SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
Mechanical Engineering

Structure of S.E. (Mechanical Engineering) w.e.f. from2013-14

Semester-I

Sr. No.	Subject	Teaching / Week					Examination Scheme				
		L	T	P	Dr	Total	TP	TW	OE	POE	Total
1	Analysis of Mechanical Elements	3	1			4	100	25			125
2	Applied Thermodynamics	3		2		5	100	25	25		150
3	Engineering Mathematics-III	3	1			4	100	25			125
4	Machine Tools and Processes	3		2		5	100	25			125
5	Machine Drawing	3			4	7	100	50			150
6	Computer Programming in C++	1		2		3		25		50	75
7	Workshop Practice- II			2		2		25		#25	50
Total		**16**	**2**	**8**	**4**	**30**	**500**	**200**	**25**	**75**	**800**
8	Environmental Science	1				1					

Semester-II

Sr. No.	Subject	Teaching / Week					Examination Scheme				
		L	T	P	Dr	Total	TP	TW	OE	POE	Total
1	Theory of Machine – I	3		2		5	100	25			125
2	Manufacturing Processes	3		2		5	100	25			125
3	Fluid Mechanics	3		2		5	100	25	25		150
4	Numerical Methods	3		2		5	100	25			125
5	Electrical and Electronics Technology	3		2		5	100	25			125
6	Computer Aided Machine Drawing	1		2		3		50		50	100
7	Workshop Practice – III			2		2		50			50
Total		**16**		**14**		**30**	**500**	**225**	**25**	**50**	**800**
8	Environmental Science	1				1					

'#' indicates practical examination only

Notes:

1. The Practical batch shall be of 20 students. After formation of batches, if the number of students remaining is more than 9, a new batch shall be formed.
2. Practical / Tutorial load indicates the load per batch.
3. TW: Term work assessment shall be a continuous process based on the performance of student in assignment, class test, quizzes, homework, interaction during theory and laboratory session, hand written lab book/ hand written journal, sheet drawing, subject seminar presentation etc. as applicable.
4. Industrial Training (B.E. Part 1) of minimum 30 days in one/two slot shall be completed in any vacation after SE Part-II but before BE Part-I & the report shall be submitted in BE Part-I.
5. For the subject '**Electrical and Electronics Technology'**, answer to the two sections must be written in separate answer books.

S.E.Mechanical Part-I

2. APPLIED THERMODYNAMICS

Teaching Scheme
Theory: 3 Hrs/week
Practical: 2 Hr/week

Examination Scheme
Theory: 100 Marks (3 Hrs.)
Term Work: 25 Marks
Oral Exam: 25 Marks

Course Objectives:

1. To study fundamental laws of Thermodynamics and its real life applications.
2. To study and analyze power producing devices used in practice such as boilers and turbines.
3. To study Power consuming devices used in practice such as compressor and their analysis.

Course Outcomes:

At the end of this course, the student will be able to

1. apply fundamental concepts of Thermodynamics to solve real life problems.
2. identify problems & analyse power producing and consuming devices.

Section-I

Unit 1: First Law of Thermodynamics – Analysis **(04Hrs)**

Review of basic concepts

Applications of throttling process:

1. Throttling calorimeter 2. Refrigeration 3. Liquefaction of gases.

Transient flow processes:

1. Charging of a cylinder 2. Discharging of a cylinder.

Chemically reacting system:

1. Fuels & combustion
2. The standard enthalpy (heat) of reaction, the standard enthalpy of formation.
3. Standard enthalpy of combustion.
4. Effect of temperature on standard heat of reaction.
5. Adiabatic flame temperature.

(Numerical treatment)

Unit 2: Second Law of Thermodynamics – Analysis. **(06 Hrs)**

Limitation of first law of thermodynamics, cycle heat engine, refrigerator and heat pump, Kelvin- Plank and Clausius statements and their equivalence, Reversibility and Irreversibility, Carnot cycle, Carnot theorem, Absolute thermodynamic temperature scale, Clausius inequality, calculation of entropy change for:

i) Absorption of energy by a constant temperature bath
ii) Heating OR cooling of matter.
iii) Phase change
iv) Adiabatic mixing
v) Change of state of an ideal gas.
vi) Mixing of non – identical gases.

Principle of entropy increase, T – S diagram, Second law analysis of a control volume, available energy, availability.

(Numerical treatment)

Unit 3: Performance of Boilers **(05 Hrs)**

Classification, constructional details of high pressure boilers, Evaporation,equivalent evaporation, Boiler efficiency, heat losses in boiler plant & heat balance
(Numerical treatment)

Unit 4: Vapour Power Cycles: **(05 Hrs)**

Classification of cycles, vapour power cycles, carnot vapour power cycles, simple Rankine cycle, actual Rankine cycle, Effect of operating conditions on Rankine cycle efficiency, Ideal reheat cycle, Ideal regenerative cycle, supercritical Rankine cycle (Numerical treatment).

Section-II

Unit 5: Steam Nozzles **(05 Hrs)**

Types of Nozzles, flow of steam through nozzles, condition for maximum discharge, expansion of steam considering friction, super saturated flow through nozzles, General relationship between area, velocity and pressure.

Unit 6: Steam Condensers **(05 Hrs)**

Condensers and Cooling Towers:- Elements of steam condensing plants, advantages of using condensers, types of condensers, thermodynamic analysis of condensers, efficiencies, cooling towers.

Unit7:Steam Turbines **(05 Hrs)**

Steam Turbines:- Advantages and classification of steam turbines, simple impulse turbine, compounding of steam turbines, parson's reaction turbine, velocity diagrams, work one done and efficiencies, losses in turbines.

Unit 8: Reciprocating Air Compressors **(05 Hrs)**

Uses of compressed air, classification of compressor, constructional detail of single & multistage compressor, types of compressor valves, computation of work, isothermal work done, isothermal efficiency, effect of clearance, volumetric efficiency FAD, theoretical & actual indicator diagram, method of improving volumetric efficiency, need of multistage, work done, volumetric efficiency, condition for maximum efficiency, inter cooling & after cooling, (Numerical treatment).

TERM WORK

Group – I

Any Three Assignments on following topics

1) Study of process boilers (Cochran, Babcock & Wilcox, Lancashire)
2) Boiler mountings & accessories
3) Study of various types of steam calorimeters
4) Lubrication – Necessity, types of lubricants, properties of
Lubricants
(oil & Greases), Selection of lubricants

Group – II

Any Six Experiments of following:

1) Cloud & Pour point of a lubricant
2) Flash & Fire point
3) Test on carbon residue
4) Trial on Redwood viscometer
5) Trial / Study of Bomb calorimeter
6) Test on grease penetrometer & dropping point apparatus
7) Trial on reciprocating air compressor.
8) Trial on steam calorimeter
9) Industrial visit to any process / power industry

Text Books:

1. An introduction to Thermodynamics – Y.V.C. Rao – Universities Presss,
2. A Course in Thermal Engineering – Domukundwar Kothandraman Dhanpat Rai & Co. Delhi.
3. Thermal Engineering R . K. Rajput – Laxmit Publication – New Delhi (Sixth Edition)
4. Basic & Applied Thermodynamics" by P.K. Nag Tata Mcgraw Hill Publication

Reference Books:

1. Thermodynamics by C.P. Arora TMH New Delhi 1998 edition
2. Thermodynamics & Heat Engine – Vol 1 & Vol 2 – R. Yadav Central Book Depat.
3. Thermodynamics Cengel Boles Tata McGraw Hill New Delhi.
4. R. Yadav, Steam & Gas Turbines CPH Allahabad.

S.E.Mechanical Part-I

4. MACHINE TOOLS & PROCESSES

Teaching Scheme	Examination Scheme
Theory: 3 Hrs/week	**Theory:** 100 Marks (3 Hrs.)
Practical: 2 Hr/week	**Term Work:** 25 Marks

Course Objectives:

1. To study the conventional machining processes such as drilling, milling, shaping, planning carried out on typical machine tools for different applications.
2. To study unconventional machining processes such as EDM, ECM and USM carried out on special purpose machine tools for typical applications.
3. To compare and select a suitable manufacturing process.

Course Outcomes:

At the end of this course, the student will

1. exhibit a knowledge of conventional, unconventional & modern machining processes and machine tools.
2. be able to select proper manufacturing process for the typical application.

Section-I

UNIT – 1 Introduction to Manufacturing processes: **(02Hrs)**

- Classification of manufacturing processes.
- Metal removal processes, principle, cutting motions, basics of metal cutting

UNIT – 2A Centre lathe: **(06 Hrs)**

- Main parts and their functions, specifications, accessories and attachments.
- Lathe operations, processing of simple component on lathe.

UNIT – 2B Capstan and Turret lathes: **(04 Hrs)**

- Principle parts, working, comparison with center lathe
- Capstan lathe vs. Turret lathe, mechanisms, tool holders.
- Introduction to Automats

UNIT – 2C Drilling machine: **(03 Hrs)**

- Classification, construction and working of Pillar type and radial drilling machines.
- Job holding devices and accessories, various operations.

UNIT – 3 Shaper, Plainer and slotting machine: **(03 Hrs)**

- Principle, types, specifications, operations on shaper.
- Types of planers, standard double housing plainer, construction, and operations.
- Introduction to construction and working of slotting machine.

UNIT -4 Unconventional Machining **(04 Hrs)**

- Introduction, classification, significance of Unconventional machining.
- Electrical discharge machining (EDM), Electrochemical Machining (ECM), Ultrasonic machining (USM)
- Principle, working, applications, advantages, limitations.

Section-II

UNIT – 5A Milling machines: **(07Hrs)**

- Classification of Milling machines, construction and working column and knee type milling machines.
- Milling methods – Up milling and down milling,
- Gear cutting on milling machines, indexing methods.

UNIT – 5B Boring machine: **(02 Hrs)**

- Horizontal and vertical boring machines, construction and working.
- Boring tools and bars, Jig boring machines.

UNIT – 6 Grinding machines: **(04 Hrs)**

- Classifications – Cylindrical, Center less, Surface grinder etc.
- Selection mounting, glazing, loading, truing, balancing.

UNIT –7 Gear manufacturing processes: **(02 Hrs)**

- Gear Hobbing, gear rolling.
- Gear finishing processes – gear shaving, gear burnishing.

UNIT – 8A Broaching machine: **(02 Hrs)**

- Classification, various operations, advantages and limitations.
- Study of Pull and Push type broach.

UNIT – 8B Introduction to CNC machines: **(01 Hrs)**

- Construction and working of CNC machine tools, types.

TERM WORK

1. Setting the lathe machine for taper turning by swiveling compound rest.
2. Setting the lathe machine for taper turning by set over of tail stock and taper turning attachment.
3. Setting the lathe machine for thread cutting operation.
4. Tool layout and processing of one simple component on capstan lathe.
5. Study and demonstration of attachments on milling machine.
6. Study and demonstration of various types of milling cutters.
7. Setting the milling machine for gear cutting operation.
8. Setting the Hobbing machine for gear cutting operation.
9. Study and demonstration of various types of grinding wheels and their specifications
10. Visit to at least one machine shop and one CNC shop

Note: Any Eight of the above exercises are expected. Journal based on above exercises shall be prepared by the Students.

Text Books:

1. Workshop Technology (Volume II) by Hajra Chowdhary.
2. Workshop Technology (Volume II) by Raghuvanshi
3. Production Technology (Volume II) by Gupte-Patel.
4. Workshop Technology (Volume II) by W.A.J.Chapman.
5. Manufacturing Technology-P.N.Rao Vol. II

Reference Books

1. Machining and Machine tools-A.B.Chatopaddhyay – Wiley India
2. Production Technology by P.C.Sharma. Production Technology – HMT Handbook.
3. Manufacturing Process and System-Phillip Ostwald and Jairo Munoj-Wiley India
4. Production Technology – HMT Handbook

- Question paper shall cover all the topics mentioned under section I and section II, as well under the heading ***TERM WORK***.

S. E. (Mechanical) Part – I

7. WORKSHOP PRACTICE – II

Teaching Scheme:
Practical: 2 Hours / week

Examination Scheme:
Term Work: 25 marks
Practical Exam: 6 Hours

Course Objectives:

1. To get hands on experience of machining techniques such as grinding, drilling, shaping, turning etc. studied in theory subjects.
2. To develop skills to operate different machine tools.

Course Outcomes:

At the end of this course, the student will be able

1. to operate different machine tools such as grinders, lathes, drilling machines etc.
2. to machine the component as per specified dimensions.

1. Tool Grinding – Demonstration and actual grinding to understand the tool geometry **(02 turns)**

2. One composite job in M.S. consisting of 2 components and inclusive of following operation shall be performed by students:
   Turning, Step turning, taper turning, Chamfering, Grooving, and Threadcutting, Knurling, drilling, Boring.
   At least one dimension of the job shall carry close tolerance **(06 turns)**

3. Inspection of the job performed (by the student) **(01 turns)**

4. Preparation of process sheet for the above job **(02 turns)**

Note:

- Practical examination of 6 hours duration at the end of term.
- Students shall perform one composite job consisting of two pieces, having minimum
  six operations on lathe.
- Students shall prepare a work book involving brief write up regarding machine/machines employed for job, calculation related to taper turning, calculations related to change gear train required for threading shall be part of work book. Along with this work book shall contain drawing and process sheet of the job and inspection report of the job.
- Based on the job performed, attendance record, work book, internal viva, faculty members may evaluate the term work.

Books:

1. Workshop Technology (Volume II) by Raghuvanshi.
2. Workshop Technology (Volume II) by Hajra Chowdhary.
3. Workshop Technology (Volume II) by W.A.J.Chapman.
4. Production Technology by P.C.Sharma.
5. Production Technology – HMT Handbook.
6. Production Technology (Volume II) by Gupte-Patel.

S.E.Mechanical Part-II

2. MANUFACTURING PROCESSES

Teaching Scheme	Examination Scheme
Theory: 3 Hrs/week	**Theory:** 100 Marks (3 Hrs.)
Practical: 2 Hrs/week	**Term Work:** 25 Marks

Course Objectives:

1. To study the fundamentals of conventional manufacturing processes such as casting, forming and joining processes and their applications.
2. To develop the ability to select a process from the recent manufacturing practices.

Course Outcomes:

At the end of this course

1. The student will develop a sound knowledge & use the various manufacturing processes.
2. The student will have the ability to choose the appropriate processes for manufacturing a product.

Section-I

UNIT-1 Casting Processes: (06Hrs)

Basic steps in casting processes, Importance and uniqueness of casting as a manufacturing process, advantages and limitations of casting process. General introduction to patterns, Core boxes and Gating systems. Types of patterns, Cores, Core boxes, materials used, Allowances, selection criteria. Components of gating system, functions of each part, function of riser, types of risers, method to improve efficiency of risers.

UNIT- 2A Moulding and core making processes: (07Hrs)

Green Moulding sand, its ingredients and properties, facing sand, backing sand, shell sand, CO_2 sand, Oil sand cores, and core making, CO_2 core making, shell core making, cold box process of core making. Green sand moulding (hand and machine moulding), shell moulding, CO_2 process.

Introduction to special casting techniques, such as Investment casting, centrifugal casting, continuous casting, gravity and pressure die casting processes.

UNIT –2B Melting and pouring: (03 Hrs)

Melting furnaces used in C.I. foundries, i.e. Cupola, Induction furnace construction and working in brief, metallurgical control, Arc furnaces used in steel foundries, Crucible, oil and gas fired furnaces, Pouring equipments.

UNIT – 2C Fettling, Cleaning and Inspection of Castings: (01 Hrs)

Need for fettling, stages in fettling, equipments used in fettling and cleaning of castings. Common important defects in castings. Inspection procedure.

UNIT – 3 Computer applications in foundry processes, foundry Mechanization. (01 Hrs)

UNIT- 4 Processes for Plastics (03 Hrs)

Injection moulding, Extrusion, Blow moulding, Compression moulding (Preliminary treatment only)

Section-II

UNIT – 5A Introduction to forming process, classification of forming processes **(01Hrs)**

UNIT – 5B Rolling process: **(03 Hrs)**

Rolling mills, classification, hot rolling, rolling of billets, rods, sections, sheet, and tube rolling, cold rolling of sheets.

UNIT – 6 Forging processes: **(03 Hrs)**

Advantages of forging processes over other processes, basic forging equipments.
Open die forging, closed die forging, drop forging, cold heading etc.

UNIT – 7A Extrusion: **(02Hrs)**

Types – direct extrusion, indirect extrusion, impact extrusion, hydrostatic extrusion.

UNIT – 7B Wire rod and tube drawing: **(02 Hrs)**

Wire drawing process, single pass and multi pass wire drawing, wire drawing bench. Methods of rod and tube drawing.

UNIT – 8 Introduction to Joining processes: **(08 Hrs)**

Welding processes, such as gas welding, arc welding, submerged arc welding, TIG welding, MIG welding, resistance welding. Gas cutting, Plasma arc cutting etc. Brazing and soldering.

TERM WORK

1. Exercise on pattern and core box design, & drawing, for a simple component
   (Drawing on sheet expected)
2. Testing of silica sand for grain fineness and clay content.
3. Testing of green sand for green compression strength, permeability, moisture content.
4. Study of mould and core hardness tester.
5. Study of manufacturing sequence of any one forged product.
6. Study of manufacturing sequence of any one rolled product.
7. Visit to Foundry unit.
8. Visit to Forging shop

   (Journal based on above term work)

Text Books:

1. Heine, Lopar, Rosenthall, Principles of Metal Casting
2. N.D.Titov ,Foundry Practice
3. P.L.Jain, Principles of Foundry Technology
4. P.N.Rao, Manufacturing Technology: Foundry, Forming and Welding
5. Production Technology by P.C.Sharma

Reference Books:

1. Manufacturing Processes and systems by Phillip F.Ostwald, Jairo Munoz –Wiley India
2. Fundamentals of modern Manufacturing by Mikel P.Groover-Wiley India

- Question paper shall cover all the topics mentioned under section I and section II, as well under the heading ***TERM WORK***.

S. E. (Mechanical) Part – II

7. WORKSHOP PRACTICE – III

Teaching Scheme:
Practical: 2 Hours / week

Examination Scheme:
Term Work: 50 marks

Course Objectives:

1. To get hands on experience in pattern making, joining processes and forming processes.
2. To develop skills in pattern making and sheet metal work

Course Outcomes:

At the end of this course, the student will be able

1. To develop the skills necessary for engineering practices like joining and forming processes.
2. To Choose and apply the appropriate methods for pattern making & sheet metal working.

1) Preparation of Wooden pattern (single piece) for a simple component:

Part A –
This shall cover –
Study of component drawing, preparing casting drawing, Allowance table, Pattern drawing, Deciding parting line & Deciding pattern making process.

Part B –
Actual manufacturing of pattern **(4 Turns)**

2) Study of gas welding & gas cutting equipments, Study of arc welding equipment, Study & demonstration of resistance welding, Study of various types of welding joints & demonstration of gas & arc welding,
Manufacturing of one job each of gas and arc welding **(4 Turns)**

3) Study of sheet metal operations like bending, shearing, lancing, perforating, punching etc...
One sheet metal job consisting of at least 3 operations. **(3 Turns)**
(Either performed manually or on press)

Demonstration:

4) Study of various hand forging operations like upsetting, drawing dawn, piercing, swaging etc…One job involving 3 operations. (Either performed manually or on press) **(4 Turns)**

5) Students should prepare a work book involves a process sheet for each job.

Text Books:

1. Heine, Lopar, Rosenthall, Principles of Metal Casting
2. N.D.Titov ,Foundry Practice
3. P.L.Jain, Principles of Foundry Technology
4. P.N.Rao, Manufacturing Technology: Foundry, Forming and Welding
5. Workshop Technology (Volume II) by W.A.J.Chapman.
6. Production Technology – HMT Handbook.

Reference Books:

1. Manufacturing Processes & systems by Phillip F.Ostwald, Jairo Munoz –Wiley India
2. Fundamentals of modern Manufacturing by Mikel P.Groover-Wiley India

SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF ENGINEERING & TECHNOLOGY

Mechanical Engineering

Structure of T.E. (Mechanical Engineering) w.e.f. from2014-15

Semester-I

Sr.No.	Subject	Teaching / Week					Examination Scheme				
		L	T	P	Dr	Total	TP	TW	OE	POE	Total
1	Theory of Machine –II	3		2		5	100	25	25		150
2	Heat and Mass Transfer	3		2		5	100	25		25	150
3	Metallurgy	3		2		5	100	25	25		150
4	Machine Design – I	3		2		5	100	25			125
5	Professional Elective - I	3		2		5	100	25			125
6	Advanced Computer Programming-I	1		2		3		25			25
7	Workshop Practice – IV			2		2		25			25
8	Self Learning (HSS)						50				50
Total		**16**		**14**		**30**	**550**	**175**	**50**	**25**	**800**

Professional Elective I	Machine Tool Design	Fluid Machinery and Fluid Power	Material Handling Systems

Semester-II

Sr.No.	Subject	Teaching / Week					Examination Scheme				
		L	T	P	Dr	Total	TP	TW	OE	POE	Total
1	Metrology and Mechanical Measurements	3		2		5	100	25			125
2	Internal Combustion Engine	3		2		5	100	25			125
3	CAD/CAM	3		2		5	100	25			125
4	Machine Design – II	3		2		5	100*	25	25		150
5	Professional Elective –II	3		2		5	100	25			125
6	Advanced Computing Techniques-II	1		2		3		25			25
7	Workshop Practice- V			2		2		25		#50	75
8	Self Learning (Technical)							50			50
Total		**16**		**14**		**30**	**500**	**225**	**25**	**50**	**800**

'#' indicates practical examination only

'*' indicates Open Book theory Examination

Professional Elective II	1)Experimental Stress Analysis	2)Power Plant and Energy Engineering	3)Tool Engineering	4) Mecanical Vibration

Note –

- The Practical batch shall be of 15 students. After formation of batches, if the number of students remaining is more than 7 a new batch shall be formed.
- Syllabus of Self learning (H.S.S.) is common for all Under Graduate Programs under Faculty of Engineering and Technology.
- Practical / Tutorial load indicates the load per batch.
- TW: Term work assessment shall be a continuous process based on the performance of student in assignment, class test, quizzes, homework, interaction during theory and laboratory session, hand written lab book/ hand written journal, sheet drawing, subject seminar presentation etc. as applicable.
- Industrial Training (B.E. Part 1) of minimum 30 days in one/two slot shall be completed in any vacation after SE Part-II but before BE Part-I & the report shall be submitted in BE Part-I.
- Electives -: To offer a particular subject as an Elective, minimum 15 students shall opt for the same. Appropriate Electives Subjects may be added when required.
- For the subject Advanced Computing Techniques-I and Advanced Computing Techniques-II any one subject given with syllabus is to be selected by the student.

T.E. –Mechanical - Part-I
Professional Elective -I
5.2 FLUID MACHINERY & FLUID POWER

Teaching Scheme	Examination Scheme
Lectures : 3 Hrs/Week	**Theory : 100 Marks**
Practicals : 2 Hrs/Week	**Term Work: 25 Marks**

Course objectives:

1.To study different types of water turbines, Gas turbines and Pumps, in all details..

2.To construct velocity triangles for turbines and pumps.

3.To learn the fundamentals and applications of fluid power technology, besides construction & working of different components.

4.To design various types of hydraulic & pneumatic circuits & their applications.

Course outcomes:

At the end of this course, the student will be able to

1.Classify turbines and pumps. Select/design water turbines, gas turbines & centrifugal pumps to meet the specific requirements.

2.Draw velocity triangles for turbines and pumps.

3.Analyse different components of hydraulic and pneumatic systems.

4.Prepare different hydraulic & pneumatic circuits needed for different applications.

SECTION -I

1.Impulse Water Turbines : **(05)**

Euler's equation for rotodynamic machines, Classification of water turbines, Pelton wheel, Work done and efficiencies of Pelton wheel, Working proportions of Pelton wheel, Design of pelton Turbine runner, Governing of Pelton turbine, Performance characteristics of Pelton turbine .(Numerical Treatment)

2.Reaction Water Turbine: **(05)**

Construction and Working of Francis, Kaplan turbine. Work done and efficiencies of Francis & Kaplan turbine, Working Proportions of Francis & Kaplan turbine, Specific speed of turbine (Pelton, Francis & Kaplan turbine), Model testing, unit quantities, Prediction of performance at other operating conditions, Draft tube (Theoretical treatment only), Types and function, Governing of reaction turbines, Performance characteristics of Francis & Kaplan turbine. (Numerical Treatment).

3.Centrifugal Pumps: **(05)**

Working principle, construction, types, various Heads, multistage pumps, Velocity triangles, Minimum starting speed, Cavitation, Maximum Suction Height & Net Positive Suction Head, Methods of priming, Calculations of efficiencies, Discharge, blade angles, Heads, Power required, impeller dimensions, specific speed of pumps, Performance characteristics of pumps. (Numerical Treatment)

4. Gas Turbines: **(05)**

General aspects, Classification of gas turbines, merits of gas turbines, constant pressure combustion gas turbines-open cycle gas turbine, methods for improvement of thermal efficiency of open cycle gas turbine plant-intercooling, reheating, regeneration, effect of operating variables on thermal efficiency, closed cycle gas turbine, uses of gas turbine, gas turbine fuels. (Numerical Treatment on basic Joule Cycle)

SECTION – II

1. Introduction to Fluid Power and Hydraulic System elements : **(05)**

Types, advantages, applications of fluid power, Pumps- Types, working, Characteristics, Applications. Seals & Packing- Types, materials, Applications. Hydraulic Actuators- Linear & Rotary, Types, Working, Cushioning effects, Calculation of force & velocity of piston. System components: Accumulators, Intensifiers, their types, working, applications. Symbols used in hydraulic and pneumatic circuits.

6. Pneumatic System Elements : **(05)**

Piping, materials and pressure ratings, piping layout, air compressors, types, working, selection criteria, FRL unit, construction and working, pneumatic cylinders and air motors, construction and working, types.

7.Hydraulic and Pneumatic Control Elements : **(05)**

Hydraulic - Pressure control valves- Direct acting type, pilot operated, sequence, counter balancing , unloading, pressure reducing, Construction & Working. Direction control valves- Types, construction & working, Spool actuation methods, spool centre positions, Flow control valves- Compensated & Non-

Compensated, Construction & Working. Pneumatic -Direction control valves, Flow control valves and pressure control valves–types and working.

8. Hydraulic and Pneumatic Circuits & their applications : (05)

Speed control circuits, Regenerative, Sequencing, Counter balancing, Synchronizing, Traverse & Feed circuit, Hydraulic and pneumatic clamping & braking systems, Pneumatic power tools, time delay circuits

Term-Work

Compulsory:

1. A drawing sheet on standard symbols of hydraulic & pneumatic components.

List of Experiments

A) Fluid Machinery-

Minimum 3 experiments from the following

2. Trial on a Pelton wheel.
3. Trial on a Francis/ Kaplan turbine.
4. Trial on a centrifugal pump.
5. Trial on gear pump

B) Fluid Power

Minimum 3 assignments from the following

6. Study of Pressure Control Valves & circuits using pressure control valves
7. Study of flow control valves & circuits using flow control valves
8. Study of direction control valves & check valves circuits.
9. Study of hydraulic power unit & accessories.
10. Demonstration of Minimum of Three hydraulic circuits such as :Basic hydraulic, Regenerative, Speed control(Meter in, meter out & bleed off), Sequencing, Synchronization, traverse & feed, circuit for riveting machine, automatic reciprocating, fail safe circuit, counter balance circuit, actuator locking, circuit for hydraulic press, unloading circuit, motor breaking circuit.

11. Demonstration on Pneumatic Trainer of Minimum of Three Pneumatic circuits (based on syllabus of UNIT 10 above).

C) Industrial visit to one of the following.

- Hydro-electric power station
- Pumping station
- Service station of Earth Moving equipment's.

Note: Students should write visit report based on the observations made during the visit.

Text Books

1. "A text book of Fluid Mechanics & Hydraulic Machines", Dr.R.K. Bansal, Laxmi Publications Ltd.
2. Thermal Engineering R.K. Rajput
3. "Oil Hydraulics- Principle & Maintenance", Majumadar, Tata McGraw Hill
4. "Pneumatics- Principle & Maintenance", Majumadar, Tata McGraw Hill

Reference Books

1. Theory of Hydraulic Machinary", V.P. Vasandani, Khanna Publishers, Delhi.
2. "Hydraulic Machines", Dr. J. Lal, Metropolitan Book Co. Pvt. Ltd., Delhi.
3. Vickers Manual on Industrial Hydraulics
4. Festo's Manual on Pneumatic Principle, applications
5. "ABC's of Hydraulic Circuits", H L Stewart, (Taraporwala Press)
6. "ABC's of Pneumatic Circuits", H L Stewart, (Taraporwala Press)
7. Hydraulics and Pneumatics'H.L.Stewart –, Industrial Press

Color, font, image, open, save dialogs, creating an application menu, adding and controlling forms, playing multimedia.

6.Scripting: **(02)**

VBA macros create word and excel macros, advanced macros, VB script, writing script for internet explorer, scripting activeX objects, dynamic scripts.

7.String Processing: **(02)**

Reading text files, Streaming lines of text, reading spreadsheets, reading XML files, creating XML dataset, RSS feed, XML attributes.

8.Database Programming: **(02)**

Database in excel, designing a database, creating a database, defining tables, table relationships, creating a dataset, data controls, build SQL queries.

Termwork:

The term work is based on the following list of Computing Assignments.

Assignment on VB controls and events.

1) Programming exercises on Variables and parameters.
2) Programming exercises on branching and looping
3) Assignment on object methods and function procedures. .
4) Programming exercises on Arrays.
5) Assignment on multimedia.
6) Programming exercises on VBA macros and scripting.
7) Programming exercises on string processing
8) Assignment on database.
9) Assignment on object oriented programming.

Text Books:

1. Introduction to Programming using Visual Basic
   -David Schneider (Pearson Education System)
2. Microsoft Visual Basic 2010 Step by Step
   -Michael Halvorson (Microsoft Press)
3. Visual Basic 6: The Complete Reference
   -Noel Jerke (MGH)

Reference Books:

1. Visual Basic -Mike McGrath (TMH)
2. Visual Basic 2010 in Simple Steps -Kogent Learning Solutions (Dreamtech Press)

T.E. –Mechanical - Part-I

7. 0 Workshop Practice – IV (T.E. Part - I)

Teaching Scheme
Practical: 2hrs/week

Examination Scheme
Term- Work – 25 Marks

==========

Course Objective:

i) To make the students aware with various skills involved in manufacturing &Assembly.

ii) To develop skills to operate different machine tools.

iii) To make the students aware of limits, fits & tolerance while manufacturing assembly.

iv) To make students aware of operation sequence, speed feed selection for different materials & operations

Course Outcomes:

i) To create confidence amongst the students in Production / manufacturing activities.

ii) Students should get experience about manual skills required to perform machining operations.

iii) To create confidence in students while designing limits, fits & tolerances during manufacturing.

iv) To create awareness in students regarding time management, work study, method study & tool engineering

---

1. A composite job consisting of three components machined from **Φ32 mm MS bar**.
(Excluding commercial components)requiring minimum five operations listed below:

1.Turning
2.Drilling
3.Boring
4.Hand tapping
5.Milling
6.Internal & External V-threading
7.Grinding

2. The components of the composite job shall carry at least two specified close tolerance operations.In addition to the above, following operations are to be demonstrated during the term. (These are not to be included in the job operations for term work & exams.)

1.Shaping

2.Slotting

3.Grinding

4.Form Turning

5.Knurling

6. Grooving

4. Journal should contain detailed process sheet of above job.

5. Assessment of Workshop Practice-IV-Term work shall be done for 50 % Work or one majorComponent & Workshop Practice-V-Term work shall be done for remaining work at the end of T.E. (Mech.) Part II.

6.Practical examination of 6 Hrs. duration having component of 2 to 3 parts.

Note: Material specification for practical work & examination is raw material **Φ32mm MS bar**.

Books:

1. Workshop Technology (Volume II) by Raghuvanshi.

2. Workshop Technology (Volume II) by HajraChowdhary.

3. Workshop Technology (Volume II) by W.A.J.Chapman.

Reference Books:

1. Production Technology by P.C.Sharma.

2. Production Technology – HMT Handbook.

3. Production Technology (Volume II) by Gupte-Patel.

4.HGerling, All About Machine Tools, New Age International, 1995.

T.E. –Mechanical - Part-I
8.0 Self Learning (HSS)

Examination Scheme
Theory Paper : 50 Marks

Note: Syllabus is common for all branches of Engineering Faculty.

T.E.(Mech.)Part-II

Metrology & Mechanical Measurements

Teaching Scheme :	**Examination Scheme :**
Lectures-3hours per week	**TheoryPaper:100 Marks**
Practical- 2 hours per week	**Term Work: 25 Marks**

Course Objectives:

1. To study the principles of measurement of various mechanicalproperties such as geometrical, dimensional, pressure, temperature etc.
2. To learn the use of various measuring instruments with different setups for accurate measurements.
3. To get acquainted with various standards of measurements & the calibration process of Instruments.

Course Outcomes :

1. Students will understand the design & construction of measuring instruments.
2. Students will setup the Instruments & accessories for measurement of properties by avoiding errors.
3. Students will calibrate the simple instruments using more accurate standards.
4. Students will use the instruments for various industrial applications such as quality control, process control etc.

Section- I

1. Introduction : Standards of Measurement & Principles of measurement: (05)

Need & Concept of measurement, Precision and accuracy. Classification of standards, International standards of length, Line, End & Wave length standards, Slip gauges: Slip-gauge set (M-45,M-87) specification, Selection of slip Gauges including numerical problems. Measuring principles of vernier caliper & micrometer

2. Systems of Limits, Fits & Tolerances and Limit Gauging: (05)

Terminology, Types of tolerances, Accumulation of tolerances, Types of fits, Hole & shaft base systems of limits, fits and tolerances, Use of tolerance charts, Numerical problems based on fundamental deviations & fundamental tolerance grades. Taylor's Principal of gauge design, types of gauges, Design of limit gauges, Disposition of gauge tolerances & wear allowances, numerical problem on gauge design.

3. Comparators & angular measurements: (05)

Introduction to comparators, Characteristics, Classification of comparators, mechanical comparators-Johnson Mikrokator, Sigma Comparators dial indicators, Optical Comparators –Principles ,Pneumatic Comparators, Angular Measurements - Bevel Protractor, Spirit level, Clinometers, Principle & use of Sine Bars, Sine Centre, Use of angle gauges (Numerical on Building of angles) Autocollimator.

4. Screw-Threads & Gear Metrology & Recent trends in measurement: (05)

Basic elements of screw-thread measurement, Methods of measurement of effective diameter, floating carriage micrometer. Basic elements of spur-gear measurement, Methods of measurement of gear tooth thickness. Introduction to modern measurement techniques- Co-ordinate Measuring Machine, Profile projector, Introduction tolaser

Measurement, Metroscope & Automatic inspection system.

Section- II

5. Introduction to Mechanical Measurement: **(05)**

Need of Mechanical Measurement, Instruments, Measurement methods, Generalized measurement system & its functional elements, Instrument characteristics-Static & Dynamic characteristics, Calibration, Classification of transducers.

6. Measurement of temperature, Pressure & Vacuum: **(05)**

Importance of temperature measurement, Thermometer, Thermocouple-Principle, Types, Calibration, RTD, Thermistor. Importance of pressure & Vacuum measurement, Range of high pressure & vacuum Bourdon tubes, Dead weight pressure-gauge tester, Diaphragm gauge, LVDT, Piezo-electrical pressure gauge, Low vacuum gauges-McLeod gauge, Pirani gauge.

7. Measurement of angular speed & flow: **(05)**

Importance of angular speed measurement, Mechanical tachometers, Electrical tachometers-Drag cup, Inductive, Photoelectric pickup, Stroboscope. Importance of Flow measurement, Turbine meter, Rotameter, Gas flow meter, Hot wire anemometer.

8. Measurement of Force, Torque & Strain: **(05)**

Force measurement- Balance, Proving Ring, Hydraulic, Pneumatic Load Cell, Torque measurement-Hydraulic, Eddy Current.Classification of strain gauges, Principle of electrical strain gauge, Gauge factor (Analytical treatment), Wheatstone's network using strain gauges. Simple Numerical problems.

(5)

TERM-WORK

A)Metrology Laboratory :

Any five of the following experiments (Experiment No. 1 is compulsory).

1. Uses of various measuring instruments .Vernier instruments, Micrometer instruments, Dial instruments and Auxiliary instruments for carrying out measurements.
2. Calibration of Vernier caliper / Micrometer using slip gauges.
3. Use of at least one type of each class of comparator such as mechanical, optical, pneumatic, etc.
4. Measurement of angle using Bevel protractor and sine bar / sine centre. Use of Clinometer and Angle gauges.
5. Measurement of Gear tooth thickness using gear tooth vernier caliper/ plate type micrometer
6. Measurement of diameters of screw threads.
7. Use of advanced measuring equipment such as Co-ordinate Measuring Machine / Metro scope/ Profile projector.

B) **Mechanical Measurements Laboratory**

Any five out of the following experiments:

1. Temperature Measurement using thermo couples, RTD, Thermistor.
2. Testing of mechanical pressure gauge using Dead Weight pressure tester.
3. Vacuum measurement using U tube manometer & Mechanical Vacuum Gauge.
4. Angular speed measurement using mechanical tachometer ,stroboscope, photo electric pick up, inductive pick-up.
5. Flow measurement using Rotameter.
6. Measurement of bending strain or load using strain gauges.
7. Use of proving ring,load cells.
8. Measurement of torque.

* Industrial Visit (Recommended for modern measuring instruments/ Calibration Lab)

Text Books:

1. Engineering Metrology: I.C. Gupta
2. Mechanical Measurement & Control: Dr.D.S. Kumar
3. A Text Book Metrology : M. Mahajan

Reference Books :

1. Practical Engineering Metrology: Sharp KWB, Pitman, London.
2. Engineering Metrology: R.K.Jain, Khanna Publishers.
3. Mechanical Measurement: Sohni & Dr. Radhakrikshan.
4. Mechanical Measurement: Beckwith, Buck, Roy

(NOTE: SEPARATE ANSWER BOOKS FOR SECTION –I & SECTION-II)

T.E. (Mechanical) Part – II
2.0 Internal Combustion Engine

Teaching Scheme
Lecturers: 3 Hrs/ Week
Practical: 2 Hrs/ Week

Examination Scheme
Theory: 100 Marks
Term work: 25 Marks

Course Objective:

1. Learn to classify different types of internal combustion engines and their applications.
2. To make students familiar with the design and operating characteristics of internal combustion engines.
3. To study the thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency and emissions.
4. To introduce students to future internal combustion engine technology and market trends.

Course Outcomes :

1. To recognize and understand the reasons for differences in the construction of different types of internal combustion engines.
2. To understand the reasons for differences among operating characteristics of different engine types and designs
3. To elect the appropriate engine for a given application.
4. To conduct performance tests on engines and Compare experimental results with theoretical predictions.
5. To compare experimental results with theoretical predictions and make proper justifications for

Section I

1. Introduction to I.C. Engines & Engine Cycles: (06)
Introduction, Basic engine components and nomenclature, Classification of I. C. Engines. Engine cycles, Deviation of actual cycles from air standard cycles, Valve timing diagram for high & low speed engine, Port timing diagram. Engine selection.
(*Theoretical treatment only*)

2. Fuel systems for S.I. Engines: (05)
Engine fuel requirements, Elementary and complete carburetor (Float, Idling and Acceleration system, Choke, Compensating system, economizer), Derivation for calculation of A/F ratio (exact and approximate method), Design of carburetor - Calculation of main dimensions of air and fuel supply, Effect of altitude on Air fuel ratio. Electronic Petrol injection system (MPFI)
(Numerical on calculations of main dimension of carburetor)

3. Fuel Systems for C.I. Engines: **(05)**

Requirements of injection system, Fuel metering, pressurizing and injecting system, Types of. injection system- Individual pump, Common rail and Distributor systems, Unit injector, Types of fuel nozzles- single hole, multi hole, pintle, and pintaux, Formation of Spray, Atomization and penetration. Governing of C.I. engines. Electronic control for diesel engine management,

(Numerical on calculations of main dimension of fuel injection system).

4. Engine systems. **(04)**

a. Ignition system: (Magneto, CDI, Electronic)
b. Lubrication system (types of lubrication systems and lubricants)
c. Engine starting system. (Starter motor, Bendix drive,)
d. Engine cooling system (Cooling system types, coolants)
e. Intake and exhaust systems (Intake manifold, intake runners, exhaust manifold, muffler)

(*Theoretical treatment only*)

Section II

5. Combustion in Engines: **(06)**

Combustion In SI Engine: Stages of combustion, Ignition lag, Flame propagation, Factors affecting flame speed, Abnormal combustion, Influence of engine design and operating variables on detonation, Requirements of combustion chambers of S. I. Engines. (*Theoretical treatment only*)

Combustion in C.I. Engines: Stages of combustion, Delay period, Factors affecting delay period, Abnormal combustion - Diesel knock, Influence of engine design and operating variables on diesel knock, Comparison of abnormal combustion in S I and C I engines,. Requirements of combustion chambers for C. I. engines. (*Theoretical treatment only*)

6. Engines testing and performance enhancement: **(06)**

Engines testing:- Performance parameters, Performance curves, Measurement of performance parameters like torque, power, Volumetric Efficiency, Mechanical Efficiency, BSFC, Brake and Indicated Thermal efficiencies. Heat Balance Sheet. *(Numerical on engine performance)*

Performance enhancement: Introduction to method of improving engine performance.

***Supercharging*:-** Purpose of supercharging, Thermodynamic cycle of supercharged engine, Types of superchargers, Turbo charging, Advantages and disadvantages, Limitations of supercharging for S.I. and C.I. Engines. (*Theoretical treatment only*)

7. Fuels **(04)**

SI Engine fuel: Fuel rating, Octane number, Fuel additives, HUCR

CI Engine fuel: Cetane number, Additives
Alternative fuels: Alternative fuel for S. I. Engines & C. I. engines, Blending, Use of CNG, Bio-gas, Non-edible oils, Ethanol, Methanol, Hydrogen, Electronic engine management system for variable valve timing, fuel supply and pollution control. Introduction to hybrid vehicles. (*Theoretical treatment only*)

8.Engine Emission and Engine electronics: (04)
S.I. engine emission (HC, CO, NOx) Control methods- Evaporative (ELCD), Thermal, Catalytic converters, C.I. Engines Emission (CO, NOx, Smog, Particulate), Control methods- Chemical, EGR, Standard pollution Norms – Bharat-I,II,III. Introduction to carbon credit. Engine electronics. (*Theoretical treatment only*)

Term Work

Minimum **four** experiments from Study Group and Test Group Each.

Study Group:
1 Constructional details of I.C. engines
2 Study of Engine systems: Air, exhaust, Cooling, Lubrication
3 Study of ignition systems, Starting systems.
4 Dismantling and assembly of Carburetor or injection system.
5 Dismantling and assembly of engine
6 Study of fuel injection system of diesel engine
7 Assignment on latest trends in IC Engine.

Text Group:

1.Test on four stroke Diesel Engine.
2 Test on four stroke Petrol Engine.
3 Morse Test.
4 Test on computer controlled I.C. Engine
5 Measurement of exhaust emissions of SI / CI engines.
6 Test on variable compression ratio engine, to predict the effect of variable compression ratio on I.C.Engine performance.
7 Visit to an engine manufacturing company / repairing unit

Text book

1 Internal Combustion Engines Mathur and Sharma Dhanpat Rai
2 Engineering Fundamentals of the Internal Combustion Engine Willard Pulkrabeck, Prentice Hall
3 Internal Combustion Engines Rajput, Dhanpat Rai Publications
4 Internal Combustion Engines – Ganesan, Tata McGraw Hill

Reference Books

Sr. No	Title	Author / Authors	Publisher
1	Internal Combustion Engines Fundamentals	John Heywood	McGraw Hill
2	Internal Combustion Engines Emission and Control	Eran Sher	SAE
3	Engine Emissions	Purandir	Narosa
4	Alternative Fuels	S.S Thipse	Jaico
5	Internal Combustion Engines Fundamentals	Maleev	McGraw Hill
6	Internal Combustion Engines Vol. 1 and Vol. 2	C.F Taylor	MIT Press
7	Internal Combustion Engines	Obert	McGraw Hill
8	Internal Combustion Engines: Applied Thermo sciences	Fergusson & Kirkpatrick	Wiley
9	SAE Handbook	SAE	SAE
10	Performance Testing of Internal Combustion Engines	SAE	SAE

T.E. (Mech) Part –II

3.0 Computer Aided Design & Computer Aided Manufacturing (CAD/CAM)

Teaching Scheme:
Lectures: 3Hrs/Week
Practical: 2Hrs/Week

Examination Scheme
Paper: 100 Marks
Term Work: 25 Marks

Course objectives:

1. To create an awareness regarding Geometric Modeling activities in Industries.
2. To create an awareness regarding CAM activities in Manufacturing Industries.
3. To develop part programming capabilities for CNC machines.
4. To empower students to learn advanced tools in Automation.

Course Outcomes:

1. To handle CAD related problems from industries.
2. To handle CAM related problems of manufacturing industries.
3. To learn CAD/CAM softwares to be updated with time.
4. To design NC Part Programs to suit Industrial requirements.

Section-I

1. **Introduction to CAD / CAM**: **(04)**

Product Design Concept, Product Cycle and CAD / CAM, Advantages of CAD / CAM, Hardware for standalone CAD system, Graphics Workstation, Types of Input Devices, CPU and Output Devices, Softwares for CAD / CAM, Functions of a Graphics Software, Selection of CAD / CAM Software

2. Computer Graphics: **(05)**

Geometric Transformations, Homogeneous Coordinates, Windowing and Viewing Transformations, Coordinate Transformations, Standardization in Graphics Software, CAD / CAM Data Exchange.

3. Geometric Modeling: **(05)**

Introduction, Types of Geometric Modeling, Parametric representation of basic entities like line and circle, Introduction to basic curves - Hermite, Bezier, B-Spline, NURBS, concept of CSG and Boolean operations, Feature based modeling.

4. Automation: **(06)**

Concept & Definition of Automation, Types, Advantages and Limitations of Automation, Group Technology, part family, Classification and Codification System, Merits and Demerits of Group Technology, Concept of a Machine Cell, CAPP, Retrieval and Generative type of CAPP, Computer Integrated Manufacturing (CIM) concept and elements, MRP, concept of ERP, concept of Rapid Prototyping.

Section-II

5. Fundamentals of NC system: **(06)**

Evolution of NC and Retrofitting, Elements of NC Manufacturing System, concept of work zero and machine zero, Types of NC systems, Structure, Drives and other devices, Steps in NC Manufacturing, Advantages and Disadvantages of NC Technology, Flexible Manufacturing System (FMS), Elements of FMS, Applications of FMS, Merits and Demerits in FMS.

6. CNC- DNC Technology: **(03)**

Classification of CNC machine tools, CNC controllers, Features and Advantages of CNC, Adaptive Control, Advantages of Adaptive Control, Direct Numerical Control (DNC), Types of DNC, Advantages and Disadvantages of DNC.

7. Tooling for CNC Machines: **(03)**

Tool holders, Adapters, Tool magazines, Automatic tool changers, Pallets, Tool setting, Modular tooling.

8.Manual Part Programming: **(08)**

Principles of an NC Program, Word Address Format (WAF), Machining Formulas, Tool Length and Cutter Diameter Compensation, Canned Cycles for Lathe, Milling and Drilling, Subprogram or Subroutines, DO Loop, Macros, Diameter versus Radius Programming, CAD / CAM Systems for Part Programming.

List of Experiments

1. One assignment on CAD/CAM fundamentals/basics.
2. Assignment on Modeling & Drafting of any two mechanical components.
3. Assignment on Modeling of simple Assembly of around 3-5 machine components.
4. Assignment based on group technology and /or Computer Aided Process Planning (preferably based on small part family).
5. Part programming of one job using CAM software or Programming and manufacturing of one job on CNC lathe or CNC Milling machine.
6. Assignment based on Industrial visit and its report based on CNC/FMS/Automation.

Text books:

1. Introduction to CAD/CAM, Rao P.N., -Tata McGraw Hill Publishing Co.
2. Automation, Production Systems and Computer Integrated Manufacturing, Grover M.P.- Prentice Hall of India
3. Numerical Control -Computer Aided Manufacturing, Kundra, Rao, Tiwari- Tata McGraw Hill Pub.Co.
4. CAD/CAM/CAE, Chougule N.K.- SCITECH Publications (I) Pvt. Ltd.
5. CAD/CAM/CIM, P. Radhakrishanan.

Reference Books:

1. Theory and Practice , Ibrahim Zeid – CAD/CAM - Tata McGraw Hill Publishing Co.
2. CAD/CAM - Mastering , Ibrahim Zeid –-Tata McGraw Hill Publishing Co.
3. Computer Integrated Design and Manufacturing , D.D. Bedworth, M.R Henderson & P.M. Wolfe- -Tata McGraw Hill Pub. Co.
4. CAD/CAM Theory and Concepts, Kuldeep Sareen, C.Grewal, -S.Chand & Co.Ltd.
5. Computer Graphics by Hearn and Baker.

TE (Mech) Part- II
Professional Elective – II
5.3 Tool Engineering

Teaching Scheme :
Lectures : 3 / week
Practicals : 2 hrs./ week/ batch

Examination Scheme :
Theory : 4 hrs. 100 marks
Term work -25 marks

Course Objectives

1. To enlighten the students about the basics in mechanics of cutting & non cutting operations.
2. To explain the concepts, principles & practices in designing various tools .
3. To explain the students about the basics in economics of cutting & non cutting operations.
4. To explain the concepts, principles & practices in designing various toolings.

Course Outcomes

1. Students are able to do the calculations involved in the mechanics & economics of operations.
2. Students are able to design & draw the tools & toolings for the given situation & operation.
3. Students are able to conceive & develop solutions, devices, contrivances to overcome present problems of the real world.

SECTION - I

1. Theory of Metal cutting

a) Orthogonal cutting & Oblique cutting, Force analysis for orthogonal cutting **(1)**
b) Chip formation, types of chips, wedge action, shear plane angle, cutting ratio, shear stress & strain, velocity relationship, Merchant's theory, Merchant's circle & force relationship **(3)**
c) Tool dynamometers- types, applications. **(1)**
d) Machinability Index, factors affecting machinability **(1)**
e) Tool life- Flank & crater wear, effect of variables on tool life, Taylor's equation of tool life **(2)**
f) Coolants- Heat generation, types of coolants. **(1)**
g) Tool Materials **(1)**

2. Press Tools

a) Elements of press tools, types of dies, types of operations. **(2)**
b) Design of die for cutting operation, mechanics of shearing, cutting force estimation, punch & die clearance, stock strip lay out, design of punches & die block functioning & place of other elements. Centre of pressure, selection of die set & press **(5)**
c) Design of drawing dies, determination of blank size, no. of draws, stage wise component drawing, drawing radii, clearance, estimation of drawing force, time & power **(2)**
d) Types of Bending dies, related estimates. **(1)**

SECTION –II

3. Geometry & Nomenclature of cutting tools

a) Single point cutting tools- Geometry & Tool signature as per ASA system & ORS system, effect of geometry on tool life, cutting force, surface finish. **(2)**

b) Types of Multipoint cutting tools like Milling cutters, Drills, Broaches, Reamers **(2)**

4. Design of Jigs & Fixtures

a) Introduction, necessity & applications, basic concepts **(1)**

b) Location & clamping systems- Principle, types, applications **(2)**

c) Design of Jigs- Principles of Jig design, types & applications, types of bushes & selection, use of standard parts, design procedure & drawing. **(4)**

d) Design of Fixtures- Principles of Fixture design, standard elements & types of fixtures, design of milling fixtures. **(4)**

5. Economics of Tooling

a) Elements of cost: methods of depreciation **(1)**

b) Estimation of total cost & sales price **(1)**

c) Break- even analysis for equipment selection **(1)**

d) Economics of small tool selection, equipment replacement **(1)**

e) Economic Order Quantity for Batch production **(1)**

TERM WORK

(**Minimum Six of the following)**

1. Study of cutting tools : Classification, Nomenclature, Geometry
2. Exercise on Theory of metal cutting.
3. Demonstration of Lathe tool & Drill tool dynamometer & calculation of cutting forces.
4. Exercises on Mechanics & Economics of Machining & Tooling
5. Sheet on Press tool design- Cutting & drawing operation, necessary calculation
6. Sheet on Jig design- Exercise & drawing
7. Sheet on Fixture design- Exercise & drawing
8. Industrial visit

RECOMMENDED BOOKS:

TEXT BOOKS

1. Text Book of Production Engineering – P.C.Sharma (S.Chand Publication)
2. Machine Tool Engineering – G.R. Nagpal (khanna Publication)
3. Press Tools – P.H.Joshi (S.Chand Publication)
4. Jigs & Fixtures - P.H.Joshi (S.Chand Publication)

REFERENCE BOOKS

1. Metal cutting Theory & tool design- Mr. Arshinnov (MIR Publication)
2. Fundamentals of Tool design- ASTME Publication
3. Tool design – Donaldson (TMH Publication)
4. Jig & Fixture Design – Kempster (ELBS Publication)
5. Die Design Fundamentals-J.R.Paquin

T.E. (Mechanical) Part – II
7.0 Workshop Practice – V

Teaching Scheme
Practical: 2hrs/week

Examination Scheme
Term- Work – 25 Marks
Practical Examination-50Marks

Practical Exam duration- 6 Hrs.

==========

Course Objective:

v) To make the students aware with various skills involved in manufacturing &Assembly.

vi) To develop skills to operate different machine tools.

vii) To make the students aware of limits, fits & tolerance while manufacturing assembly.

viii) To make students aware of operation sequence, speed feed selection for different materials & operations

Course Outcomes:

i) To create confidence amongst the students in Production / manufacturing activities.

ii) Students should get experience about manual skills required to perform machining operations.

iii) To create confidence in students while designing limits, fits & tolerances during manufacturing.

iv) To create awareness in students regarding time management, work study, method study & tool engineering

---

1. A composite job consisting of three components machined from **Φ32 mm MS bar**.
(Excluding commercial components) requiring minimum five operations listed below:

1.Turning
2.Drilling
3.Boring
4.Hand tapping
5.Milling
6.Internal & External V-threading
7.Grinding

2. The components of the composite job shall carry at least two specified close tolerance operations. In addition to the above, following operations are to be demonstrated during the term. (These are not to be included in the job operations for term work & exams.)

1.Shaping
2.Slotting
3.Grinding
4.Form Turning
5.Knurling
6. Grooving

4. Journal should contain detailed process sheet of above job.

5. Assessment of Workshop Practice-IV-Term work shall be done for 50 % Work or one majorComponent & Workshop Practice-V-Term work shall be done for remaining work at the end of T.E. (Mech.) Part II.

6.Practical examination of 6 Hrs. duration having component of 2 to 3 parts.

Note: Material specification for practical work & examination is raw material **Φ32mm MS bar**.

Books:

1. Workshop Technology (Volume II) by Raghuvanshi.
2. Workshop Technology (Volume II) by HajraChowdhary.
3. Workshop Technology (Volume II) by W.A.J.Chapman.

Reference Books:

1. Production Technology by P.C.Sharma.
2. Production Technology – HMT Handbook.
3. Production Technology (Volume II) by Gupte-Patel.
4.HGerling, All About Machine Tools, New Age International, 1995.

T.E. (Mechanical), Semester - II

Self Learning (Technical)

Teaching Scheme:-- Nil

Examination Scheme: Nil **Term Work – 50 Marks**

==========

Course Objective:

i) To develop the ability for self study

i) To make the students acquainted with various skills involved in presenting a data.

ii) Student is expected to understand & analyze the basic problems in engineering.

Course Outcomes:

i) Outcome is to create confidence amongst the students in the field of engineering.

ii) Students should get experience about case study.

1. Mini Project/Case study: 30 Marks

A mini project /case study is expected to be on a state of the art technical topic, related to Mechanical Engineering discipline. Every individual or a group of maximum two students shall work on a area/topic, selected or assigned from any engineering/allied/applied fields, for the academic or industrial interest.

The task may be like:

-A work/task can be completed using software tools like CAD tools, MALAB SCILAB, AUTOLISP, or any Programming Languages.

-Animation, simulation oriented task.

-Making a prototype, working model, attachment/extension to machine tool/equipment.

-Design of element, mechanism, product, subassembly etc.

-Experimentation with critical task like using IC engine, Hydraulic trainer circuit, Vibration analysis or using any working experimental set-up.

Such similar kind of task/case in the field of Mech. Engg., can be taken for mini project.

For this mini project the report should be prepared and student has to present it and demonstration to the expert panel appointed by HOD.

The Term work marks will be allotted as per the following :

i) Report 10 Marks

ii) Theme/content, Presentation and question-answer : 20 Marks

2. A) Paper Presentation 20 Marks

OR

B) Seminar 20 Marks

A) Paper Presentation :

A research paper is expected to be on a state of the art technical topic, related to Mechanical Engineering discipline. Every individual or a group of maximum two students shall work on a area/topic, selected or assigned from any engineering/allied/applied fields, for the academic or industrial interest. Student shall work on a recent/advanced topic, recent development/research work, may be selected by them or assigned from any engineering/allied/applied fields, for the academic or industrial interest. The student shall prepare the research paper and participate/submit for any competition/conference may be of university level/state level/national level/international level. The student has to produce the proof for the same in the form of certificate of selection/attendance/paper presentation, at the competition/conference, a copy of souvenir/proceeding etc.

For this the report including research paper should be prepared and student has to present it to the expert panel appointed by HOD.

The Term work marks will be allotted as per the following:

i) Research paper: 10 Marks

ii) Presentation and question-answer: 10 Marks

B) Seminar:

A seminar is expected to be on a state of the art technical topic, related to Mechanical Engineering discipline. Every individual student shall work on a recent topic selected or assigned from any engineering/allied/applied fields for the seminar of academic or industrial interest. It is expected that the student may collect information on a topic which is not covered in curriculum of the under graduate course. Student has to refer hand book, latest research papers, research journals, reference books, proceeding of conference through library or internet and record of references considered for seminar is too preserved in hard copy or soft copy, which shall be produced at the time of seminar. The seminar report & its presentation are to be based on content material, mainly collected & analyzed from above.The report of seminar should be submitted in printed volume (about10-20 pages) duly certified by guide. The student should deliver a seminar talk at least for 20 minutes based on the work done by him/her. The performance will be judged by expert panel appointed by HOD.

Presentation shall be made with help of Power point (Guidelines)-

a. Preferably each slide shall have plain white or faint yellow or navy blue or maroon colored back ground with contrast matching font.

b. Each slide shall be numbered and header - footer shall be added similar to report.

c. Figure / Graph / Table shall be labeled with Figure No. / Graph No. / Table No. and with reference nos. Shown in seminar report

d. Only brief points are to be highlighted on slides

e. Points are not to be read directly from slide at the time of presentation.

f. Presentation shall be based on Figure, Graph, Table, Charts and points etc.

g. First slide shall be identical to cover page of report.

h. Second slide should contain introduction / abstract of seminar and content of presentation with bullets.

i. Third slide shall focus on literature review.

j. Fourth slide on wards core content of presentation shall be discussed.

l. Slides at the end shall consist of merits, demerits, future scope, conclusion and references.

The Term work marks for seminar will be allotted as per the following

i) Seminar Report : 08 Marks
iii) Presentation and question-answer : 12 Marks

Recommended Books:

Text Books :

1.Communication Skills for Engineers –S. Mishra, C. Muralikrishna, Pearson Education.
2.Professional Communication Skills -Pravil S. R. Bhatia, S. Chand and Co., New Delhi.
3. Soft Skills,know Yourself & Know the world-Dr.K.Alex.S. Chand & Company Ltd.,N.Delhi.
4. Awaken the Giant Within: Tony Robbins HarperCollins Publishers, ISBN-139780743409384

Reference Books:

1. Entrepreneur Development by Vasant Desai, Himalaya Publication
2. Thinks and Grow Rich: Napoleon Hill, Ebury Publishing, ISBN 9781407029252
3. Change Your Thoughts, Change Your Life: Wayne Dyer, Hay House India, ISBN-139788189988050
4. Habits of Highly Effective People: Stephen Covey Pocket Books, ISBN-13
5. Organizational Behaviour-Fred Luthans, McGraw Hill.

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
Mechanical Engineering
Structure of B.E. (Mechanical Engineering) w.e.f. from2015-16

Semester-I

Sr. No.	Subject	Teaching / Week					Examination Scheme				
		L	T	P	Dr	Total	TP	TW	OE	POE	Total
1	Automatic Control Engineering	3		2		5	100	25			150
2	Operations Research	3		2		5	100	25			125
3	Refrigeration and Air Conditioning	3		2		5	100	25	25		125
4	Professional Elective - 3	3		2		5	100	25	25		150
5	Free Elective - I	3	2			5	100	25			125
6	Industrial Training			1		1		50	25		75
7	Project Work– I			4		4		50			50
Total		**15**	2	13		**30**	**500**	**225**	**75**	-	**800**

Professional Elective III	Finite Element Methods	Automobile Engineering	Process Engineering

Free Elective I	Industrial Robotics	Sugar Engineering	Textile Engineering	Entrepreneurship Development

Semester-II

Sr.No.	Subject	Teaching / Week					Examination Scheme				
		L	T	P	Dr	Total	TP	TW	OE	POE	Total
1	Industrial and Quality Management	3		2		5	100	25			125
2	Industrial Engineering	3		2		5	100	25			125
3	Professional Elective - 4	3		2		5	100	25	25		150
4	Free Elective - II	3	2			5	100	25	25		150
5	Project Work – II			8		8		100	100		200
6	General Proficiency	2				2		50			50
Total		**14**	2	14		**30**	**400**	**250**	**150**	-	**800**

Professional Elective IV	Mechatronics	Computational Fluid Dynamics	Production and Operation Management

Free Elective II	Software Engineering & cyber security	Agro Machine Engineering	Plastic Engineering	Economics for Engineers

w.e.f. academic year 2015-16

Note –

1. The Practical batch shall be of 15 students. After formation of batches, if the number of students remaining is more than 7 a new batch shall be formed.
2. Project group shall not be of more than four students.
3. Practical / Tutorial load indicates the load per batch.
4. TW: Term work assessment shall be a continuous process based on the performance of student in assignment, class test, quizzes, homework, interaction during theory and laboratory session, hand written lab book/ hand written journal, sheet drawing, subject seminar presentation etc. as applicable.
5. For Elective -: To offer a particular subject as an Elective, minimum 15 students should opt for the same. Appropriate Electives Subjects may be added when required.

3. Refrigeration And Air Conditioning

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hrs. / Week

Examination Scheme:
Theory Paper: 100 Marks
Term work: 25 marks

Oral Exam.: 25Marks

Course objective:

1. To Study basic refrigeration cycles and air refrigeration systems.
2. To study different refrigerants and multi pressure refrigeration systems
3. To Study Psychometric properties of air and human comfort conditions

4 To study and design of air conditioning systems

Course outcomes:

At the end of course a student can be able to

1. Analyze basic refrigeration cycles and air refrigeration systems
2. Select proper refrigerant and appropriate refrigeration system based on application
3. Define and estimate psychometric properties
4. Estimate cooling and heating load calculations and design air conditioning system

for different applications

Section – I

1. a)Basic Refrigeration Cycles:

Refrigeration, Units of Refrigeration, Reversed Carnot cycle, Bell-Colemon cycle, Types of Vapour Compression Cycles, Calculations & performance of above cycles, Actual vapour compression cycle.

(Numerical Treatment) (7 hrs)

b) Air Refrigeration systems for Air Craft Refrigeration:

Necessity of air cooling for air craft, Simple system, Boot strap system, Regenerative system, Reduced ambient system (Descriptive Treatment) (3hrs)

2. Multi pressure systems:

Introduction, Multistage compression, Flash gas removal, flash inter cooling, complete multistage compression system, Multi evaporator systems (Descriptive Treatment) (3 hrs)

3. Refrigerants:

Classification, Desirable properties, Nomenclature of refrigerants, Selection of refrigerant, Secondary refrigerants, Effect on ozone depletion & Global warming, Total equivalent warming impact (TEWI), Alternative refrigerants, Nan refrigerant (Descriptive Treatment) (3hrs)

4. Vapour Absorption System:

Simple aqua-ammonia vapour absorption system, Practical aqua-ammonia vapour absorption system, Comparison between vapour absorption & vapour compression systems, Lithium Bromide absorption refrigeration systems, Electrolux refrigerator. (Descriptive Treatment) .
(4hrs)

Section – II

5. Psychrometry

Moist air as a working substance, Psychrometry properties of air, Use of psychometric tables & charts, Processes, Combinations & calculations, ADP, Coil condition line, Sensible heat factor, Bypass factor, Air washer &it's applications.(Numerical Treatment) (7 hrs)

6. Heating & Cooling Load Calculation:

Representation of actual air conditioning process by layouts & on Psychometric charts, Load analysis RSHF, GSHF, Enumeration & brief explanation of the factors forming the load on refrigeration & air conditioning system (Numerical Treatment) (6hrs)

7. Comfort Conditions & Air Distribution System:

Thermal exchange between human body & environment, Factors affecting comfort, effective temperature comfort chart, Ventilation requirements.

Duct classification, duct material, duct construction, duct design, Methods for duct design, determination of duct size, losses in duct (Theoretical Treatment)
(4hrs)

8. Introduction to Cryogenics:

Introduction, Limitation of VCRS For production of low temp., Cascade refrigeration, Linde system for liquefaction of air, production of low temperature by adiabatic demagnetization of paramagnetic salt. (Theoretical Treatment)
(3hrs)

Term Work

Group I (Study, Demonstration & minimum four assignment on following topics)

01. Study of Refrigeration methods

02. Study of Refrigeration Equipments

03. Study of Refrigeration systems – domestic refrigerator, Split air conditioning, Ice plant, Deep freezer etc.

04. Study of food preservation, Methods of food freezing

05. Study of charging, leak testing of refrigeration systems

06. Study of non conventional refrigeration systems

Group II (Minimum three experiments on following list)

01. Trial on Refrigeration primer / bench
02. Trial on Air conditioning tutor

03. Trial on mini ice plant

04. Trial on Vapour Absorption system

05. Trial on Heat Pump

Group III

1. Visit to refrigeration plant or Central Air conditioning plan

2. Performance evaluation of any one trial of Group-II by using MATLAB/C Programming

Text Books:

01. 'Refrigeration & Air Conditioning' by C.P. Arora

02. 'Refrigeration & Air Conditioning' by Arora & Domkundwar

03. 'Refrigeration and Air-conditioning' by Khurmi R.S.,Gupta

Reference Books:

01. 'Principle of Refrigeration' by Roy J Dossat

02. 'Air Conditioning Applications & design' by W.P. Jones

03. 'Refrigeration & Air Conditioning' by Stocker

4.2 Automobile Engineering

Teaching Scheme
Lecturers: 3 Hrs/ Week
Practical's: 2 Hrs/ Week

Examination Scheme
Theory: 100 Marks
Term work: 25 Marks
Oral: 25 Marks

Objectives

1. Study basic principles of actual automobile systems
2. Study important systems in an automobile
3. Study recent and modern trends in automobile sector
4. To make students aware about the entrepreneurial opportunities in automobile engineering field.

Outcomes: Learner will be able to…

1. Demonstrate & explain various systems in an automobile
2. Describe importance and features of different elements like axle, differential, brakes, steering, suspension, wheel balancing etc.
3. Explain principle of operation, construction and applications of various sensors used in modern automobile

Section – I

1. Introduction to Automobiles: **04**

Broad classification of Automobiles. Major Components and their functions. Types of vehicle layouts, Front engine rear wheel drive, Front engine front wheel drive, Rear engine rear wheel drive, All wheel drive**,** specifications of vehicles. Types of bodies, Body construction and materials, and safety devices.

2. Performance of Automobiles: **05**

Resistance to vehicle motion, Air, Rolling and Gradient resistance, Acceleration, Grade ability and draw bar pull, Traction and Tractive effort, Distribution of weight, Power required for vehicle propulsion, Selection of gear ratio, Rear axle ratio. (Numerical)

3. Transmission System: **08**

Requirements of transmission system, Automobile clutch- requirements, types & functions, Single plate, Multi-plate, Centrifugal, Electromagnetic & Fluid flywheel. Types of automotive gearboxes, Working of sliding mesh, Constant mesh and Synchromesh gearbox, Overdrive, Principle of operation of automatic transmission, Torque converter, Epicyclical gear trains, Propeller shaft, Universal and slip joint, Final drive and its types, Differential, Construction and types of rear axles, Introduction to wheels and tyres.

4. Automobile Electrical Systems: **03**

Automotive batteries, automotive lighting system. Starting system, charging system, Electric horn, Electric fuel Gauge- thermostatic & balancing coil type, Wiper & side indicator circuit, electric Speedo meter.

Section – II

5. Steering System: **06**

Function of steering, Steering system layout, Automotive steering mechanism- Ackerman and Davis, Types of steering gear boxes, Condition for true rolling, Steering geometry-Camber, Caster, King pin inclination, Included angle, Toe-in and Toe-out, Wheel alignment, Slip angle, Under steer & over steer, Types and working of power steering,. . (Numerical)

6. Braking System: **06**

Function of automotive brake system, Types of braking mechanism, internal expanding & Disc brake, Mechanical, Hydraulic & Air brake system, power brakes, Anti lock braking, Calculation of braking force required, stopping distance and dynamic weight transfer.(Numerical)

7. Suspension Systems: **05**

Suspension requirements, Sprung and Un sprung mass, Types of automotive suspension systems. Conventional and Independent, Shock absorber, Types of springs, Hotch- kiss and Torque tube drive, Reaction members-Radius rod, Stabilizer bar, Air suspension system.

8. Modern Trends: **03**

Engine electronic control modules, Introduction to Sensors and actuators used in automobile controls, Electronic Control Unit, traction control devices, fuel cells Hybrid vehicles-Electrical vehicle, solar vehicles.

Term Work

Minimum **six** experiments from Group A and **two** experiment from Group B are to be performed

Group A.

1. Study and demonstration of four wheeler chassis layout. Two-wheel & four wheel drive layouts.
2. Study and Demonstration of working of single plate automobile clutch.
3. Study and demonstration of synchromesh gearbox.
4. Study and demonstration of final drive and differential.
5. Study and demonstration of working Hydraulic braking system.
6. Study and demonstration of front wheel steering geometry and steering mechanism.
7. Study and demonstration of suspension system of a four-wheeler.
8. Study and demonstration of battery and electrical starting system
9. Study and demonstration of (a) Electric horn. (b) Electric fuel Gauge. (c) Flasher unit. (d) Wiper circuit

Group B.

1. Experiment on wheel balancing & front wheel alignment.
2. Visit to servicing station for study of vehicle maintenance, repairs and report.
3. A case study presentation and report covering recent trends in automobiles.

Books Recommended

Text books-

1. Kripal Singh - Automobile Engineering – Standard publisher.
2. Automobile Mechanics -.N. K. Giri
3. Automobile Electrical Equipment -P. S. Kohali

Reference Books:

1. K. Newton and W. Seeds, T.K. Garrett,Motor Vehicle, Elsevier publications
2. Hans Hermann Braess, Ulrich Seiffen, handbook of Automotive Engineering, SAE Publications
3. William H. Crouse. Automotive Mechanics - Tata McGraw Hill Publishing House
4. Joseph Heitner, Automotive Mechanics -C.B.S Publishers And Distributors
5. SAE Manuals and Standard
8. Narang G. B. S - Automobile Engineering - S. Chand and Company Ltd.
9. Singh Kripal - Automobile Engineering –Standard publisher

6. Industrial Training

Teaching Scheme :

Practical : 1 Hour / week

Examination Scheme:

Term work : 50 Marks

Oral Exam: 25 Marks

Course Objectives :

1. To make the students aware of Industrial culture & Organizational setup.
2. To create awareness about technical report writing among the student.

Procedure for Assessment of Industrial Training done by student

- Every student should prepare a report of training done (minimum 15 days) in a prescribed format before end of Part I Semester.
-
- Format of the report will be decided by the concerned guide.

- The report shall be comprehensive and presented in duplicate, typed on a standard A4 size sheet and bound.

- Every student should give presentation to project guide on industrial Training Report.

- The University oral examination will be based on the term work.

- Guidelines for conducting vocational training practical's

7. Project Work - I

Teaching Scheme	Examination Scheme
Practical: 4 Hrs/ Week	**Term work**: 50 Marks

Course Objectives:

1. Application of the knowledge gained to practical situations.
2. Develop the technical problem solving ability.

Guidelines for Project content & Mark Distribution:	Marks
a. Work diary and weekly reporting	20
b. Synopsis	10
c. Progress report submission and presentation	20

Project Term Work:

The term work under project submitted by students shall include:

a. Work diary and weekly reporting:
Work Diary maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project group for
1. Searching suitable project work
2. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring out the project.
3. Brief report of feasibility studies carried to implement the conclusion.
4. Rough Sketches/ Design Calculations, etc.

b. Synopsis:
The group should submit the synopsis (of 4-5 pages) in following form.
2. Title of Project
3. Names of Students
4. Name of Guide
5. Proposed work (Must indicate the scope of the work & weekly plan up to March end)
6. Approximate Expenditure (if any)

The synopsis shall be signed by the each student in the group, approved by the guide and endorsed by the Head of the Department.

c. Progress report submission and presentation:
The group has to give a power point presentation in front of the faculty of department on the progress completed till end of first semester along with the progress report.

4.3 Plastic Engineering

Teaching Scheme :
Lectures : 3 Lectures / weeks
Tutorial : 2 Hours / week

Examination Scheme:
Theory Exam.: 100 Marks
Term work : 25 Marks
Oral Exam: 25 Marks

OBJECTIVES

1. To understand the mechanism of polymerization, techniques of polymerization and the significance of different molecular weight averages.
2. To provide the depth knowledge about different kinds of plastic materials based on their structure and properties.
3. To make the students familiar about properties and processing of plastics and use it for different applications.

OUTCOMES

At the end of the course, the student should be able to

1. Select the plastic materials for particular end user application
2. Predict the structure and properties of different kind of plastic material
3. Know the processing of different plastic material based on the end user requirement.

Section I

Unit –I Introduction to Plastics **4**

Definition and Classification of Plastic Materials, Properties of plastics, applications, Testing methods for plastics, additives in plastics, Monomers & Polymers, Polymerization - Types of Polymerization.

Unit –II Processing of Plastics **6**

Injection moulding, Extrusion moulding, sheet forming processes calendaring, Blow moulding, Processing of thermosetting plastics, compression moulding, Transfer moulding, rotational moulding.

UNIT III Welding of Plastics **4**

Hot gas welding, hot tool welding, High frequency induction welding, nuclear welding, Intra-red welding.

UNIT IV Design of Plastic Parts **6**

Tolerances of molded plastics parts, allowances in plastics, Design corners, undercuts, curing time, ribs, minimum wall thickness, design of inserts, cores mould materials,

Section II

UNIT V Design of compression and transfer molds **6**

a) Design and main parts of compression mould, standard insert mould body, design of loading chamber, design of punch, ejectors, stripper guided pin.
b) Technology of transfer mould, types, main parts, automation in transfer mould.

Unit VI Injection Mould Design **6**

Injection mould design, Single, multi cavity, semi-automatic and automatic moulds.
Types of injection mould, detailed structure and working. Feed system, Temperature control system, Ejection System, application.

UNIT VII Cooling of plastic injection mould **5**

Determining the heat quantity dissipated with cooling, heat dissipation with natural cooling, mean temperature, thermal resistance of mold body, summery of dimension and construction of correct cooling system.

UNIT VIII Introduction of advanced Plastics **3**

Introduction to composite plastics, Introduction of polymer degradation and biodegradable plastics, advanced application like Agriculture, Packaging, Building, Transport, Electrical, Electronics, Medical and Furniture

Term Work-

1. Injection mould design for simple component 2 Turns
2. Design of Blow Mould 2 Turns
3. Design of Compression mould 2 Turns
4. Two Case studies for mould manufacturing 2 Turns
5. Visit to Plastic industry (Thermo sets & Thermo Plasts)

Books -

1. J.A.Brydson, “Plastics Materials”, Butter worth Heinemann Oxford,1999
2. Schwartz & good man “Plastics materials and processing”
3. Irwin rubin “Hand book of Plastic Materials and technology”
7. Fred W. Billmeyer, JR., “Text Book of Polymer Science”, John Wiley &Sons,Singapore,1994.

5. Project Work – II

Teaching Scheme:

Practical's: 8 Hrs/ Week

Examination Scheme:

Term work: 100 Marks

Oral Exam: 100 Marks

Guidelines for Project contents & mark distribution:

a) Work diary and weekly reporting	20
b) Project Report	40
c) Presentation	40

Project Report:

Project report should be of 25 to 50 pages (More pages can be used if needed). For standardization of the project reports the following format should be strictly followed.

1. Page size : Trimmed A4
2. Top Margin : 1.00 Inches
3. Bottom Margin : 1.32 Inches
4. Left Margin : 1.5 Inches
5. Right Margin : 1.0 Inches
6. Para Text : Times New Roman 12 point font
7. Line Spacing : 1.5 Lines
8. Page Numbers : Right aligned at footer, font 12 point Times New Roman
9. Headings : New Times Roman, 14 point, Boldface
10. Certificate :

    All students should attach standard format of Certificate as described by the Department. Certificate should be awarded to batch and not individual student Certificate should have signatures of Guide, Principal, and External Examiner. Entire Report has to be segmented chapter wise as per the requirement.

11. Index of Report :

    i) Title Sheet

    ii) Certificate from Guide/ College

iii) Acknowledgement

iv) Abstract (Brief content of the work)

v) List of Figures

vi) List of Table

1. Introduction (History, Importance of Project Area, Problem identification, Objective of the Project)

2. Literature Review

3. Design/ Experimentation/ Fabrication/ Production/ Actual work carried out for the same.

4. Observation/ Analysis/ Findings/Results

5. Discussion on Results and Conclusion

References:

12. References or Bibliography: References should have the following format

For Books: "Title of Book"; Authors; Publisher; Edition;

For Papers: Authors, Year of Publication, "Title of Paper"; Conference Details/ General Details; Page No.

b) Presentation:

The group has to prepare a power point presentation on project report, project and present it in front of the faculty of department along with the demonstration of the project. One copy of the report should be submitted to Institute/ Department, One copy to Guide and one copy should remain with each student of the project group.

(Sample Format for Project Work Diary):

Project Progress Sheet

Activity Week: Date from…… to……..

Description of the Work Performed by the student:

(Literature Survey /Design/ Drawings /Purchase/ Manufacturing / Testing/Data Collection/Analysis/Algorithm/Flowchart/Simulation)

……

Space for Drawings:

Constraint / Problem Found:

……

……

……

Activity to be carried out in next week:

……

……

Remarks by the Guide/ Co-Guide:

……

……

……

Date: Sign of Guide/Co-Guide: