publication, 2005.

## **ME404 MANUFACTURING PROCESSES**

**Teaching Scheme : 04 L + 00 T Total 04**

**Credit : 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Total Marks: 100**

**Duration of ESE: 2 hrs. 30 min**

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**Pattern Making and Mould Design:** Introduction to basic manufacturing processes, Pattern materials, allowances, Types of patterns, Basic principle and Terminology of sand casting, gating system, types of gate, Risers design, Riser aids, Directional and Progressive solidification. Analytical approach to riser design, General properties of moulding sands, testing of moulding sand, Mold hardness. Preparation of sand moulds of different types, Moulding processes, core making.

**Technology of melting and special casting methods:** Melting furnaces pit, open hearth, gas fired cupola and electric hearth furnaces, cupola operation development in cupola melting, Electric furnaces - Direct Arc, Indirect arc and electric induction furnace. Modernization and Mechanization of Foundries, permanent mold casting, slush casting, shell molding, Investment or lost wax casting, vacuum process, centrifugal casting,

continuous casting, Die casting equipments and processes for Gravity, pressure and vacuum casting methods.

**Defects, Inspection and testing of casting:** Origin and classification of defects, shaping faults, Inclusions and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors. Radiography, ultrasonic, Eddy current testing, fluorescent penetrate test.

**Mechanical working of metals:** Principle of Hot and cold working processes, Different types of hot and cold working processes, e.g. Rolling, types of rolling forging operations, extrusion, piercing, pipe and tube production, manufacture of seamless pipe and tubing. Spinning, embossing and coining, squeezing and bending operations, rotary swaging

**Processing of plastics:** Compression, Transfer, Injection, Extrusion. Blow moulding, Rotational moulding and calendaring.

**Joining processes:** Introduction to riveting, soldering, brazing and welding. Gas welding, working principle and its application, Arc welding: arc initiation, arc maintenance, and arc control, transfer of metal across the gap, Electrode efficiency, Types and purpose of Electrodes, TIG welding: working principle and its application, MIG- welding: working principle and its application. SAW - welding: working principle and its application, Resistance welding: - Working principle and its applications

**Other welding processes:** Working principle and applications of Friction Welding, Forge Welding, Plasma arc, and Thermit Welding. Ultrasonic, Electro slag, Electron Beam, laser welding.

**Welding defects, Testing and Inspection of welds:** Various welding defects, weld testing methods. Weld ability. Welding symbols.

**Surface Treatment:** Electroplating, electroforming, and anodizing, metal spraying, shot penning, polishing, mechanical cleaning.

### **Books Recommended:**

#### **Text Books:**

1. Workshop Technology-I, B. S. Raghuwanshi, Dhanpat Rai and Sons 2001
2. Workshop Technology, Hajra Chaudhary, Dhanpat Rai and Sons 2001

#### **References Books:**

1. Processes and Materials of Manufacture By R A LindBerg PHI Pub 2001
2. Workshop Technology, O. P. Khanna Dhanpat Rai and Sons-2001.
3. Manufacturing Process-II H. S. Bawa, Tata Mc Graw hill Publishing Co. Ltd.2004
4. Production Technology, Jain. R. K., Khanna Publications 2000

## **ME 405 MACHINE DRAWING**

**Teaching Scheme : 04 L + 00 T Total 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE**

**Duration of ESE: 3 hrs.**

**Credit : 04**

**Total Marks :100**

**Sectional views:** Conversion of pictorial view into sectional orthographic projections, sectional views with different types of sections, missing views.

**Development of Surfaces:** Development of surface of cubes, prisms, cylinders, pyramids, cones etc.

**Intersection of Surfaces:** Interpenetration of solids, prism and prism, cylinder and cylinder, cylinder and prism, cone and cylinder, cone and prism.

**Latest ISI Conventions:** Conventions covering the standard practice in machine drawing. Conventions for various components like bearing, gears, springs, key and key ways, threads, tap holes and materials.

**Symbolic Representations:** Working drawing for welded joints, Use of specifications for limits, fits and tolerances, Conventions used for surface roughness i.e. machining symbols, M/c allowance symbols. Constructional details and working of various machine elements such as,

1. Rivets and Riveted joints.
2. Keys, Cotter and cotter joints, knuckle joints and couplings.
3. Bearing and bearing mountings.
4. Engine and machine tool components.

**Assembly Drawing:** Preparation of detailed and assembly drawing of simple machine assemblies, like pedestal bearing, Plummer block, simple eccentric, stuffing box, cross head, connecting rod, tail stock, tool post, c-clamp, screw jack, boiler safety valve etc.

Introduction to CAD drawing.

**Text Books:**

1. Machine Drawing, N. D. Bhatt, Charotar Pulisher, 2003, 38<sup>th</sup> Edition.
2. Machine Drawing R.K.Dhawan S.Chand and Co., 2005.

**Reference Books:**

1. Machine Drawing N. Sidheshwar, Shastry, Kanhaiah. Tata Mcgraw Hill 2005
2. Machine Drawing Narayanan. K. L, Reddy KV, New Age International Publisher 2004, 2<sup>nd</sup> Edition
3. Computer Graphics and Design P. Radhakrishnan – Dhanpat Rai and Sons.
4. Using AUTOCAD James E Fuller - Denmark Publishing Co.
5. Machine Drawing, P. J. Shah, Shah Publishers, 1997, 3<sup>rd</sup> Edition.

**ME 406 GENERAL PROFICIENCY-II**

**Teaching Scheme : 02 P Total 02**  
**Evaluation Scheme : 50 Internal**

**Credit : 02**  
**Total Marks: 50**

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**Planning:** Nature, importance, functions, types of plans, strategic decision making, types of decisions, business forecasting, types and techniques of forecasting. Case study of different forecasting techniques

**Leadership and Organizational Structure :** Characteristic, styles, types, qualities of leadership, Case study of Leadership styles and organizational structures in different organizations

**Human Resources Management:** Human resources planning, recruitment, selection, training and development, motivation, employee welfare, safety and health, trade unions and industrial relations. Case study of HRM in government and non-government organizations

**Negotiation:** Concept, types, Different types of MoU agreements and different contents. Case study of MoU agreement between 2 agencies / organizations

**R and D Projects :-** Different types of research projects and funding agencies, their eligibility criteria, different types of formats. Case study of different funding agencies and different types of research projects funding

**Finance Management in Industries:-** Different types of financing institutions and their funding agencies, financial management, Case study of financing procedures and schemes for SSI / SMEs

### **Books Recommended:**

#### **Text Books**

1. Dynamics of Personnel Management in India, R D Agrawal, Tata McGraw Hill Pub Co, New Delhi, 2005.
2. Personnel Management: Edwin B Flippo : McGraw Hill International Edition, New Delhi, 2003.
3. The Spirit of Leadership: Harrison Owen: Tata McGraw Hill Pub. Co, New Delhi 2005.

#### **Websites:**

1. [www.aicte.ernet.in](http://www.aicte.ernet.in)
2. [www.ugc.ac.in](http://www.ugc.ac.in)
3. [www.dst.gov.in](http://www.dst.gov.in)
4. [www.isro.org](http://www.isro.org)
5. [www.vichar.nic.in](http://www.vichar.nic.in)

### **ME 407 KINEMATICS OF MACHINES LAB**

**Teaching Scheme : 02 P Total 02**

**Credit: 01**

**Evaluation Scheme : 50 Internal**

**Total Marks: 50**

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### **List of Experiments:**

1. To draw inversions of four bar kinematics chain locating end points and explain working of mechanisms.
2. To draw inversions of single slider crank chain, locating points and explain working of mechanisms.
3. To draw inversions of double slider cranks Kinematic chain locating end points and explains working of mechanisms.

4. To determine relative velocity of given links in mechanisms by relative velocity method or instantaneous center of rotation.
5. To determine relative acceleration of links in mechanisms by relative acceleration method.
6. To layout profile of cam graphically for given follower with its specified motion.
7. Mini Project on Clutch, Brake, and Dynamometers- It is required to select these contrivances from working system. With suitable sketch explain working of system.
8. Gear trains –case study.

### **ME 408 MANUFACTURING PROCESSES LAB**

**Teaching Scheme : 04 P Total 04**

**Credit: 02**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

#### **List of Experiments:**

1. Pattern making: study of different patterns and pattern making tools. Preparation of pattern.
2. Sand preparation and testing, Preparation of moulds
3. Joining Processes: Preparation of composite jobs with the help of electric welding, gas welding and arc welding.

A journal should be prepared and submitted on above term work. The practical examination shall consist of a job preparation and college assessment should be based upon the jobs, term work and viva examination

### **ME 409 COMPUTER AIDED DRAFTING LAB**

**Teaching Scheme : 02 P Total 02**

**Credit: 01**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

#### **List of Drawings:**

##### **PART A**

Sheets and sketchbook

1. Sectional views of objects
2. Development of surfaces.
3. Intersection of solids.

##### **PART B**

Drawing of following machine elements using AUTOCAD/SOLIDWORKS (at least four)

1. Cotter Joint
2. Knuckle Joint
3. Flange Coupling
4. Wall Bracket
5. Plummer block
6. Stuffing Box
7. Tool Post