UNIVERSITY OF PUNE

Structure and Syllabus

FOR

T.E. Mechanical (Sandwich)Engineering
2012 Course

UNDER FACULTY OF ENGINEERING

EFFECTIVE from July 2014

T. E. Mechanical (Sandwich) Semester – I
(w.e.f. Academic year 2014-15)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302061	Numerical Methods & Computational Techniques	3	--	2	30	70	25	--	--	**125**
302042	Heat Transfer*	4	--	2	30	70	--	50#	--	**150**
302050	Mechatronics*	3	--	2	30	70	25	--	--	**125**
302043	Theory of Machines II*$	4	--	2	30	70	--	--	50	**150**
302062	Machine Design	4	--	2	30**	70@	25	--	50	**175**
302063	Machine Shop	--	--	2	--	--	25	--	--	**25**
Total of Semester – I		**18**	**--**	**12**	**150**	**350**	**100**	**50**	**100**	**750**

*** Subjects common with Mechanical Engineering (refer T.E Mechanical Engineering 2012 course syllabus for the same)**

$ Common Oral will be based on both TOM-I and TOM-II term work at end of first Semester of T.E. Mechanical Sandwich.

 # Evaluation should be on performance in practical examination and oral based on Term Work by Internal Examiner and one External Examiner

Important Notes

1. ***In-Sem Theory examination will be conducted, approximately one and half month after the commencement of each semester***
2. ***In-Sem Theory examination will be based on first three units from Syllabus and will be conducted by the University of Pune***
3. ***Total time allotted for In-Sem Theory examination will be 1 hr.***
4. ***(**) Total time allotted for In-Sem Theory examination (Machine Design) will be 1 hr 30 mins.***
5. ***Total time allotted for End-Sem Theory examination will be 2 hrs 30 min.***
6. ***(@) Total time allotted for End-Sem Theory examination (Machine Design) will be 3 hrs.***

T. E. Mechanical (Sandwich) Semester – II
(w.e.f. Academic year 2014-15)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302064	Industrial In-plant Training	One contact hour per student per week[@]			-	-	150	-	100[*]	**250**
302065	Seminar	-	-	-	-	-	-	-	50[#]	**50**
302066	Materials and Manufacturing Engineering (Self Study-I)	-	-	-	-	100[+]	25	-	-	**125**
302067	Industrial Engineering and Production Management (Self Study –II)	-	-	-	-	100[+]	25	-	-	**125**
Total of Semester – II		**60 Hrs/ for 60 students**			-	**200**	**200**	-	**150**	**550**

+ **Only End-Sem Theory examination will be conducted and there will not be In-Sem examination for self study subjects - I & II**
@ **Contact hour is provided for supervision of student under training.**
* **Oral based on TW by one Internal Examiner and one External Examiner from Industry**
\# **Presentation in front of one Internal Examiner & one External Examiner.**

T.E. Mechanical (Sandwich) - 2012 Course

Numerical Methods & Computational Techniques [302061]

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302061	Numerical Methods & Computational Techniques	3	---	2	30 (1Hr.)	70 (2 Hr. 30 Min.)	25	---	---	125

COURSE OBJECTIVES

1. The student shall understand Concept of Numerical Methods and its engineering applications.
2. Student shall learn various techniques to solve mathematical problem in different ways.
3. The student shall able to undergo the programming skills to solve mathematical problems.
4. To prepare the students for their higher education.

COURSE OUTCOMES

1. The student will understand Concept of Numerical Methods and its role in solving engineering mathematical problems.
2. The student will be good at programming skills.
3. The student will be able to carry out proper selection of the method for solving the mathematical problems.

Unit – I ***(08 hrs)***

Roots of Equations and Numerical Integration

Newton Raphson method, Modified Newton Raphson method, and Successive approximation method.
Trapezoidal rule, Simpson's Rules (1/3rd , 3/8th), Gauss Quadrature Method- 2 point,
Double integration - Trapezoidal rule, Simpson's 1/3th rule.

Unit – II ***(08 hrs)***

Interpolation

Lagrange's Interpolation, Newton's interpolation - Forward, Backward, Hermit Interpolation, Spline Interpolation- cubic, inverse interpolation, extrapolation.

Unit – III ***(08 hrs)***

Linear Simultaneous Equations

Gauss Elimination Method, partial pivoting, Thomas algorithm for tridiagonal matrix, Gauss-seidal method.

Unit – IV ***(08 hrs)***

Curve Fitting and errors

Least square technique- straight line, quadratic equation, power equation, exponential equation.
Errors and approximations

Unit – V ***(08 hrs)***

Numerical Solutions of ODE

Taylor series method, Euler Method, Modified Euler Method, Runge Kutta Methods- second order and fourth order, Predictor-corrector method.

Unit – VI ***(08 hrs)***

Finite difference methods

Introduction to finite difference method, PDEs- Parabolic - explicit, Crank Nicholson method, Hyperbolic equations , and Elliptic equations.

Term-Work

Term work shall consist of following assignment:

1 **Program on** Roots of Equations
2 **Program on** Numerical Integration
3 **Program on** Interpolation
4 **Program on** Simultaneous Equations
5 **Program on** Curve Fitting
6 Program on **ODE**
7 **Program on** Finite difference methods
8 One assignment on all above topics using any suitable Solver

Practical Exams.

1. One program on Unit No 1.
2. Any one program from unit 2 to 6 option within unit

Text Books

1. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 4/e, Tata McGraw Hill Editions, 2002, ISBN 0-07-047437-0Dr. B. S. Garewal, Numerical Methods in Engineering and Science, 7/e, Khanna Publishers, ISBN 81-74009-205-6
2. M. K. Jain, S R K Iyengar, R K Jain, Numerical Methods for Scientific and Engineering Computations, 5/e New Age International Publishers ISBN 13 978-81¬224-2001-2008
3. Gerold/ Wheatley, Applied Numerical Analysis, 6/e, Pearson Education Asia, 2002 ISBN 81-7808-567-4

Reference Books

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Ltd, New Delhi, ISBN 10: 0-07-0643419-X
2. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientist, 2/e, Tata Mc-GrawHill Publishing Co-Ltd, 2008, ISBN 0-07-064853-0,

T.E. Mechanical (Sandwich) - 2012 Course
Machine Design [302062]

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302062	Machine Design	4	--	2	30 (90 Min.)	70 (3 Hrs.)	25	--	50	**175**

COURSE OBJECTIVES

1. The student shall gain appreciation and understanding of the design function in Mechanical Engineering, the steps involved in designing and the relation of design activity with manufacturing activity.
2. Shall be able to choose proper materials for different machine elements depending on their physical and mechanical properties. Thus he shall be able to apply the knowledge of material science in real life usage.
3. Student shall gain a thorough understanding of the different types of failure modes and failure criteria. He will be conversant with various failure theories and be able to judge which criterion is to be applied in which situation.
4. Student shall be able to design different machine elements e.g. shafts, couplings, springs, gears etc. by applying basic design process.

COURSE OUTCOMES

1. Ability to analyze the stress and strain of mechanical components and understand, identify and quantify failure modes for Machine components.
2. Ability to select standard machine components from Manufacturer's catalogue.
3. Enhancement in proficiency of CAD software for designing Mechanical systems and to generate production drawing

Unit – I ***(08 hrs)***

Design Process and design of Simple Machine elements:

Machine Design, Design Process, Design considerations, Standards and codes, Use of preferred series, Factor of safety, Service factor.

Design of Cotter joint, Knuckle joint.

Design of Shafts, Keys and Couplings:

Shaft design on the basis of strength, torsional rigidity and lateral rigidity, A.S.M.E. code for shaft design, Design of parallel keys and splines, Design of Flange Coupling.

Unit – II ***(08 hrs)***

Design for Fluctuating Loads:

Stress concentration-causes & remedies, fluctuating stresses, fatigue failures, S-N curve, endurance limit, notch sensitivity, endurance strength modifying factors, design for finite and infinite life, cumulative damage in fatigue failure, Soderberg, Gerber, Goodman, Modified Goodman diagrams.

Power Screws:

Forms of threads, multiple start screws, Torque analysis and Design of power screws with square and trapezoidal threads, Self locking screw, Collar friction torque, Stresses in power screws, design of a C-Clamp, design of screw jack.

Unit – III ***(08 hrs)***

Mechanical Springs:

Types, applications and materials for springs, Design of helical compression and helical tension springs, Style of ends, Springs in series and parallel, Concentric helical springs.

Welded Joints:

Welding symbols, Stresses in butt and fillet welds, Strength of butt, parallel and transverse fillet welds, Axially loaded unsymmetrical welded joints, Eccentric load in plane of welds, Welded joints subjected to bending and torsional moments.

Unit – IV ***(08 hrs)***

Gear Drives: Classification of gears, Selection of types of gears, Selection of materials for gears, Standard gear tooth systems, Basic modes of gear tooth failures, Gear Lubrication Methods.

Spur Gears: Number of teeth and face width, Constructional details of gear wheel, Force analysis, Beam strength (Lewis) equation, Velocity factor, Service factor, Load concentration factor, Effective load on gear, Wear strength (Buckingham's) equation, Estimation of module based on beam and wear strength, Estimation of dynamic tooth load by velocity factor and Buckingham's equation, Design of spur gears.

Helical Gears: Transverse and normal module, Virtual no of teeth, Force analysis, Beam and wear strengths, Effective load on gear tooth, Estimation of dynamic load by velocity factor and Buckingham's equation, Design of helical gears.

Unit – V ***(08 hrs)***

Rolling Contact Bearings:

Types of rolling contact Bearings, Static and dynamic load carrying capacities, Stribeck's Equation, Equivalent bearing load, Load-life relationship, Selection of bearing life, Selection of rolling contact bearings from manufacturer's catalogue, Design for cyclic loads, bearing with probability of survival other than 90%

Lubrication and mounting of bearings, Preloading of rolling contact bearings, Types of failure in rolling contact bearings – causes and remedies.

Selection of Taper roller bearings.

Unit – VI ***(08 hrs)***

Belts, Rope and Chain Drives:

Belt drive:

Materials and construction of flat and V belts, geometric relationships for length of belt, power rating of

belts, concept of slip & creep, initial tension, effect of centrifugal force, maximum power condition, selection of flat and V belts from manufacturer's catalogue, belt tensioning methods, relative advantages and limitations of flat and V belts, construction and applications of timing belts.

Wire Ropes

Construction of wire ropes, lay of wire ropes, stresses in wire rope, selection of wire ropes.

Chain Drives

Types of power transmission chains, Geometry of Chain, Polygon effect of chain, Modes of failure for chains, Lubrication of chains, Selection of roller chain from manufacturers catalogue.

Term-Work

Term work shall consist of:

1. One design project based on Design of a Two Stage Gear Box
2. The design project shall consist of two full imperial (A1) size sheets involving assembly drawing with a part list and overall dimensions and drawings of individual components. Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified wherever required. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file. Design data book shall be used wherever necessary to achieve selection of standard components. Drawing Sheets should be plotted using any CAD software.

2. Three assignments should be based on following topics:
   i) Design of Flexible bush pin coupling
   ii) Design of screw jack.
   iii) Selection of Belt / Chain / Rope drive from manufacturer's catalogue.

Text Books

1) Shigley J.E. and Mischke C.R., Mechanical Engineering Design, McGraw Hill Publication Co. Ltd.

2) Spotts M.F. and Shoup T.E., Design of Machine Elements, Prentice Hall International.

3) Bhandari V.B., Design of Machine Elements, Tata McGraw Hill Publication Co. Ltd.

4) Juvinal R.C., Fundamentals of Machine Components Design, John Wiley and Sons

Reference Books

1) Black P.H. and O. Eugene Adams, Machine Design, McGraw Hill Book Co. Inc.

2) Willium C. Orthwein, Machine Components Design, West Publishing Co. and Jaico Publications House.

3) Hall A.S., Holowenko A.R. and Laughlin H.G, Theory and Problems of Machine Design, Schaum"s Outline Series.

4) C.S.Sharma and Kamlesh Purohit, Design of Machine Elements, PHI Learing Pvt. Ltd.

5) D.K.Aggarwal & P.C.Sharma, Machine Design, S.K Kataria and Sons

6) P. C. Gope, Machine Design: Fundamentals and Applications, PHI Learing Pvt. Ltd.

7) Design Data - P.S.G. College of Technology, Coimbatore.

8) Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd.

9) K. Mahadevan, K. Balveera Reddy, Design Data Handbook for Mechanical Engineers, CBS Publishers.

T.E. Mechanical (Sandwich) - 2012 Course

MACHINE SHOP [302063]

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302063	MACHINE SHOP	--	--	02	--	--	25	--	--	25

COURSE OBJECTIVES

1. To prepare the appropriate manufactory setup.
2. To select appropriate process parameters for machining component.
3. To understand the operational problems and suggest remedial solution for adopted manufacturing process.

COURSE OUTCOMES

Student will be able to design the process for manufacturing job as per need.

COURSE CONTENT

Each candidate is required to complete and submit the following

A) Jobs

1) Any one marketable assembly consisting of at least three components involving use of lathe, drilling, milling, grinding and any additional machine tool or processes as per requirement .

2) Development and execution of one milling job on CNC machine.

B) Journal

a. Design and drawing of one jig / fixture for a component. (manual drafting)

b. Process planning sheets for job 1 and Part program details for job 2.

Note :-

Term work assessment will be based on job completed and journal write-ups.

Text Books:

1. S. K Hajra Choudhury , Elements of workshop technology – Vol. II,, Media Promoters And Publishers, Mumbai
2. P. C. Sharma, Production Engineering, S. Chand Publication.

Reference Books

- P. N. Rao, CAD/CAM Principles and Applications, McGraw Hill Education, Third Edition.

TE-Mechanical (Sandwich) Engineering 2012 Course
Industrial In-plant Training [302064]

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302064	Industrial In-plant Training	-			-	-	150	-	100	**250**

Notes:-
1. **Teaching load - One contact hour per student per week.**
2. **Duration of Industrial In-plant training: 6 months.**

COURSE OBJECTIVES

1. Student will get the exposure to the industry.
2. Understand day to day working of the industry.
3. To understand design, manufacturing processes, quality control and testing of products.
4. Student will undertake small assignments.
5. To interact with various departments of industry during work.

COURSE OUTCOMES

1. Student will understand industrial environment and practices.
2. Work on a specific project and complete it in given stipulated time period.
3. Able to understand the importance of quality of product and human safety.
4. Able to relate theory and practical for while dealing with industrial problem.

Students are expected to learn followings during their Industrial In-Plant Training. He or She shall be given training in Large or Medium size manufacturing unit in various departments.

1. **Orientation:** Types of Industry, Industrial Environment, Industrial Psychology, Industrial Management, Industrial Relations, Government Policies, Associated organizations and their role. Company profile, Organizational structure of the company, Organizational behavior, Scale and type of production, Types of products.
2. **Departments in Manufacturing Industries:** R & D (research and development), quality control, shipping, distribution, production, purchasing, recruiting or human resources, operations, finance, accounting, accounts payable, accounts receivable, billing, sales, marketing, advertising, maintenance, etc., There could be additional departments within other departments depending on the size and type of business.
3. **Industrial Design and Drawing Practice:** Design and Drawing Standards, Study of mechanical components and component design such as gears, gear boxes, chain and belt drives, couplings, shaft, keys, bearings, brackets, bolted and welded connections. Sub-assembly and assembly drawings. Simple assignments based on the above items.

4. **Manufacturing processes:**
   To understand manufacturing concepts applied in industry. Study of material requirements, material standards. Heat treatments applied to products.
5. **Machine Tools:**
   Machine tool classifications, types of machines tool, special machine tools, machine tool design, CNC controls, Programming languages and codes, Machine tool maintenance.
6. **Manufacturing Automation:**
   Automation level, types of automation, application of hydraulics and pneumatics, mechatronics control, use of sensors and feedback in control, robotic control over the process.
7. **Material Handling:**
   Unit load concept, types of material handling equipments, selection of Material handling equipment, design requirement of material handling system.
8. **Measurement and Quality Control:**
   Precision measurement, Control chart, Statistical process control, Process capability.
9. **Processes and Operation Planning:**
   Production planning and control, Order preparation, Material planning, Process planning, Route sheets, documents in process planning, production control- dispatching, follow-up.
10. **Machines, Personal and Plant safety.**
    Safety rules in organization, posters exhibits and publicity, fire prevention and protection, Health and sanitation, Protective wearing apparel, Safety signs, Industrial safety standards.

Operational Guidelines:

- Institute and Industry will prepare detail training program at the beginning of the training, covering as much as possible from above mentioned topics.
- It is expected that students get exposure to all departments in industry.
- The student shall be asked to do simple assignments in various departments where he or she is undergoing training.
- Institute will assign a supervisor faculty to each student.
- Supervisor will guide and monitor student's training by visiting the industry once a month.
- Student will maintain logbook during the training.

Term Work:

Term Work shall consist of a comprehensive report based on his or her observations, training received and assignments (at least three) completed during six months of training. The report shall also include drawings, figures, process sheets, machine and product specifications and any other relevant details. The report should include a certificate of successful completion of training and attendance from concerned industry.

Examination:

Oral will be based on Term Work completed during training.

Oral Examination shall be conducted by appointing one Internal Examiner and one External Examiner from industry.

T.E. Mechanical (sandwich) - 2012 Course
Seminar [302065]

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302065	Seminar	-			-	-	-	-	50	**50**

The Seminar topic must be related to one of the following

1. Mechanical Engineering
2. Interdisciplinary subjects
3. Recent trends in Engineering

INSTRUCTIONS FOR SEMINAR REPORT WRITING

It is important that the procedures listed below be carefully followed by all the students.

Prepare 3 **COPIES** of your Seminar report.

1. Limit your seminar report to preferably 20 – 25 pages
2. Header ***For e.g. University of Pune***
3. The footer ***For e.g. Mechanical Engineering***
   Institute Name, Mechanical Engineering Times New Roman 10 pt. and centrally aligned.
4. Page number as second line of footer, Times New Roman 10 Pt, centrally aligned
5. Print the report using
   a) Letter quality computer printing.
   b) The main part of report should be Times New Roman 12 pt. and justified**.**
   c) Use 1.5 line spacing.
   d) Entire report shall be one chapter. No chapters for Seminar report.
6. Use the paper size **8.5'' × 11''** or **A4 (210 × 197 mm).** Please follow the margins given below.

Margin Location	Paper 8.5" × 11"	Paper A4 (210 × 197 mm)
Top	1"	25.4 mm
Left	1.5"	37 mm
Bottom	1.25"	32 mm
Right	1"	25.4 mm

7. All paragraphs will be 1.5 line spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.
8. Section titles should be bold with 14 pt typed in all capital letters and should be left aligned.
9. Sub-Section headings should be aligning at the left with 12 pt, bold and Title Case (the first letter of each word is to be capitalized).
10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, **black and white. Illustrations downloaded from internet are not acceptable.**
    a) Illustrations should not be more than **two** per page. One could be ideal
    b) Figure No. and Title at bottom with **12 pt**
    c) Legends below the title in **10 pt**
    d) Leave proper margin in all sides

e) Illustrations as far as possible should not be in xerox form.

University of Pune

11. **Photographs** if any should of glossy prints
12. **Equations** if any, should be typed in text **(it should not be copied as image)**
13. Please use **SI** system of units. If students would like to add the equivalent in inch-pound (British) units, they must be stated in parenthesis after the **SI** units. In case the final result comes out in any other units (say due to empirical formula etc.) covert the unit to **SI** unit.
14. Please **number the pages** on the front side, centrally below the footer
15. **References** should be either in order as they appear in the report or in alphabetical order by last name of first author
16. **Symbols** and **notations** if any should be included in nomenclature section only
17. Following will be the order of report
    i) **Cover page** and **Front page** as per specimen on separate sheet
    ii) **Certificate** from Institute as per specimen on separate sheet
    iii) **Acknowledgement**
    iv) **List of Figures**
    v) **List of Tables**
    vi) **Nomenclature**
    vii) **Contents**
18. All section headings and subheadings should be numbered. For sections use numbers **1, 2, 3, ….** and for subheadings **1.1**, **1.2**, **….** etc and section subheadings **2.1.1**, **2.1.2, ….** etc.
19. **References** should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If **figures** and **tables** are taken from any reference then indicate source of it. Please follow the following procedure for references

Reference Books

Collier, G. J. and Thome, J. R., "Convective boiling and condensation", 3rd ed., Oxford University Press, UK, 1996, pp. 110 – 112.

Papers from Journal or Transactions

Jung, D. S. and Radermacher, R., "Transport properties and surface tension of pure and mixed refrigerants", *ASHRAE Trans*, 1991, 97 (1), pp. 90 – 98.

Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., "An empirical correction for sizing capillary tubes", *Int. Journal of Refrigeration*, 1996, 19 (8), pp.497 – 505.

Papers from Conference Proceedings

Colbourne, D. and Ritter, T. J., "*Quantitative assessment of flammable refrigerants in room air conditioners"*, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.

Reports, Handbooks etc.

United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002.

ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent

Patent no, Country (in parenthesis), date of application, title, year.

Internet

www.(Site) [Give full length URL]

A Seminar on (TNR, 16pt, centrally aligned)

Title (TNR, 27pt, Bold, Centrally Aligned,Title Case)

By (TNR, 16pt, Centrally Aligned)

Mr. Student's Name (TNR, 16pt, Centrally Aligned)

Guided by (TNR, 16pt, Centrally Aligned)

Guide's Name (TNR, 16pt, Centrally Aligned)

Institute
Logo

Department of Mechanical Engineering

Name of the Institute

[2011-12](TNR, 22pt, Title Case Centrally Aligned)

Name of the Institute

Institute
Logo

C E R T I F I C A T E

This is to certify that *Mr/Miss. .....*, has successfully completed the Seminar work entitled "Performance analysis of……." under my supervision, in the partial fulfillment of Bachelor of Engineering - Mechanical Engineering, by University of Pune.

Date :

Place :

_____ _____

Guide Head Department

Name: Name:

_____

Seal Principal,
Name

T.E. Mechanical (Sandwich) - 2012 Course

Materials and Manufacturing Engineering [302066]

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302066	*Materials and Manufacturing Engineering*	Self Study	--	---	---	100 (3 Hrs.)	25	--	---	125

COURSE OBJECTIVES

1. The student shall understand different materials and their properties.
2. Student shall learn various advanced materials used in actual industrial practice.
3. The student shall able to undergo with various powder metallurgy processes.
4. The student will be able to carry out proper selection of Material in actual practice.
5. The student will be able to learn CNC machines.
6. Student shall be able to understand advanced manufacturing processes-Broaching, Gear & Thread Manufacturing.

COURSE OUTCOMES

1. The student will understand advanced materials and manufacturing processes and its use in industry.
2. The student will display professional skills in selecting proper materials at work.
3. The student will develop a good product by using proper manufacturing process.

Unit – I ***(08 hrs)***

Study of Non-Metallic Materials:

Introduction & Classification of Materials, Definition, Classification & characteristics of polymers, Types of polymerization, Polymer processing, Elastomers, properties and applications of engineering polymers. Properties, processing and applications of ceramic materials (WC, TIC, Al2O3), cermets. Composite materials, Classification & Types of composite, Properties & applications, Metal matrix composite, Ceramic matrix composite, Fiber Reinforced plastic , Numerical based on composite (isostress & isostrain conditions).

Unit – II ***(08 hrs)***

Introduction to Advanced Materials:

Classification of biomaterials - Comparison & properties of some common biomaterials, Metallic, Ceramic and Polymeric implant materials, Introduction to bio sensors. Basic concepts of Nano science and technology, Properties and technological advantages of Nano materials, Carbon Nanotubes and applications. Magnetic materials: Soft & Hard Ferrites, Dielectric materials: Piezo electric and ferro electric materials and their applications, superconductors. Modern Materials for high, low temperatures and Cryogenic applications Smart materials, Shape memory alloys.

Unit – III ***(08 hrs)***

Corrosion and Its Prevention:

Mechanism of corrosion, Classification of corrosion: General, Pitting, Crevice, Intergranular, Stress corrosion & cracking. Velocity related corrosion: Erosion, Impingement, and Cavitations corrosion. Corrosion fatigue, Hydrogen Blistering. High temperature corrosion. Corrosion prevention methods: Inhibitors, Internal & External coating, Cathodic & Anodic protection, Use of special alloys, Control over temperature & velocity, Dehydration, Improvement in design/ changes in design to prevent or control corrosion

Unit – IV ***(08 hrs)***

Powder Metallurgy Processes:

Basic steps of powder metallurgy process, powder manufacturing, characteristics of metal powders, Conditioning of metal powders (Screening, Blending & mixing, annealing), Compacting (cold compaction, hot compaction, Isostatic compaction & powder rolling) Pre-sintering & sintering secondary operations Advantages, limitations and applications of powder metallurgy. Production of typical P/M components (with flow charts), self lubricated bearing, cemented carbides, cermets, refractory metals, electrical contact materials, friction materials, and diamond impregnated tools.

Unit – V ***(08 hrs)***

CNC machines:

Introduction and working of NC, CNC, DNC machines. CNC axis and drives, Introduction to Automatic Tool Changer and Automatic pallet changer. Principles and block diagram of Machining centers, advantages and applications. CNC programming for simple parts on Lathe and Drilling machines. Introduction to FMS.

Unit – VI ***(08 hrs)***

Broaching, Gear & Thread Manufacturing:

Broaching: Introduction to broaching, broach tool geometry, Types of broaching machines and operations. Numerical on broach design

Gear Manufacturing: Different Gear manufacturing Methods: Gear hobbing, Gear shaping, Gear shaving. Gearfinishing processes: Gear grinding and lapping.

Thread Manufacturing: Thread cutting, chasing and dies, milling, rolling, Thread finishing processes: grinding and lapping.

Term-Work

Term work shall consist of following assignment.(Any six)

1. Study of different non-metallic materials used in industrial applications.
2. Selection of non-metallic materials for different applications.
3. A report on nano materials and their applications in mechanical engineering.
4. Study of advanced materials and their application in manufacturing industry.
5. Assignment on corrosion and its prevention.
6. Assignment on conditioning of metal powders.
7. Report of production of powder metallurgy components.
8. Case study report on working of CNC machines.
9. Assignment on CNC programming.
10. Assignment on study of gear manufacturing methods.

Text Books

1. V.D. Kodgire and S.V. Kodgire, Material Science and Metallurgy for Engineers, EverestPublishing House, Pune, 24th edition, 2008.
2. P. C. Sharma, Production Engineering, Khanna Publishers.

Reference Books

1. W.D. Callister, Jr., Materials Science and Engineering: An Introduction, John Wiley and Sons, 5thedition, 2001
2. Mechanical Metallurgy, Dieter, G.E., McGraw-Hill, 1988.
3. P. N. Rao, Manufacturing Technology Vol I & II Tata McGraw Hill Publishers

T.E. Mechanical (Sandwich) - 2012 Course

Industrial Engineering and Production Management [302067]

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
302067	*Industrial Engineering and Production Management*	Self Study	--	---	---	100 (3 Hrs.)	25	--	---	125

COURSE OBJECTIVES

1. The student shall understand Concept of Industrial Engineering and its role in production management.
2. Student shall learn various Industrial Engineering techniques implemented in relation to production management in actual industrial practice.
3. The student shall able to undergo with various world class techniques in practice.
4. The student will be able to carry out proper selection of process for production in actual practice in industry
5. To develop overall personality by exposing them to soft skills and professional ethics programs
6. Student shall be able to understand industrial psychology.

COURSE OUTCOMES

1. The student will understand Concept of Industrial engineering and its role in production management.
2. The student will be good team member and project leaders to carry out projects in companies.
3. The student will display professional ethics while dealing with their colleagues at work.
4. The student will develop good inter personnel skills to deal with their superiors, peers as well as juniors.

Unit – I ***(8 hrs)***

Industrial Engineering: History, development, definition, functions and applications of Industrial Engineering, contribution of F.W Taylor, Gilberth, Gantt and Maynard to industrial engineering, motivation and control, Maslow's hierarchy of needs,

Management concept: Basic concepts and functions of management, Evolution of management thoughts, various approaches to the management

Unit – II ***(8 hrs)***

Method Study: Introduction, steps, tools and techniques used in method study, Recording of facts, Process chart, symbols, flow diagrams, Two hand chart, Multiple activity chart,5W&1H , use of motion pictures and analysis ,critical examination, selection of job, maintenance of proposed method, SIMO charts, importance of ergonomics in industry.

Work Measurement : Time Study: Aim and objectives, use of work measurement data, techniques of work measurement, Time study procedures, Time study forms, Performance rating, allowances and types, calculation of standard time. Work Sampling ,Procedure.

Unit – III ***(8 hrs)***

The Production Function: Concept of production, Productivity, total productivity, organization of production, responsibilities of production manager, qualities of production manager, organization structure of engineering company.

Plant layout and Material handling: Location- importance and factor affecting location, single and muti facility location problems, Layout-Need ,importance, objectives and principles of good plant lay out, types of layouts and applications, Material Handling- Objectives ,functions, principles of material handling, types of material handling equipment and selection.

Unit – IV ***(8 hrs)***

Production planning and control: Functions of PPC, work order preparation material planning, Bill of materials, Material requirement planning (MRP), Moving average method, Exponential smoothing, capacity planning

Inventory control- objectives, basic EOQ, Safety stock inventory control systems, Numerical treatment), Cost associated with inventory, selective control of inventory ABC,FMS,VED.

Unit – V ***(8 hrs)***

Process Planning

Introduction- Production Engineering, Role of Product Engineering department, Phases of process planning, process planning principles and process sheet design, factors affecting process design, general considerations in selecting machining methods, planning the sequence of machining operations.

Project Scheduling with CPM and PERT- Objectives, Basic concepts in network, Programme evaluation and review Techniques,Time cost trade off(crashing), Comparison between CPM and PERT

Unit – VI ***(8 hrs)***

Loading & Scheduling

Concept of loading & scheduling, master production schedule, basic sequencing and scheduling techniques, dispatching rules, expediting and evaluating the production plans, design of production planning & control system for Intermittent & continuous production

Supply chain management- Managing supply chain cycle inventory. Uncertainty in the supply chain – Analyzing impact of supply chain redesign on the Pricing and Revenue Management. Computerized production management system, just in time and Lean manufacturing, Agile & reconfigurable manufacturing, green production, energy conservation & energy audit.

World class techniques

5'S, TPM, SMED, Muda (Waste) elimination, Kaizen, Concurrent Engineering, JIT, Kanban, Poka Yoke.

Term-Work

Term work shall consist of following assignment. (Any six)

1. Preparation of organization structure of a company indicating hierarchy of operation.
2. A report on plant location indicating economic survey of the site selection.
3. Detail schematic layout of plant indicating all facilities.
4. Assignment on unit load concept of material handling and criteria for selection of material handling equipment.
5. Case study on maintenance schedule of plant.
6. Report of Method study using charting techniques
7. Assignment on study of Statistical Process control - control charts
8. Case study report using world class technique.

Text Books

1. Prof L C Jhamb, "Production(Operations) Management, Everest Publishing house
2. Mukherjee & Kachwala, "Operations Management & Productivity Tech", Prentice Hall of India
3. M. Mahajan, "Industrial Engineering & Production Management", Dhanpat Rai and Company
4. P. Rama Murthy, "Production & Operation Management", New Age Internation (P) Ltd.
5. Banga ans Sharma,"Industrial Organisation and Engineering Economics",Khanna Publishers.
6. Adam EE & RJ Ebert, "Production and operation management:, Prentice Hall
7. Riggs. J. L., "Production system, planning, analysis and control", John Weily and sons
8. James Dilworth, "Production and operation management", McGraw Hill Book Company, New York.
9. Martand Telsang, "Industrial Engineering and Production Management", S Chand & Co, New Delhi
10. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 5th edition, 2012.
11. Sunil Chopra and Peter Meindl, Supply Chain Management-Strategy Planning and Operation,PHI Learning / Pearson Education, 5th edition, 201

Reference Books

1 Buffa. E.S., "Modern production and Operation Management", Willey, New Delhi.ISBN9971511630
2 Barry Shore, "Operation Management", McGraw Hill Book Company, New York.
3. Samuel Elion, "Production planning and control".ISBN8185027099.
4. Joseph Monks, "Operation Management Theory and Problems", McGraw Hill Book Company, New York.ISBN007100579X.
5. Koontz & Weihrich, "Essentials of Management by", TMH. ISBN007062030X.
6. F. L. Francis, J. A. White, L. F. McGinnis, "Facilities Layout and Location", Prentice Hall of India Pvt. Ltd., ISBN 81-203-1460-3. 8120314603.
7. Richard Muther, "Systematic Layout Planning
8. Paneerselvam R., "Production and Operations Management", Prentice Hall India 2005.