Shivaji University, Kolhapur

STRUCTURE FOR B. E. (PRODUCTION ENGINEERING) PROGRAM

Class: S. E. (Production Engg.)

SEMESTER-III

(TO BE REVISED FROM JULY 2014)

Sr. No.	Subject	Teaching Scheme Hours/week				Theory Paper Duration Hours	Examination Scheme Marks				Total Marks
		L	Pr	Tut	Total		Theory	TW	Pr	Oral	
1	Machine Tools and Processes	3	1	-	4	3	100	25	-	25	150
2	Engineering Mathematics - III	3	-	1*	4	3	100	25	-	-	125
3	Machine Drawing	2	4	-	6	4	100	25	-	25	150
4	Thermal Engineering	3	2	-	5	3	100	25	-	-	125
5	Electrical and Electronics Engineering	3	2	-	5	3	100	25	-	-	125
6	Object Oriented Programming with C++	2	2	-	4	-	-	25	50	-	75
7	Workshop Practice-III	-	2	-	2	-	-	50	-	-	50
	Total	16	13	1	30	-	500	200	50	50	**800**

L: Lecture, Pr: Practical, Tut: Tutorial, TW: Term Work, * Tutorials shall be conducted batch-wise.

SEMESTER-IV

Sr. No.	Subject	Teaching Scheme Hours/week				Theory Paper Duration Hours	Examination Scheme Marks				Total Marks
		L	Pr	Tut	Total		Theory	TW	Pr	Oral	
1	Foundry Technology	3	2	-	5	3	100	25	-	-	125
2	Advanced Machine Tools and Processes	3	1	-	4	3	100	25	-	-	125
3	Theory of Machines-I	3	2	-	5	4	100	25	-	-	125
4	Analysis of Machine Elements	3	2	-	5	3	100	25	-	25	150
5	Welding Technology	3	2	-	5	3	100	25	-	-	125
6	Computer Aided Solid Modelling	1	2	-	3	-	-	25	25	-	50
7	WS Practice-IV	-	2	-	2	-	-	25	25		50
8	Mini Project*	-	1	-	1	-	-	50	-	-	50
	Total	16	14	-	30	-	500	225	50	25	**800**

L: Lecture, Pr: Practical, Tut: Tutorial, TW: Term Work,

* Note: For Mini Project, a group of nine students shall be considered for workload purpose.

Class: T. E. (Production Engg.)

SEMESTER-V

(TO BE REVISED FROM JULY 2015)

Sr. No.	Subject	Teaching Scheme Hours/week				Theory Paper Duration Hours	Examination Scheme Marks				Total Marks
		L	Pr	Tut	Total		Theory	TW	Pr	Oral	
1	Metallurgy	3	2	-	5	3	100	25	-	-	125
2	Theory of Machines-II	3	2	-	5	4	100	25	-	-	125
3	Design of Machine Elements	3	2	-	5	3	100	25	-	-	125
4	Metrology and Quality Control	3	2	-	5	3	100	25	25	-	150
5	Metal Forming and Plastic Engineering	3	1	-	4	3	100	25	-	-	125
6	Metal Cutting Theory	3	1	-	4	3	100	25	-	-	125
7	WS & CNC Practice -V*	-	2	-	2	-	-	25	-	-	25
	Total	18	12	-	30	-	600	175	25	-	**800**

L: Lecture, Pr: Practical, Tut: Tutorial, TW: Term Work

*Note: Work load of 2 Hrs. practical per batch to be allotted to the teaching faculty member.

SEMESTER-VI

Sr. No.	Subject	Teaching Scheme Hours/week				Theory Paper Duration Hours	Examination Scheme Marks				Total Marks
		L	Pr	Tut	Total		Theory	TW	Pr	Oral	
1	Industrial Management	3	1	-	4	3	100	25	-	-	125
2	Industrial Hydraulics and Pneumatics	3	2	-	5	3	100	25	-	25	150
3	Design of Jigs, Fixtures and Dies	4	2	-	6	4	100	25	-	25	150
4	Quality Management	3	2	-	5	3	100	25	-	-	125
5	Machine Tool Design	3	2	-	5	3	100	25	-	-	125
6	CAM Laboratory	-	4	-	4	-	-	50	50	-	100
7	Research Seminar #	-	1	-	1	-	-	25	-	-	25
	Total	16	14	-	30	-	500	200	50	50	**800**

L: Lecture, Pr: Practical, Tut: Tutorial, TW: Term Work

Note: For Research Seminar, a group of nine students shall be considered for workload purpose.

Class: B. E. (Production Engg.)

SEMESTER-VII

(TO BE REVISED FROM JULY 2016)

Sr. No.	Subject	Teaching Scheme Hours/week				Theory Paper Duration Hours	Examination Scheme Marks				Total Marks
		L	Pr	Tut	Total		Theory	TW	Pr	Oral	
1	Operations Research	3	2	-	5	3	100	25	-	-	125
2	Mechatronic Systems	3	2	-	5	3	100	25	25	-	150
3	Production and Operations Management	3	2	-	5	3	100	25	-	-	125
4	Process Engineering	4	2	-	6	4	100	25	-	25	150
5	Elective-I	3	2	-	5	3	100	25	-	-	125
6	Industrial Training*	-	-	-	-	-	-	25	-	25	50
7	Project Work * Phase-I	-	4*	-	4*	-	-	75	-	-	75
	Total	16	14	-	30	-	500	225	25	50	**800**

L: Lecture, Pr: Practical, Tut: Tutorial, TW: Term Work

*Note: For Industrial Training and Project Work a group of nine students shall be considered for workload purpose.

SEMESTER-VIII

Sr. No.	Subject	Teaching Scheme Hours/week				Theory Paper Duration Hours	Examination Scheme Marks				Total Marks
		L	Pr	Tut	Total		Theory	TW	Pr	Oral	
1	Costing and Cost Control	3	2	-	5	3	100	25	-	-	125
2	Industrial Engineering	3	2	-	5	3	100	25	-	25	150
3	Finite Element Analysis	4	2	-	6	3	100	25	25	-	150
4	Elective-II	3	2	-	5	3	100	25	-	-	125
5	Elective-III	3	2	-	5	3	100	25	-	-	125
6	Project Work Phase-II #	-	4	-	4	-	-	75	-	50	125
	Total	16	14		30	-	500	200	25	75	**800**

L: Lecture, Pr: Practical, Tut: Tutorial, TW: Term Work

Note: For Project Work a group of nine students shall be considered for workload purpose.

List of Elective Subjects for B. E. (Prod. Engg.) Sem. VII and Sem. VIII

Elective I: (Interdisciplinary Group)

1. Automobile Engineering
2. Energy Engineering
3. Composite Materials and Technology
4. Experimental Stress Analysis
5. Safety Engineering
6. Rapid Prototyping
7. Reliability Engineering

Elective II: (Design and Systems Group)

1. Industrial Product Design
2. Advanced Machine Design
3. Advanced Tool & Die Design
4. Material Handling Systems
5. Artificial Intelligence
6. Industrial Robotics
7. Computer Integrated Manufacturing Systems

Elective III: (Management Group)

1. Marketing Management
2. Statistics for Engineering Research
3. Materials Management
4. Project Management
5. Financial Management
6. Entrepreneurship Development
7. Supply Chain Management

EQUIVALENCE OF OLD & NEW SYLLABI (S. E.)

Old Examination	Sr. No.	Subject under Old Syllabus	New Examination	Equivalent Subject under New Syllabus
S. E. (Prod.Engg.) Sem. I	1	Engineering Mathematics-III	S. E. (Prod. Engg.)Sem. I	Engineering Mathematics-III
	2	Machine Drawing	S. E. (Prod. Engg.)Sem. I	Machine Drawing
	3	Thermal Engineering	S. E. (Prod. Engg.)Sem. I	Thermal Engineering
	4	Electrical Technology & Industrial Electronics	S. E. (Prod. Engg.)Sem. I	Electrical & Electronics Engineering
	5	Machine Tools & Processes	S. E. (Prod. Engg.)Sem. I	Machine Tools and Processes
	6	Advanced Programming Laboratory	S. E. (Prod. Engg.)Sem. I	Object Oriented Programming with C++
S. E. (Prod.Engg.) Sem. II	1	Advanced Machine Tools and Processes	S. E. (Prod. Engg.)Sem. II	Advanced Machine Tools and Processes
	2	Foundry Technology	S. E. (Prod. Engg.)Sem. II	Foundry Technology
	3	Analysis of Machine Elements	S. E. (Prod. Engg.)Sem. II	Analysis of Machine Elements
	4	Welding Technology	S. E. (Prod. Engg.)Sem. II	Welding Technology
	5	Theory of Machines - I	S. E. (Prod. Engg.)Sem. II	Theory of Machines-I
	6	Computer Aided Solid Modelling	S. E. (Prod. Engg.)Sem. II	Computer Aided Solid Modelling
	7	Work Shop Practice-IV	S. E. (Prod. Engg.)Sem. II	Work Shop Practice-IV

EQUIVALENCE OF OLD & NEW SYLLABI (T. E.)

Old Examination	Sr. No.	Subject under Old Syllabus	New Examination	Equivalent Subject under New Syllabus
T. E. (Prod. Engg.) Sem. I	1	Metallurgy - I	T. E. (Prod. Engg.) Sem. I	Metallurgy
	2	Theory of Machines – II	T. E. (Prod. Engg.) Sem. I	Theory of Machines-II
	3	Design of Machine Elements	T. E. (Prod. Engg.) Sem. I	Design of Machine Elements
	4	Metal Cutting Technology	T. E. (Prod. Engg.) Sem. I	Metal Cutting Theory
	5	Metal Forming & Plastics Technology	T. E. (Prod. Engg.) Sem. I	Metal Forming & Plastics Engineering
	6	Metrology	T. E. (Prod. Engg.) Sem. I	Metrology & Quality Control
	7	Work Shop Practice-V		Work Shop & CNC Practice-V
T. E. (Prod.Engg.) Sem. II	1	Metallurgy – II	T. E. (Prod. Engg.) Sem. II	No Equivalence, Two additional chances to be given
	2	Industrial Management	T. E. (Prod. Engg.)Sem. II	Industrial Management
	3	Industrial Hydraulics & Pneumatics	T. E. (Prod. Engg.) Sem. II	Industrial Hydraulics & Pneumatics
	4	Design of Jigs, Fixtures & Dies	T. E. (Prod. Engg.) Sem. II	Design of Jigs, Fixtures & Dies
	5	Quality Management	T. E. (Prod. Engg.) Sem. II	Quality Management
	6	Machine Tools & Product Design	T. E. (Prod. Engg.) Sem. II	Machine Tool Design
	7	Work Shop Practice-VI	T. E. (Prod. Engg.) Sem. II	CAM Laboratory
	8	Seminar	T. E. (Prod. Engg.) Sem. II	Research Seminar

EQUIVALENCE OF OLD & NEW SYLLABI (B. E.)

Old Examination	Sr. No.	Subject under Old Syllabus	New Examination	Equivalent Subject under New Syllabus
B. E. (Prod. Engg.) Sem. I	1	Operations Research	B. E. (Prod. Engg.) Sem. I	Operations Research
	2	Mechatronic Systems	B. E. (Prod. Engg.) Sem. I	Mechatronic Systems
	3	Process Engineering	B. E. (Prod. Engg.) Sem. I	Process Engineering
	4	Production & Operations Management	B. E. (Prod. Engg.) Sem. I	Production and Operations Management
	5	Computer Aided Design & Analysis	B. E. (Prod. Engg.) Sem. II	Finite Element Analysis
	6	Advanced CNC Laboratory	T. E. (Prod. Engg.) Sem. II	CNC Laboratory
B. E. (Prod. Engg.) Sem. II	1	Costing and Cost Control	B. E. (Prod. Engg.) Sem. II	Costing and Cost Control
	2	Computer Integrated Manufacturing Systems	B. E. (Prod. Engg.) Sem. II	Elective II -7. Computer Integrated Manufacturing Systems
	3	Advanced Industrial Engineering	B. E. (Prod. Engg.) Sem. II	Industrial Engineering
	4	E I- Marketing Management	B. E. (Prod. Engg.) Sem. II	E III- 1. Marketing Management
	5	E I- Entrepreneurship Development	B. E. (Prod. Engg.) Sem. II	E III-6. Entrepreneurship Development
	6	E I- Materials Management	B. E. (Prod. Engg.) Sem. II	E III- 3. Materials Management
	7	E I- Data Base Management	B. E. (Prod. Engg.) Sem. II	No Equivalence, Two additional chances to be given
	8	E I- Financial Management	B. E. (Prod. Engg.) Sem. II	E III- 5. Financial Management
	9	E I- Environment & Pollution Control	---	No Equivalence, Two additional chances to be given
	10	E I- Organizational Behaviour	B. E. (Prod. Engg.) Sem. II	No Equivalence, Two additional chances to be given
	11	E II- Flexible Manufacturing Systems	B. E. (Prod. Engg.) Sem. II	EII- 7-Computer Integrated Manufacturing Systems
	12	E II-Artificial Intelligence	B. E. (Prod. Engg.) Sem. II	E II- 5. Artificial Intelligence
	13	E II-Industrial Robotics	B. E. (Prod. Engg.) Sem. II	E II-6. Industrial Robotics
	14	E II-Low Cost Automation	B. E. (Prod. Engg.) Sem. II	No Equivalence, Two additional chances to be given
	15	E II-Material Handling Systems	B. E. (Prod. Engg.) Sem. II	E II-4. Material Handling Systems

	16	E II-Advanced Foundry Technology	B. E. (Prod. Engg.) Sem. II	No Equivalence, Two additional chances to be given
	17	E II-Advanced Tool & Die Design	B. E. (Prod. Engg.) Sem. II	E II- 3. Advanced Tool & Die Design

S.E. (PRODUCTION ENGINEERING) – Part I, Sem. III

1. MACHINE TOOLS AND PROCESSES

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 1 Hr. / Week/Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks
External Oral: 25 Marks

Course Objectives:

1) Study and understand the various conventional and basic machine tools and manufacturing processes carried out on these machines for different applications- outsight.
2) Identification of basic knowledge about machine tools and their overall idea of construction.
3) To study various parts of the machine tools used in manufacturing machine shops only
4) To study the constructional design aspect of various engineering machine tools only.
5) To study the assembly (Fitment of parts- detailing) of various engineering machine tools only.
6) To study assembly of various machine tools, actual fitments of components / assembly of conventional and present era machine tools.

Course Outcomes:

1) Students will be able to know various kinds of machine tools of previous and present era machine tools.
2) Students will be able to visualize positions of each components of the machine tool.
3) Students will be able to know the different components and their work contribution through different operations performed on the particular machine tool.
4) Students will be able to design/ alternate designs of the same machine tool or different machine tool.
5) Students will learn visualize and design components/ shapes demanded by the present / advanced machine tools.
6) Students will be able to process plan and manufacture the newly designed components of their own design for betterment, lesser time and economy of production.

SECTION –I

Unit No.1:- Metal cutting machines & Broaching machine

Metal cutting machines: (2)

Hacksaw, circular saw, band saw, abrasive cut off machines (general working)

Boring machines: (3)

Construction and working of boring machines, work setup and tool mountings, use of boring bar, types of boring – plain, step, recessing.

Unit No.2:- Study of center lathe

Study of center lathe: (7)

Construction and working, Types of lathe, operations performed – Turning, Facing, Step turning, Grooving, Undercutting, Taper turning, Eccentric turning, Boring, Thread cutting, Gear train calculations, Use of grinding attachment, Milling attachment

Unit No.3:- Study of Drilling machine & Turret and Capstan lathe

Turret and Capstan lathe: (3)

Construction, working, Types. Types of tool holders, Bar feeding mechanism.

Study of Drilling machine: (4)

Types- Bench, Radial, Pillar machines Construction and working, Operations – Drilling,
Reaming, Spot facing, Counter boring, Counter sinking, Tapping, Multi-spindle and Gang drilling machines (Classification only)

SECTION-II

Unit No.4:- Plain surface Generation & Boring machines

Plain surface Generation: (3)

Shaper, Planer, Slotter – construction, working and applications,
Types of these machines (Classification only)

Broaching machine: (2)

Construction and working of horizontal, vertical pull type and push type Broaching machine Use of broach head and fixtures.

Unit No.5:- Milling Machine

Milling Machine: (7)

Construction and working of Column and Knee Milling machine, Types of milling operations up milling, down milling, face milling, end milling, plain end milling, straddle milling, gang milling. Types of milling machines – horizontal, vertical, universal, duplex, triplex, Plano- milling (Classification only). Milling cutters – types and use. Construction and working of head, methods of indexing and applications of dividing head

Unit No.6:- Grinding machines

Grinding machines: (7)

Grinding machines and operations - External. Internal, Centre less, Surface grinding, Grinding wheel – elements, nomenclature, types, wheel mounting, wheel dressing, wheel tracing, wheel balancing, grinding wheel balancing.

Term work:

1. At least two industrial visits to study applications related to the subject and submission of the relevant reports.
2. Center lathes (Calculation and creation of setup for a taper turning exercise. Each group of about five students should create a setup for a different exercise along with submission of schematic sketch and description.)
3. Milling machines - Setting up of indexing mechanism on Universal Dividing Head for one exercise (Each group of about five students should create a setup for a different exercise along with submission of schematic sketch and description.

Study of construction, working mechanism and applications of any two of the following

4. Grinding Machines
5. Drilling Machines
6. Shaping Machines
7. Planing Machines

Recommended Text Books:

1. Workshop Technology Vol. I & II by Hajra Chaudhary, (Media Promoters & Publishers Pvt. Ltd. Mumbai)
2. Workshop Technology Vol. I , II and III by W.A.J. Chapman, (ELBS)
3. Manufacturing Processes & Systems by Phillip F. Ostwald & Jairo Minoz (John Willey & Sons.)
5. Manufacturing Processes by Begeman Amstead, (Wiley.)
6. Manufacturing Processes by Rusinoff, (Tata McGraw Hill Publishing Co. Ltd.)
7. Advanced Manufacturing Technology by Kalpakjian (Addison Wesley)
8. Manufacturing Technology – Metal Cutting & Machine Tools by P. N. Rao (TMH)
9. Workshop Technology Vol. II by Bawa H. S. (TMH)

Reference Book:

1. Production Technology – HMT Handbook (HMT)
2. Production Technology by Jain Gupta, (Khanna Publishers, New Delhi)
3. Ghosh and A. K. Malik, Manufacturing Science, Affiliated East West Press Pvt. Ltd., New Delhi, 2008.
4. H. El Hofy, Fundamentals of Machining Processes, Taylor and Francis, 2006.
5. G. C. Sen and A. Bhattacharyya, Principles of Machine Tools, New Central Book Agency (P) Ltd., Calcutta, 2nd Revised Edition, 2009.
6. V. K. Jain, Advanced Machining processes, Allied publishers, New Delhi, 2008.
7. J. A. McGeough, Advanced methods of machining, Chapman & Hall, London, 1st Edition, 1988

S.E. (PRODUCTION ENGINEERING) – Part I, Sem. III

2. ENGINEERING MATHEMATICS – III

Teaching Scheme	**Examination Scheme**
Lectures : 3 hours/week	Theory : 100 marks
Tutorial : 1 hour/week	Term work : 25 marks

Course Objectives:

1) The main aim of the course is to develop abstract, logical and critical thinking and the ability to reflect critically upon their work.
2) To study various mathematical tools available for analysis and design of engineering systems.
3) The main purpose of the course is to provide students with skills in statistics, integral transforms, vector calculus, differential equations and numerical solutions to differential equations which could enable them to devise engineering solutions for given situations they may encounter in their profession.
4) The student must be able to formulate a mathematical model of a real life and engineering problem, solve and interpret the solution in real world.

Course Outcomes:

After undergoing this course the candidates shall be able to apply the concepts of statistics, integral transforms, vector calculus, differential equations and numerical solutions to differential equations in their professional courses.

1) After completing this course, the student shall be familiar with and be able to:

2) Solve linear differential equations with constants coefficients and apply them to realistic problems.
3) Find directional derivatives of functions of two or three variables.
4) Apply knowledge of vector differentiation to find curl and divergence of vector fields.
5) Apply probability distributions to find probabilities.
6) Express the given function in Fourier series.
7) Find analytic and numerical solution to partial differential equations.

SECTION-I

Unit 1 Linear Differential Equations: [7]

1.1 Linear Differential Equations with constant coefficients Definition, Complementary function and Particular integral (without method of variation of Parameters).

1.1 Homogeneous Linear differential equations.

Unit 2 Applications of Linear Differential Equations with constant coefficients: [8]

2.1 The Whirling of Shafts.

2.2 Mass – spring Mechanical system

2.2.1 Free oscillations

2.2.2 Damped Oscillations

2.2.3 Forced oscillations without damping.

Unit 3 Probability Distributions: [6]

3.1 Random variable

3.2 Binomial Distribution

3.3 Poisson Distribution

3.4 Normal Distribution

SECTION-II

Unit 4 Vector Differential Calculus: [6]

4.1 Differentiation of vectors

4.2 Gradient of scalar point function and Directional derivative

4.3 Divergence of vector point function and Solenoidal vector fields.

4.4 Curl of a vector point function and Irrotational.

Unit 5 Fourier series: [6]

5.1 Definition, Euler's Formulae.

5.2 Functions having points of discontinuity

5.3 Change of interval

5.4 Expansion of odd and even periodic functions

5.5 Half range series.

Unit 6 Application of Partial differential equations: [7]

6.1 The Wave Equation.

6.1.1 The method of separation of variables.

6.1.2 Fourier Series solution of wave equation.

6.2 One dimensional heat flow equation

6.2.1 The method of separation of variables.

6.2.2 Fourier Series solution of wave equation.

6.3 The Laplace equation in two dimensional heat flow (Steady State).

6.3.1 Solutions of Laplace equations by the Gauss – Siedel iterative method.

General Instructions:

1. For the term work of 25 marks, batch wise tutorials are to be conducted. The number of students per batch should be as per university pattern for practical batches.
2. Minimum number of assignments should be 8 covering all topics.

Nature of Question paper:

1. There will be two questions carrying 20 marks each and four questions carrying 15 marks each.
2. Each question should have internal option.

Reference Books:

1. A text book of Applied Mathematics: Vol. I, II and III by J. N. Wartikar & P. N. Wartikar, Vidyarthi Griha Prakashan, Pune.
2. Higher Engineering Mathematics by Dr. B. S. Grewal.
3. Advanced Engineering Mathematics by Erwin Kreyszig.
4. Advanced Engineering Mathematics, by H. K. Das (S. Chand Publication.)
5. Advanced Engineering Mathematics, by Merle C. Potter (OXFORD University Press)

S.E. (PRODUCTION ENGINEERING) – Part I, Sem. III

3. MACHINE DRAWING

Teaching Scheme:	Examination Scheme:
Lectures: 2 Hrs/ Week	Theory Paper (4 Hours): 100 marks
Practical: 4 Hrs/ Week/ Batch	Term Work: 25 marks
	External Oral Exam: 25 marks

Course Objectives:

1) Understanding, preparation and reading of 2D drawings of various machine parts and assemblies used in industry.
2) To develop primary knowledge of working drawings.
3) To develop skills to produce assembly and detail drawings of machine parts.

Course Outcomes:

1) Read and interpret engineering drawings.
2) Represent machine components using standard conventions.
3) Selection of required fits and tolerances for the designed components.
4) Draft 2D drawings of assembly and details of systems, along with preparation of bill of materials.
5) Free hand sketching of engineering components.

SECTION-I

Unit 1

1.Study of I.S. conventions: (4)

Designation of drawing sheet sizes according to ISO A-series.Title block details and sizes. Screw thread terminology. Various parts of screw threads. Forms of screw threads. Conventional representation of threads

[internal & external].Different types of nuts and bolts, studs, set screws, cap screws, lock nuts, washers and split pins. To draw views of hexagonal, square nuts and bolts according to scale. IS conventions for- chamfers, tapped and drilled holes, slope and taper & welded joints, countersunk and counter bores. Conventions for showing different metals and materials on drawing. IS conventions of different types of gears like spur gears, helical gears, worm & worm wheel, bevel gears and rack & pinion. Conventions of different types of springs like helical spring, disc spring, spiral spring and leaf springs. Conventions for splined and serrated shafts. Conventions for straight & diamond Knurling, broken ends of shafts and rods. I.S. conventional representation of ball and roller bearings. Identification of bearings with reference to manufacturing catalogues.

Unit 2

2. Dimensioning with tolerances: (4)

Study of Limits, Fits and Tolerances. Hole base and shaft

base system for selection of fits. Selection of class and grade of hole & shaft by using hole base system and shaft base system. Designation of fundamental deviation, types of fits and selection of fits between various parts.

Unit 3

3. Assembly and details of general units: (4)

Meaning and use of machine drawing. Purpose of making assembly and detail drawings. Classification of machine drawing production drawings, working drawings. Practice in making assembly and detail drawings of units consisting of not more than 8 to10 parts [excluding fasteners], giving dimensions with limits fits and tolerances. (Indicative list for assembly, details drawing) Engine parts and other machine parts – stuffing boxes, cross heads, Eccentrics, connecting rod, Piston assembly, Screws jacks, Machine Vices, Tailstock, Crane hook, Simple drill jig & milling fixture, simple press tool assembly, Tool holders etc.

SECTION-II

Unit 4

4. Free hand sketching: (4)

To draw free-hand proportionate sketches of the machine parts like-

4.1 All types of taper and parallel keys. Flanged coupling, protected type flanged coupling, muff coupling, solid coupling, pin type flexible coupling and universal coupling.

4.2 Flat belt pulleys, V-belt pulleys, rope pulleys and fast and loose pulleys.

4.3 Simple solid bearing, bushed bearing, pedestal bearing, foot step bearing.

Unit 5

5. Preparation of working drawings: Preparation of working drawings of units and assemblies showing: (4)

Geometrical requirements like surface finish, flatness, straightness, parallelism, perpendicularity, concentricity, etc. Machining symbols, welding symbols, and other Surface texture, roughness values (Ra) and roughness grade numbers.

Unit 6

5) Interpenetration of solids- (4)

Introduction, interpenetration of prism with prism, prism with cylinder, prism with cone, prism with pyramid, (prism and pyramid limited up to rectangular), cylinder with cylinder , cone with cylinder

Components mentioned above to be shown to the students before they draw it for understanding practical applications.

Term work:

Each candidate has to draw following submission sheets on A-2 size drawing sheets-
1. IS conventions mentioned in topic 1.
2. Drawing details and assembly by taking actual measurements.
3. One sheet showing assembly from given details showing limits, fits. (Given problem of details to be attached and need not be drawn. Extensive practice sheets required)
4. One sheet showing details from given assembly showing tolerances. (Given problem of assembly to be attached and need not be drawn. Extensive practice sheets required)
5. Tracing and taking out ammonia print of details or assembly drawing.
6. One sheet based on preparation of working drawings of simple machine parts, showing machining symbols, geometrical requirements, surface finish, welding symbols etc.
7. One sheet based on free hand sketching of machine parts mentioned in topic 4.
8. One sheet based on interpenetration of solids.

Oral Examination:
External oral will be conducted based on term work and above syllabus.
Note: Stress should be given on reading of "Industrial Drawings" by the students; and the same should be considered during external orals.

Reference Books:
1 IS: SP 46- Engineering drawing practice for schools and colleges, BIS Publication.
2. Graphic Science & Design by French, Vierck & Foster (McGraw Hill)
3. Production Drawing: K L Narayana, P Kannaiah,K Venketa Reddy, (New Age International)

Text Books:
1. Machine Drawing by N.D.Bhatt, (Charotar Publication, Anand)
2. Machine Drawing by N. Sidheswar, Shastri, Kanaiah, (TMH.)
3. Machine Drawing by K.L.Narayanan., (New Age International Publishers)
4. Machine Drawing by R.K.Dhavan, G.R. Nagpal, (S. Chand & Co.)
5. Machine Drawing by P.S. Gill, (S. K. Kataria, Delhi)
6. Engineering drawing by N. D. Bhatt, (Charotar Publication, Anand)

S.E. (PRODUCTION ENGINEERING) – Part I, Sem. III

4. THERMAL ENGINEERING

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

Examination Scheme
Theory Paper(3 Hrs): 100 Marks
Term Work: 25 Marks

Course Objectives:

1. To apply the fundamentals of thermodynamics to various power producing and power absorbing devices.
2. To analyze the performance of thermodynamic systems and understand their applications.

3. To understand the basic modes of heat transfer and applications of the same.
4. To understand the use of steam for power generation and process heating.
5. To become familiar with the working of air standard cycles and application of the same.
6. To get acquainted with the basic principles of refrigeration and air-conditioning.
7. To understand the basic concepts of air compressors.

Course Outcomes:

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

1. Implement the laws of thermodynamics to various power producing and power absorbing devices.
2. Comprehend the application of the modes of heat transfer to devices such as heat exchangers.
3. Understand the use of steam for power generation, process heating and relevant calculations for the efficiency of a power plant.
4. Analyze IC engines and evaluate their performance using relevant parameters.
5. To understand the working of refrigeration systems and measure their performance.
6. To get acquainted with air conditioning systems and the determination of physical and thermodynamic properties of gas vapor mixtures.
7. To evaluate an air compressor and the methods of enhancing efficiency (multi-staging)

SECTION-1

UNIT 1

Thermodynamics (6)

Limitations of the frst law of thermodynamics, Second Law, Clausius Statement, Kelvin - Planck statement, Equivalence of the two statements, Corollaries of the second law, Refrigerators and Heat pumps, Reversibility and irreversibility, causes of irreversibilities, Carnot Theorem, Phase property diagram.

UNIT 2

Vapour Power Cycles (9)

Properties of steam, Ideal Rankine Cycle, Thermal efficiency,

Nozzles

Flow of steam through Nozzles, critical pressure ratio, maximum discharge, effect of friction, calculation of throat and exit areas, nozzle efficiency, Use of Mollier Chart

Turbines and Condensers

Introduction to steam turbine, Types, Compounding Introduction to condensers, Types

UNIT 3

Heat Transfer (5)

Modes and laws of heat transfer, steady state heat conduction, thermal resistance, Insulating materials, Heat Exchangers - Classification and Types

SECTION-II

UNIT 4

Internal Combustion Engines (8)

Analysis of air- standard Otto, Diesel and Dual combustion cycles, Mean effective pressure, Classification of IC engines, Construction and working of two stroke, four stroke, S.I and C.I engines, Systems for IC engines - Cooling and lubrication system, Governing of IC engines, Performance of IC engines - IP, BP, Thermal

efficiency, Specific fuel consumption, Heat balance, Applications and Testing of IC engines.

UNIT 5

Compressors (5)

Applications of compressed air, Classification of air compressors, Thermodynamic analysis of single stage and multi stage reciprocating air compressors without clearance volume, Work and power calculations, Volumetric efficiency, FAD, Construction and working of Centrifugal and Axial flow air compressor

UNIT 6

Refrigeration and Air conditioning (7)

Applications of refrigeration, Reversed Carnot Cycle, Bell Coleman Cycle, Analysis of Simple Vapour Compression Cycle, Representation on T-S and P-H diagrams, COP and power calculations, Introduction to Vapour Absorption Cycle, Types and properties of refrigerants, Eco-friendly refrigerants,
Psychrometry - basic concepts, terms and processes
Summer, Winter and Industrial Air conditioning Systems.

Term Work

1. Study of constructional details of boilers.
2. To determine the thermal conductivity of a metallic rod.
3. To determine experimental heat transfer coefficient for natural convection.
4. A trial on IC engine to determine Brake specific fuel consumption (BSFC) and thermal efficiency.
5. A trial on reciprocating air compressor to determine isothermal and volumetric efficiency.
6. Industrial visit to study refrigeration / air conditioning plant and submission of relevant report.
7. Visit to a steam power plant to understand the working of its primary constituents and submission of relevant report.
8. Determination of COP of a vapour compression refrigeration system.

Text Books:

1. Basic and Applied Thermodynamics by P.K.Nag (TMH).
2. Thermal Engineering by R.K. Rajput (Laxmi Publications).
3. Thermal Engineering by P.L. Ballaney (Khanna Publishers).
4. Thermal Engineering by B.K. Sarkar (TMH).
5. Thermal Engineering by Kodandaraman (New Age International Publication).

Reference Books:

1. Thermodynamics - an engineering approach by Y.A. Cengel (TMH).
2. Heat Transfer by Holman J.P (TMH).
3. Basic Refrigeration and Air conditioning by Ananthanarayanan (TMH).
4. I.C. Engines by Mathur and Sharma (Dhanpat Rai and Co.).
5. Heat Transfer by S.P. Sukhatme (Orient Longman).
6. Power Plant Engineering by Domkundwar (Dhanpat Rai and Co.).
7. Basic Engineering Thermodynamics by Rayne Joel (ELBS).

S.E. (PRODUCTION ENGINEERING) – Part I, Sem. III

5. ELECTRICAL AND ELECTRONICS ENGINEERING

Teaching scheme:
Lectures: 3 hrs/week
Term Work: 2 hrs/week

Exam scheme:
Theory Paper: 100 marks
Term Work: 25 marks.

Course objective :
To obtain necessary and broad knowledge of electric machines and electronics useful in the field of production engineering.

Course outcome :

1) After completion of this course the students shall be able to make use of electric machines for a certain requirement in production engineering area.
2) The students shall also be prepared to work in interdisciplinary fields.

SECTION-I

Unit 1 : (6 hrs)
D C Motor: Construction, working, types, back emf, speed equation, torque equation, speed torque characteristics, power losses, applications, Need of starter, 4 point starter, reversal of rotation, Electric braking*(Numerical treatment)

Unit 2: (6 hrs)
3 phase induction motor: Construction, working, types, speed equation, torque equation, speed torque characteristics, power losses, applications, Need of starter, star delta starter, DOL starter, autotransformer starter, rotor resistance starter, reversal of rotation, Electric braking*(Numerical treatment)

Unit 3 : (6 hrs)
Electric drive and their control – group drive, individual drive, multimotor drive. Selection of a drive for different types of mechanical load(Based on speed-torque variation, based on duty period, active/passive. Determination of power rating of an electric motor for continuous duty-constant load.Speed control* of D.C. motor, Speed control of 3 phase induction motor - voltage control*, VFD control*, rotor resistance speed control, (Numerical treatment)

SECTION-II

Unit 4: (6 hrs)
Solid state switches- Switching phenomenon in diode, SCR, BJT, IGBT, MOSFET, triac. Electronic controllers* - AC to DC converter(1 quadrant, 2 quadrant, 4 quadrant), Dc to DC converter (1 quadrant , 2 quadrant), DC to AC converter(Inverter) for voltage and frequency control. (Numerical treatment)

Unit 5: (6 hrs)
Sensors and transducers- Parameters, Classifications, resistance transducers, inductance transducers, capacitance transducers, proximity sensors, rotary incremental encoder, tachogenerator, ultrasonic flow meter, torque measurement using strain gauge.

Unit 6 : (6 hrs)
Electric heating- Construction and working of indirect resistance furnace, salt bath electric furnace, 3 phase direct arc furnace, indirect arc furnace, Ajax Wyatt induction furnace, coreless induction furnace, High frequency eddy current heat treatment. (Numerical treatment) (Topics marked by * are co-related.)

Term Work :

Minimum 8 experiments based on following topics:

1. Speed control of d c motor and 3 phase induction motor
2. Reversal of rotation of d c motor and 3 phase induction motor
3. 4 point starter and induction motor starter
4. Electronic controllers
5. Measurement using sensors / sensor parameters
6. Switching action of s s switches / characteristics of s s switching devices.
7. Energy calculations for electric furnace.
8. Industrial visit to study electric furnace.

Text Books:

1. Electrical Technology (Vol. II)- B. L. Theraja , S. Chand Publ.
2. Utilllization of Electric power- R.K.Rajput, Laxmi Publ.
3. Mechatronics – M D Singh, J G Joshi, PHI
4. Power electronics - P C sen

Reference Books:

1. Electrical power – S. L. Uppal, DBS Publ
2. Mechatronics-Integrated Mechanical Electronic Systems- Ramchandran, Vijayraghavan, Balsundaram, Wiley India.

Instruction to paper setters:

The question paper will contain one question on each unit.

S.E. (PRODUCTION ENGINEERING) – Part I, Sem. III

6. OBJECT ORIENTED PROGRAMMING WITH C++

Teaching Scheme:
Lecture : 2 Hrs./Week
Practical : 2 Hrs. / Week / Batch

Examination Scheme:
Term work : 25 Marks
Practical : 50 Marks

Course Objectives:

1) To understand basic concepts of C++ language.
2) To develop programming skills using object oriented programming with C++.
3) To develop basic skills of office automation.

Course Outcomes:

1) Student will be able to create program using C++ language.
2) Student will be able to create document, data spread sheet using MS-Excel.
3) Increase in logic development capability of student .

Unit 1. Introduction to C++: (5 Hrs)

Introduction, Applications of C++, C++ statements, Structure of C++ program, Keywords, Identifiers and Constants, Basic Data Types, User Defined Data Types, Derived Data Types.Arrays - One dimensional and two dimensional.

Unit 2. Functions: (4 Hrs)

Function types, Recursive function, Function & Arrays, Function with default argument

Unit 3. Pointers, Virtual Function & Polymorphism: (6 Hrs)

Declaration, Pointer arithmetic, Pointers & functions, Pointers to a function, Pointer & arrays, Virtual Function and Pure virtual function, Function Overloading, Operator Overloading.

Unit 4. Inheritance, File Handling ,Templates and Exception Handling: (6 Hrs)

Forms of Inheritance, Direct & Indirect base class, Types of derivations (public, private, protected), Opening file, writing data, reading data, closing file, file copy, file opening modes, Templates, Function template, Class template, Exception handling.

Unit 5. Introduction to Data Structures in C++: (4 Hrs)

Introduction to Stack, Queues and Linked List.

Unit 6. Excel Worksheet: (2 Hrs)

Use of formulas, functions, graphs, Types of charts, using filters.

Term Work

1) Development of minimum two Programs on each unit.
2) Development of minimum two data spread sheets.

Practical Examination: (One candidate on one PC terminal) **Duration: 3 Hrs.**

1) At least one program in C++ to be compiled and executed **20 marks**
2) Followed by Oral Examination in C++ **20 marks**
3) At least one exercise on use of Spreadsheets (eg. Excel) **10 marks**

Total: 50 marks

Text Books:

1) Let Us C++ ----Yashwant Kanetkar (BPB Publications)
2) Mastering C++- K. R. Venugopal (Tata McGraw Hill)
3) Programming with C++ -Ravichandran (Tata McGraw Hill)
4) Help Manuals of MS-EXCEL

Reference Books:

1) Object Oriented Programming –E.Balgurusamy (TMH)
2) Programming with C++ --Hubbard (Schaum Series) Tata McGraw Hill
3) Waite Group's Object Oriented Programming in C++, Robert Lafore, Galgotia

S.E. (PRODUCTION ENGINEERING) – Part I, Sem. III

7. WORKSHOP PRACTICE-III

Teaching Scheme:
Practical: 2 Hrs/Week/Batch

Examination Scheme:
Term work: 25 Marks

Course Objective:
To practice basic metal cutting processes and acquire elementary skills.

Course Outcomes:
After completion of this course a student shall be able to perform basic metal cutting processes and acquire elementary skills to produce the specified jobs.

Term Work

1 Machine shop – Two jobs (Mating parts).

Job 1- 12 Marks.
Facing, Plain turning, Step turning, External taper turning, External threading, knurling, Parting-off,

Job 2- 8 Marks.
Facing, Plain turning, Drilling, boring, Internal threading.
2 Hand forging and grinding of dummy tools 5 Marks.

Note:-
1 Students should prepare setup wise working drawing showing all the details in work diary.
2 Dimensional accuracy is of prime importance.
3 Student must maintain work diary showing regular progress in the semester.
4. Assessment of the term work should be carried out considering the above points.

S.E. (PRODUCTION ENGINEERING) – Part II, Sem. IV

1. FOUNDRY TECHNOLOGY

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

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Internal Term work: 25 Marks

Course Objectives:
1) Understand the basic casting process, sequence of operations be followed through design of pattern and gating system.
2) Gain fundamental knowledge of various traditional and special casting processes.
3) Understand cause and effect of various defects in casting.
4) Understand optimizing yield though use of casting simulation software

Course outcome*:*
1) Understand activities related to converting raw material in to a finished product.
2) Apply their knowledge of CAD/CAM in designing and manufacturing pattern and dies.
3) Understand means of improving casting yield.

SECTION-I

Unit 1 Overview of Metal Casting Technology:

Introduction **(2)**

- Importance of casting process as a manufacturing process
- Advantages and disadvantages of casting process
- Classification of foundries based on different criteria
- Flow chart describing basic steps & major foundry activities
- Layout of different types of foundries
- Introduction to different ferrous and non-ferrous cast alloys and their applications

Unit 2 Introduction to Foundry Tooling:

Patterns, core boxes and dies. **(3)**

- Types of patterns
- Material used for pattern making
- Tools for pattern making
- Criteria for selection of pattern material
- Functions of patterns, core boxes and dies
- Design and layout of patterns, core boxes and dies
- Application of allowances and selection of parting line
- Use CAD- CAM in Designing and manufacturing of patterns

Unit 3 Gating and Risering System, Sand Conditioning

(3a) Gating and Risering system **(4)**

- Components of gating system,
- functions and importance
- design parameters of gating system
- Gating ratio,
- Pressurized and un-pressurized gating systems.
- Risers, functions and modulus.
- Directional solidification,
- Methods of improving casting Yield
- Numerical treatment to be given to design of and gating system and riser design.
- Use of simulation software for designing, optimization of gating, risering.

(3b) Sand Molding, core making: **(6)**

- Sand mullers and mixers, continuous and intensive mixers, sand slinger
- Sand conditioning and sand reclamation.
- Green sand mixes.
- Ingredients of green sand and their effect on properties of green sand like – Strength, Permeability, Compatibility, Permeability, Wet-tensile, Friability, and Collapsibility.
- Introduction to resin sands – Alkyd resins, Phenolic resins, Furan sands
- Hand molding tools and machine molding machines.
- High pressure line, disamatic (flask less) and shell molding, magnetic molding, vacuum "V" molding process, cosworth molding process, CO2 molding, "N" Process.

- Simple sand mixes for core making,
- Oil sand, cold box processes,
- Shell core making. Core shooters for shell core making and cold box
- Core assembly, Use of core prints and chaplets, Core and mould venting

SECTION-II

Unit 4 Special casting technology

Introduction to special casting techniques **(4)**

- Investment, full mold, ceramic castings and their applications.
- Squeeze casting, vaccume casting, slush casting, Centrifugal casting and Die casting Types and applications

Unit 5 Melting technology

Melting practices **(8)**

- Types of melting furnaces: Cupola: construction and working of cupola, lining material, Raw material for melting, Charge calculations (numerical treatment), Latest designs and modifications in cupola melting. Rotary furnaces, Oil fired furnaces. Electric furnaces– Induction and arc furnaces (Construction, working, applications and selection parameters for furnaces)
- Composition, physical properties and applications of ferrous and non-ferrous castings – Grey cast iron, S. G. iron, White cast iron, malleable cast iron, Al,Cu,Mg based alloys.

- Importance and methods of inoculation in cast irons and De-oxidation practices in steel castings.
- Degassing and modification treatments in aluminum, copper and magnesium alloy castings.
- Ladles – Types, Use, Lining materials. Automatic ladle system
- Instruments for process control: Composition tests – CE meter, Wedge test, Fluidity test, Wet chemical analyses, and Spectrometers. Temperature tests – Pyrometers
- Maintenance and energy saving concepts

Unit 6 Post melting operations

Fettling and cleaning of castings **(2)**

- Knock out, Cutting of in-gates, Risers
- Shot blasting
- Finishing by using pneumatic chippers and grinders
- Salvaging of castings

Defects, inspection and testing of castings **(3)**

- Casting defects –Analyses and remedies.
- Testing of strength and hardness
- Non-destructive testing of castings-Visual and dimensional inspections, dye penetrant test, magnetic particle inspection, ultrasonic test, Leak test.
- Casting rejection analysis

Heat treatment and painting of castings: **(2)**

- Purposes, methods.(Annealing, normalizing, hardening and stress relief hardening)
- Age hardening of Al alloy castings
- Painting of castings: Purpose types and methods of painting of castings

Pollution and safety in foundries **(2)**

- Possible hazards in foundries,
- Safety measures, Safety devices
- Types and sources of pollution in foundries,
- Measures for pollution control

Term Work:

1. Two industrial visits one each to a ferrous and a non-ferrous foundry to study foundry practices and submission of the relevant report.
2. Drawing sheet based on Design of pattern, Pattern layout, Pattern allowances, Selection of parting line, gating and risering system design.
3. Pattern making based on the exercise no. 2 above. (4 practical turns for pattern making job in pattern shop)
4. Study of types and different tests on raw and prepared sand.
5. Sand tests of minimum three types (Sieve analyses, Sand preparation, green/dry Strength, clay content, moisture content, Mould and core hardness)
6. Study of types of molds and cores.
7. At least one simple exercise for pattern making and metal pouring for the same separately for a group of about five students.
8. One presentation of 10 minutes by each student related to the subject and submission of the write up on the presentation. (Optional)

Recommended Text Books:

1. Manufacturing Technology: Foundry, Forming & Welding by P. N. Rao (TMH)
2. Metal Casting – Principles & Practice by T. V. Rama Rao (New Age International Pvt. Ltd.)
3. A Text Book on Foundry Technology by M. Lal, O. P. Khanna(Dhanpat Rai & Co.)
4. A Course on Workshop Technology – Vol. 1 by B. S. Raghuvanshi; (Dhanpat Rai & Co.)
5. Fundamentals of Metal Casting by P. C. Mukharjee (Oxford & IBH Publishing Co).
6. Principles of Foundry Technology by P. L. Jain (Tata McGraw Hill)
7. Foundry Practice by N. D. Titov (MIR)
8. Foundry Engineering by Taylor, Flemings, Wulff (Wiley Eastern Ltd.)
9. Principles of Metal Casting by Heine, Loper, Rosenthal

Recommended Reference Books:

1. Casting Technology And Casting Alloys by A.K.Chakrabarti, (PHL Learning Pvt Ltd.)
2. Iron and steel making by Ahindra Ghosh, Amit Chatterjee (PHL Learning Pvt Ltd.)
3. Complete Casting Handbook-Metal Casting Processes, Metallurgy, Techniques & Design by John Campbell (BH Publication)
4. The FOSECO Foundry man's handbook 10^{th} edition by Butter Worth-Heinemann (BH Publication)

S.E. (PRODUCTION ENGINEERING) – Part II, Sem. IV

2. ADVANCED MACHINE TOOLS & PROCESSES

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 2 Hr. / Week/Batch	Term work: 25 Marks

Course Objectives:

1) Study and understand the various nonconventional and CNC machine tools and manufacturing processes carried out on these machines for different applications- outsight.
2) Identification of basic knowledge about Composite material and Manufacturing Processes for composites material.
3) Identification of basic knowledge about advanced machine tools and their overall idea of construction.
4) To study various parts of the machine tools used in manufacturing machine shops only
5) To study the constructional design aspect of various engineering machine tools only.
6) To study the assembly (Fitment of parts- detailing) of various engineering machine tools only.
7) To study assembly of various machine tools, actual fitments of components / assembly of conventional and present era machine tools.

Course Outcomes:

1) Students will be able to know various kinds of machine tools of previous and present era machine tools.
2) Students will be able to visualize positions of each components of the machine tool.
3) Students will be able to know the different components and their work contribution through different operations performed on the particular machine tool.
4) Students will be able to design/ alternate designs of the same machine tool or different machine tool.
5) Students will learn visualize and design components/ shapes demanded by the present / advanced machine tools.
6) Students will be able to process plan and manufacture the newly designed components of their own design for betterment, lesser time and economy of production.

SECTION-I

1. Unit no:1 Non-Conventional Machining Processes and Rapid manufacturing

Non-Conventional Machining: (5)

Importance & scope of various non-conventional machining processes like Electro-Chemical machining (ECM), Electro-Discharge machining (EDM), Wire Electro-Discharge machining (WEDM), Abrasive Jet Machining (AJM), Laser Beam Machining (LBM), Ultrasonic Machining (USM**),**Abrasive water Jet Machining (AWJM), Photochemical machining(PCM)

Rapid manufacturing: (2)

Definition of rapid manufacturing, Process overviews, Selective Laser Sintering, Fused deposition modeling, Laminated object manufacturing, Laser powder forming.

2. Unit no: 2 Gear Manufacturing: (6)

Gear Manufacturing – Different methods of gear manufacturing (for Spur, Helical, Bevel Gears), Casting, Rolling, Extrusion, Stamping, Powder Metallurgy of Gears, Machining of Gears (Forming, Template generating). Gear finishing by Shaving, Lapping, Grinding, and Burnishing.

3. Unit no:3 Thread manufacturing processes & Super Finishing processes

Thread manufacturing processes: (3)

Thread Cutting on Lathe, Thread milling, Thread Grinding, Thread Whirling, Thread Rolling, Use of Chasers & Dies for thread manufacturing.

Super Finishing processes: (3)

Working, Scope & Importance – Lapping, Honing, Burnishing, Buffing, Electro polishing, Polishing & allied processes.

SECTION-II

4. Unit no: 4 Introduction to Computer Numerical Control

Computer Numerical Control: (5)

Principle of Operation of Numerically controlled (NC) machine tools, control of axis motion, Advantages and limitations, Computer Numerical Control (CNC)– advantages over NC machine tools, Types of controls in CNC:- Point-To-Point (PTP), Para-axial, 2 axis and 3 axis Continuous Path, Closed and Open Loop; CNC elements:- structure, spindle, Drives- DC & AC Servomotors, Stepper Motors, Linear Motors, Lead screws and ball screws, Feedback Devices, Coordinate system and Axis nomenclature

5. Unit no: 5 Introductions to CNC Machining Centers & Turning Centers

CNC Machining Centers: (5)

Types and construction:- Vertical-Traveling Column, Gantry type, Multiple spindle; Horizontal, Use of rotary table, Types of Operations on VMC and HMC, Pallets and pallet changers, Tools for machining centers- Tool Holder (Adaptor), Retention knob, Collets, Various cutting tools and materials- HSS, Solid carbide, indexable insert type, Cemented carbide, coated carbide, ceramics, Concept of Tool Presetting, Tool Magazines, Automatic Tool Changer

CNC Turning Centers: (4)

CNC Lathes, Types and construction, Slant bed, Vertical, Twin turret, Multiple Spindle; Tool Turret, Feed and indexing, Turn-mill centers, Live spindle tool adaptors, Types of operations on Turn-mill centers, Coordinate system for CNC lathes, Work Holding, Tools for CNC Lathes, ISO coding system for turning tools and inserts

6. Unit no: 6 Composite material & CNC Support Systems:

CNC Support Systems: (2)

Automatic Chip removal, Machine control unit (MCU), MCU operation control panel, Benefits, Control program, External inputs, External outputs, Additional programming facility, Communication, Tool Management, Graphic Proving, Concept of a CNC Part Program

Composite material: (3)

Definition of composite material – Classification - Application – Merits and Demerits. Manufacturing Processes for composites such as hand lay, filament winding, pultrusion, RTM, DMC etc.

Term Work:

(To be assessed on the basis of Submission of Report of the following assignments)

1. Thread manufacturing: Calculation of Gear Trains for three different pitch values-Single and Double Start
2. Industrial visit to study Broaching, Thread Cutting and Super finishing Processes
3. Industrial Visit to study Gear manufacturing Processes, (Gear cutting on Milling/ Shaping /Hobbing, Gear Grinding)
4. Industrial visit to study Construction, Operation and accessories of VMC, HMC and Turning centers

Recommended Text Books:

1. Workshop Technology Vol. I & II by Hajra Chaudhary, (Media Promoters & Publishers Pvt. Ltd. Mumbai)
2. Workshop Technology Vol. I , II and III by W.A.J. Chapman, (ELBS)
3. Production Technology by Jain, Gupta, (Khanna Publishers, New Delhi)
4. Manufacturing Processes by Begeman Amstead, (Wiley.)
5. Manufacturing Processes by Rusinoff, (Tata McGraw Hill Publishing Co. Ltd.)
6. Fundamentals of Modern Manufacturing – Materials, Processes & Systems (2/e) by Grover, Mikell P. (John Wiley & Sons)
7. Advanced Manufacturing Technology by Kalpakjian (Addison Wesley)
8. Manufacturing Technology – Metal Cutting & Machine Tools by P. N. Rao (TMH)
9. Workshop Technology Vol. II by Bawa H. S. (TMH)
10. CAD / CAM- Principles & Application (2/e) by P. N. Rao (TMH)
11. Computer Numerical Control - Machining & Turning Centers by Quesada & Jayapoovan (Pearson)
12. CNC Machines – M. Adithan, B.S.Pabala (New Age International Publication)

Reference Books:

1. Production Technology – HMT Handbook
2. Production Technology by Jain Gupta, (Khanna Publishers, New Delhi)
3. Ghosh and A. K. Malik, Manufacturing Science, Affiliated East West Press Pvt. Ltd., New Delhi, 2008.
4. H. El Hofy, Fundamentals of Machining Processes, Taylor and Francis, 2006.
5. G. C. Sen and A. Bhattacharyya, Principles of Machine Tools, New Central Book Agency (P) Ltd., Calcutta, 2nd Revised Edition, 2009.
6. V. K. Jain, Advanced Machining processes, Allied publishers, New Delhi, 2008.
7. J. A. McGeough, Advanced methods of machining, Chapman & Hall, London, 1st Edition, 1988
8. Non Conventional Machining Processes – Prof. P.K.Mishra (IIT, Kharagpur)
9. Rapid Manufacturing: An Industrial Revolution for the Digital Age – Editors N. Hopkinson, R.J.M. Hague and P.M. Dickens, (2006) John Wiley & Sons, Ltd., ISBN-10 0-470-01613-2
10. R.F. Gibson, Principles of Composite material mechanics, McGraw-Hill, Inc, Newyork, International edition 1994.
11. Robert M Jones, Mechanics of composite material, Taylor & Francis 2nd edition, Newyork, Indian Print 2010
12. G. Benedict, Nontraditional manufacturing processes, Marcel Dekker, New York, 1st Edition, 1987.
13. D. T. Pham and S. S. Dimov, Rapid manufacturing, Springer-Verlag, 1st Edition, 2001.

S.E. (PRODUCTION ENGINEERING) – Part II, Sem. IV

3. THEORY OF MACHINES – I

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

Examination Scheme:
Theory Paper (4 Hrs):**100 Marks**
Term work: **25 Marks**

Course Objective:

1) To be familiar with common mechanisms used in machines and everyday life.
2) To provide basic concept of kinematics and kinetics of machine elements.
3) To develop the ability to understand the concepts of mechanisms and the kinematic analysis of mechanisms.
4) To study basics of power transmission.

Course Outcomes: Learner shall be able to:

1) Define various components of mechanisms.
2) Construct/Compose mechanisms to provide specific motion.
3) Draw velocity and acceleration diagrams of various mechanisms.
4) Construct CAM profile for the specific follower motion.
5) Select appropriate power transmission mechanism.

SECTION-I

Unit 1

Introduction: **(4 hours)**

Theory of machines – scope, definitions-machine, mechanism, link, kinematic pair, degrees of freedom, mobility criteria, classification of kinematic pairs, conversion, inversion and expansion of mechanism, study of four bar chain, single slider and double slider crank chain and is inversions.

Unit 2

Kinematic Analysis of Mechanisms:

2.1 Velocity Analysis **(6 hours)**

Concept of position, displacement and velocity of a point and link of a given mechanism, Kinematic analysis of mechanisms by - Relative velocity method, graphical method, (mechanisms up to 6 links) Instantaneous Center method, (mechanisms up to 4 links) (Numerical treatment expected)

2.2 Acceleration Analysis **(6 hours)**

Concept of acceleration of a point and link of a given mechanism, Kinematic analysis of mechanisms by Relative method, graphical method, Corioli's Component of Acceleration , Klein's construction (Numerical treatment expected)

Unit 3

Simple Mechanisms: **(4 hours)**

Condition for steering, Ackerman's steering mechanism, Davis steering mechanism, Hooke's Joint, Ratchet mechanism, Geneva mechanism. (Numerical treatment expected on Hooke's Joint)

SECTION-II

Unit 4

Cam and Follower: **(4 hours)**

Classification of cam and follower, Follower displacement, Simple Harmonic Motion, Constant Velocity, Uniform Acceleration and Retardation, Cycloidal motion, Graphical layout of cam, cam with specified counters.

Unit 5

Friction: **(4 hours)**

Friction, friction between screw and nut, square thread and v threads, friction in turning pairs- slider crank chain, four bar chain, friction at pivot and collar bearings uniform pressure and uniform wear theory, Greasy friction , Film Friction or Viscous Friction, Study of friction clutches. (Numerical treatment expected)

Unit 6

Belt, Rope, Brakes and Dynamometers: **(5 hours)**

6.1 Belt Drives: Types of Belt and rope drive, angular velocity ratio, effect of belt thickness, effect of slip, length of belt, angle of contact, angle of lap, law of belting, crowning of pulley, limiting tension ratio, power transmission, centrifugal tension in the belt and its effect on power transmission, initial tension and its effect on power transmission. Creep of belt (Numerical treatment expected).

6.2 Brakes and Dynamometers **(5 hours)**

Introduction, External Shoe Brakes, Block Brakes, Double Shoe Block Brake, Internal Shoe Brake, Band Brakes, Band and Block Brake, Heat Generated in Braking.(Numerical treatment expected on Brakes) Dynamometers, Absorption Dynamometers & Transmission Dynamometers.

Term Work:

1. At least one industrial visit to study applications related to the subject and submission of the relevant report. **(Compulsory)**
2. One presentation (minimum 10 minutes duration) by each student related to the subject and submission of the write up on the presentation. **(Optional)** and **Minimum seven experiments from the following list.**

1. Study of machine and mechanisms.
2. Velocity analysis. - By Instantaneous Center method
3. Velocity and Acceleration analysis. - By relative method.
4. Study of mechanisms with lower pairs.
5. Graphical layout of cam profile.
6. Study of friction clutches.
7. Study of dynamometers.
8. Study of Belt and Rope Drive.

Text Books :

01. Theory of Machines and Mechanisms, by P. L. Ballaney, (Khanna Publishers, Delhi)
02. Theory of Machines, by S. S. Ratan, (TMH)
03. Theory of Mechanism and Machines by Ghosh and Mallik (EWP)
04. Theory of machines, by Dr. R.K.Bansal, Laxmi Publication
05.Theory of Machines by R.S. Khurmi S.Chand and co.

Reference Books:

01. Theory of Machines, by Thomas Bevan, (CBS Publishers, Delhi)
02. Theory of Machines &Mechanisms,John Uiker, Garden Pennock & Late. J. F. Shigley,

03. Theory of Machines, by W. Green,
04. Kinematics of Machines by R T Hinckle (Prentice Hall Inc.)
05. Kinematics by V.M. Fairs (McGraw Hill)
06. Mechanism Design: Analysis and Synthesis Vol. I by A. Erdman and G.N. Sander (Prentice Hall)
07. Kinematics and Dynamics of Planer Mechanisms by Jeremy Hirsihham (McGraw Hill)
08. "Machines and Mechanisms Applied Kinematic Analysis", David H. Myszka, Pearson Education, Asia.
09. "Design of Machinery", R. L. Norton, McGraw-Hill.

S.E. (PRODUCTION ENGINEERING) – Part II, Sem. IV

4. ANALYSIS OF MACHINE ELEMENTS

Lectures: 3 Hrs/Week — Theory Paper (3 Hrs): 100 Marks
Practical: 2 Hrs/Week/Batch — Term work: 25 Marks
External Oral: 25 Marks

Course Objectives:

1) To study different type of stresses induced in structural parts due to loading conditions.
2) To study stress distribution diagram for various cross-sections.
3) To study different types of failures due to stresses induced and deflection.

Course Outcomes:

1) Student should able to calculate direct and indirect stresses induced due to loading conditions.
2) Student should able to select best cross-section according to stress distribution diagram.
3) Student can optimize cross-section and length from design point of view.

SECTION-I

Unit I: Concept of stress, strain and strain energy (9 hours)Types of loads, Stress, Strain, Stress – Strain diagrams, factor of safety, failure stress, working stress, Modulus of Elasticity, Rigidity, Bulk Volume, relations, Hook's law, Poisson's ratio. Strain energy: strain energy due to axial forces, strain energy in bending.

Unit II: Shear Force and Bending Moment Diagram (7 hours)
Shear force & Bending moments, Shear force and Bending moment computation and diagrams and diagram for statically determinate beams. Application for transverse point loads, UDL, UVL, Intermediate couples on simply supported and cantilever beams. Locating the place of contraflecture and maximum bending moments.

Unit III: Stresses in beams (9hours)
Theory of Bending, Flexural formula for straight prismatic beams, Role of Moment of Inertia, for economic use of materials, Neural Axis, Section modulus, moment of resistance, stresses due to bending, beams of uniform strength. Shear stresses in beams due to bending loads, Distribution of shear stresses across plane sections used for common structural purposes.

SECTION-II

Unit IV: Direct and bending stresses (4 hours)

Direct and Bending stresses: Axial loading combined with bending, eccentric loading on plane sections, core of section, middle third rule, applications to the problems of crane hooks, machine columns, brackets etc.

Unit V: Deflection of beams (6 hours)

Deflection of statically determinate beams due to bending loads, Macaulay's method. Application for simply supported and cantilever beams. Struts subjected to axial loading, end connections, Empirical design formulae, Euler's and Rankine's methods.

Unit VI: Principle stresses and principle planes (5 hours)

Principal stresses and planes, general equations for direct stresses in mutually perpendicular directions along with shear stress, Mohr's circle, determination of maximum shear stress and their planes.

Term Work:

The term work will consists of following assignments:

1. Computation of Shear force & Bending moment.
2. Computation of bending stresses.
3. Computation of shear stresses
4. Problems on deflection and slope
5. Axially loaded struts and columns.
6. Problems on principal stresses
7. Problems on Struts.

Instructions for oral examination:

1. Oral examination is based on simple concepts like stress, strain, plotting of stress distribution diagrams etc.
2. Oral examination is also based on practical implementation of Strength of Materials to Mechanical Engineering problems.

TEXT BOOKS:

1. Ferdinand P Beer and E.R. Johnston JR. John Dewolf, Mechanics of Materials 3/e,McGraw Hill Book Company
2. Timoshenko and Young. Elements of Strength of Materials, East-West Press. Pvt. Limited, New Delhi.
3. Ramamurthum, Strength of Materials, Dhanpat Rai and Sons, New Delhi.
4. Rajput, Strength of Materials, Laxmi Publication
5. S.B Junnerkar. Mechanics of structure Vol I, Publication House
6. Bansal, Charotor Strength of Materials, Laxmi Publication
7. Khurmi Gupta, Strength of Materials, S. Chand Publication.
8. E.P.Popov "Mechanics of Materials" Prentice Hall Inc.
9. Andrew P. & Singer F.L., "Strength Of Materials", Harper & Row Publishers
10. G.H. Rider. "Strength of Materials ", Mac Millan India Ltd.
11 Mechanics of Materials Hibbler 2e Pearson Education Publication

REFERENCE BOOKS:

1. Den Hartong, Strength of Materials, McGraw Hill, New York.
2. H. BURR and John Cheatam, Mechanical Analysis and Design, PHI, New Delhi.
3. Robert Norton, Machine Design, Prentice Hall

S.E. (PRODUCTION ENGINEERING) – Part II, Sem. IV

5. WELDING TECHNOLOGY

Teaching Scheme:
Lectures: 3 Hrs/ Week
Tutorial: 2 Hr/ Week/ Batch

Examination Scheme:
Theory Paper (3 Hours): 100 marks
Term Work: 25 marks

Course Objectives:

1) To gain knowledge of various types of conventional & non conventional welding processes
2) To gain knowledge of various prerequisites; critical parameters of welding process
3) To gain knowledge of selection the appropriate welding process
4) To gain knowledge of selection of appropriate welding equipment, welding electrode, flux, type of flame, filler material
5) To gain knowledge of causes of defects generated during welding process; remedies to control defects and various inspection & testing methods

Course Outcomes:

1) Students will be able to know the basics of various conventional & non conventional Welding Processes
2) Student will be able to understand advantages & limitations of welding processes and select the appropriate welding process based on application ; customer requirement and specifications
3) Student will demonstrate an ability to design of welding fixtures as per requirement and specifications.
4) Student will demonstrate an ability of inspection and testing of welded components.
5) Students will be able to know the various aspects of estimation & costing of Welding jobs

SECTION-I

Unit 1. Fundamentals and Classification of Welding Processes. (3 hours)

Introduction, classification of Welding processes. Comparison with other joining processes, advantages, disadvantages, practical applications.Welding Symbols. Basic & supplementary weld symbols, types of weld Joints, Selection of Weld Joint, and edge preparation.

Unit 2. Arc Welding Processes and Equipments (6 hours)

Definition, types of processes, Carbon Arc Welding, Flux Shielded Metal Arc Welding, Submerged Arc Welding, Tungsten Inert Gas Welding, Metal Inert Gas Welding, Electroslag Welding, Electro Gas Welding, Plasma Arc Welding , Arc Welding equipments, Electrodes Types, classification and coding of electrodes.

Unit3. (3a) Gas Welding (3 hours)

Principle of operation, types of flames, Gas welding Techniques, filler material and fluxes, Gas welding equipments, advantages and applications

(3b) Resistances welding: (3 hours)

Definition, Fundamentals, variables advantages and application, Spot Welding, Heat Shrinkage, Heat Balance Methods, Equipment, Electrodes, Seam, Projection Butt (up sets and flash), Percussion Welding – Definition, Principle of Operation, equipment, Metal Welded, advantages and application.

(3c) Soldering and Brazing (3 hours)

Definition, Comparison of Soldering, Brazing and Welding, principle, joint design, filler alloy, fluxes, processes and application.

SECTION-II

Unit 4. (4a) **Introduction to Solid State Welding Processes** (3 hours)

Cold Welding, Diffusion Welding, Ultrasonic Welding, Explosive Welding, Friction Welding, Inertia and Forge Welding – Definition, principle of operation advantages, limitation and application.

(4b) Thermal Cutting of Metal (2 hours)

Oxy-Fuel, Oxygen-Lance, Metal Powder, Chemicals Flux Cutting, Arc Cutting- Metallic, Air-Carbon, Tungsten Arc, Plasma Arc Cutting

Unit 5. (5a) Weldability: - (2hours)

Definition, effect of alloying elements, Purpose and types of tests, Hot Cracking, Root Cracking and Cold Cracking Tests.

(5b) Weld Defects & Welding Distortion:- (2hours)

Common Weld defects, Causes and remedies. Concept of distortion, Types of distortion, Control of welding distortion

(5c) Inspection and Testing of Welds (4hours)

Destructive testing of weld – Tensile, Bend, Impact, Nick Break, Hardness, Etch Tests, Non Destructive Testing of Welds – Visual, Leak, X- ray and Gamma ray Radiography, Magnetic Particle Inspection, Dye, Fluorescent Penetrant Tests, Ultrasonic Inspection & Eddy Current Testing

Unit 6. (6a) Welding Automation and Robotics:- (3 hours)

Introduction, Automation options, Simple Mechanization, Dedicated and Special Purpose Automation, Robotic welding, Modular Automation, Programmable control, Remote Control Slave and Automated Systems

(6b)Welding Fixtures (3hours)

Introduction, welding fixtures, their characteristics, classification and selection considerations, Principles governing design of good welding fixtures, various types of welding fixtures.

(6c)Estimation of Welding Cost (2 hours)

Introduction, main components costs of welding processes, factors involved in welding costs, basic costing procedure for arc welding, basic costing procedure for gas welding, factors affecting welding costs.

Term Work

The Term Work shall consist of any 5 assignments out of first seven listed below. Assignment No.8 & 9 are compulsory.

1. One Job- Butt Joint or Lap Joint by Manual Metal Arc Welding
2. One Job- Edge or corner or T Joint by Manual Metal Arc Welding
3. One Job – by using TIG or MIG welding
4. One Job – by using Gas Welding
5. One Job by using Resistance Welding
6. One Job by using soldering Method
7. Study of selection of Welding Processes
8. Design of welding fixture
9. Minimum one Industrial Visit to study advanced welding processes & submission its report.

Recommended Books

Text Books:

1. Welding Technology –O.P. Khanna (Khanna Publisher)
2. Welding & Welding Technology-by Richard Little (TMH)
3. Welding Technology –N.K.Srinivasan (Khanna Publisher)
4. Welding Processes and Technology by Dr. R.S.Parmar (Khanna Publisher)

Reference books:

1) Welding Science & Technology by Md. Ibrahim Khan (New Age International)
2) Welding Technology & Design by V.M.Radhakrishnan(New Age International Publisher)
3) Welding Guide and Handbook by- James E Brambaugh (Taraporwala Mumbai)
4) Welding by A.L. Davies – (Cambridge University Press.)
5) Welding Process Technology – P.T.Houltcroft (Cambridge University Press.)
6) Principles of Welding Technology- by L.M.Gourd (ELBS)
7) Advanced Welding systems- Vol..I ,II and III by Jeam Cornu (Jaico Publishing)
8) Arc and Gas welding- V. Rybakav (Mir Publication)
9) Practical Welding Technology- Rudy Molher (Industrial Press Inc.)
10) Manufacturing Technology: Foundry, Forming & Welding by P. N. Rao (TMH)

S.E. (PRODUCTION ENGINEERING) – Part II, Sem. IV

6. COMPUTER AIDED SOLID MODELING

Teaching Scheme:
Lectures: 1 Hr/ Week
Practical: 2 Hrs / week/Batch

Examination Scheme:
Term Work: 25 Marks
Practical Exam: 25 Marks

Course Objectives:

1) To understand concepts of CAD, and its benefits and applications
2) To understand the concept of 3D modeling and its applications in the areas of CAM & CAE
3) To create solid models, Surface models, assemblies and drafting of a part by using suitable 3D modeling software.

Course outcomes:

1) Students shall be able to generate 3D solid models using suitable 3D modeling software.
2) Students shall be able to generate Surface models using suitable 3D modeling software.
3) Students shall be able to generate assemblies of simple industrial components using suitable 3D modeling software.

1. **Introduction to CAD:** (1)

   Need for implementing CAD, Application of CAD and its benefits, Hardware Requirements, Different Software packages used for 3D Modeling. Concept of feature based and parametric modeling.

2. **Sketching:** (2)

   2D sketching of elements like line, circle, arc, spline etc. Dimensioning these elements, Geometrical constraints like parallel, perpendicular, co-incident, vertical, horizontal, tangent, symmetric etc.

3. Generation of Solid models of any five components (4)

   (Preferably 03 industrial drawing with G; D and T annotations) using any suitable 3D modeling software package. Import and export of 3D solid models between two different software packages. Physical properties like volume, surface area, center of gravity etc of solid model.

4. **Introduction to Surfacing:** (3)

   Generation of surface models of any three simple components using any suitable 3D modeling software..

5. **Assembly Modeling:** (2)

   Concept of Bottom up and top down approach, Building two composite assemblies of components (consisting at least five components) along with all relevant details, Exploded Views using assembly features in any suitable 3D modeling software.

6. **Generation of 2D Drawings:** (2)

   Generation of Orthographic views of individual components required for shop floor [working drawings] from 3D model which will include all relevant views like front, side, top, bottom views, sectional views, dimensioning, dimensional and geometrical tolerances etc. Generation of title block in sheet. Orthographic views of assembly drawings, generation of Bill of Materials (BOM). Plotting of drawings.

Term Work:

1. Creation of at least 5 solid models using solid modeling features available in any suitable 3D modeling software package.
2. Creation of at least 3 surface models using surface modeling features available in any suitable 3D modeling software package.
3. Creation of 2 assembly models of at least 5 parts of different geometry.
4. Generation of 2D (Orthographic) drawings for shop floor using above solid models and surface models.
5. Generation of 2D (Orthographic) drawings of above assemblies along with exploded views
6. Retrieving physical properties for different component materials.
8. Plotting of above drawings on sheet.

Note:

1. Multimedia projection facility shall be used during lecture sessions along with computer facility
2. For term work no. 1 & 2 above A4 size sheets are to be used for printouts.
3. For term work no. 3 above A3 size sheets are to be used for printouts.
4. for conduction of practical sessions one computer terminal per candidate shall be used

Practical Examination:

Creation of solid model and generation of 2D views from the given part drawing followed by oral assessment based on above term work. (one computer terminal per candidate.)

Recommended Books

1. Various 3D modeling Software Manuals.
2. CAD / CAM, Theory and Practice by Zeid, (TMH)
3. CAD / CAM, Principles & Applications by P. N. Rao (TMH)

S.E. (PRODUCTION ENGINEERING) – Part II, Sem. IV

7. WORKSHOP PRACTICE – IV

Teaching Scheme:
Practical: 2 Hrs/Week/Batch

Examination Scheme:
Term work: - 25 Marks
Practical Examination- 25 Marks.

Course Objective:

To practice basic metal cutting processes and enhance the skills.

Term Work

One composite job consisting of three to four parts employing operations on lathe in addition to profile turning and eccentric turning and operations on Milling, Drilling Demonstration of Grinding operation on Grinding Machine. - 50 Marks.

Note:-

1) Students should prepare setup wise working drawing showing all the details in work diary.
2) Dimensional accuracy is of prime importance.
3) Student must maintain work diary showing regular progress in the semester.

4) Assessment of the term work should be carried out considering the above points.

Practical examination of 6 hours duration will be held and shall consist of preparation of job involving operations based on Workshop Practice-III and workshop practice-IV

S.E. (PRODUCTION ENGINEERING) – Part II, Sem. IV

8. MINI PROJECT

Teaching Scheme:	Examination Scheme
Practical: 1 Hrs/Week/Batch	Term work: 50 Marks

Course Objective:
To encourage hands-on working skills by fabricating simple working mechanisms illustrating technical principles.

Term Work:

Any one of the following two:

1. A group of maximum four students will design and fabricate one simple working mechanism involving mechanical or electromechanical components / sensors. (Mechanisms already proven may also be taken up.)

For example : Gear trains, shaft bearing assembly, mechanisms with lower and higher pairs, water level indicator, Screw jack etc.

Assessment scheme:

Fabrication of model and presentation	:	40 marks
Report (5 – 10 pages, typed on A4 sheets)	:	10 marks
Total	**:**	**50 marks**

Reference Books:

1. Machines and Mechanisms (Mir Publications, Moscow)
2. School Projects

OR

2. A group of maximum four students will carry out disassembly of a product comprising of 5 to 10 components; prepare the drawings of the components and reassemble the components to the final product so that it is again in working condition. The report of this work should consist of part drawings and engineering aspects of each part and the assembly.

Assessment scheme:

Disassembly or assembly and understanding with presentation	:	40 marks
Report (5 – 10 pages, typed on A4 sheets)	:	10 marks
Total	**:**	**50 marks**