SCHEME AND SYLLABI

OF B.Tech

PRODUCTION ENGINEERING

2014
Admission onwards

PRODUCTION ENGINEERING

3rd Semester

Code	Subject	Hours/week			Marks		End-sem duration-hours	Credits
		L	T	P/D	Inte-rnal	End-sem		
EN14 301	Engineering Mathematics III	3	1	-	50	100	3	4
EN14 302	Computer Programming in C	3	0	1	50	100	3	4
PE14 303	Electrical Drives and Automation	3	1	-	50	100	3	4
PE14 304	Mechanics of Solids	3	1	-	50	100	3	4
PE14 305	Metallurgy and Material Science	3	1	-	50	100	3	4
PE14 306	Machine Tool Technology	3	1	-	50	100	3	4
PE14 307(P)	*Production Engineering Drawing*	-	-	3	50	100	3	2
PE14 308(P)	*Machine Tool Lab-I*	-	-	3	50	100	3	2
	Total	18	5	7	400	800		28

4th Semester

Code	Subject	Hours/week			Marks		End-sem duration-hours	Credits
		L	T	P/D	Inte-rnal	End-sem		
EN14 401	Engineering Mathematics IV	3	1	-	50	100	3	4
EN14 402	Environmental Science	3	1	-	50	100	3	4
PE14 403	Theory of Machines	3	1	-	50	100	3	4
PE14 404	Fluid Mechanics and Machinery	3	1	-	50	100	3	4
PE14 405	Design of Machine Elements	3	1	-	50	100	3	4
PE14 406	Thermal Engineering	3	1	-	50	100	3	4
PE14 407(P)	*Electrical and Electronics Lab*	-	-	3	50	100	3	2
PE14 408(P)	*Mechanical Engineering Lab*	-	-	3	50	100	3	2
	Total	18	6	6	400	800		28

5th Semester

Code	Subject	Hours/week			Marks		End-sem duration-hours	Credits
		L	T	P/D	Inte-rnal	End-sem		
PE14 501	Engineering Economics and Principles of Management	3	1	-	50	100	3	4
PE14 502	Computational Methods in Engineering	3	1	-	50	100	3	4
PE14 503	Welding and Allied Processes	3	1	-	50	100	3	4
PE14 504	Metal Casting	3	1	-	50	100	3	4
PE14 505	Metal Forming	3	1	-	50	100	3	4
PE14 506	Metrology and Instrumentation	3	1	-	50	100	3	4
PE14 507(P)	*Machine Tool Lab II*	-	-	3	50	100	3	2
PE14 508(P)	*Material Testing Lab*	-	-	3	50	100	3	2
	Total	18	6	6	400	800		28

6th Semester

Code	Subject	Hours/week			Marks		End-sem duration-hours	Credits
		L	T	P/D	Inte-rnal	End-sem		
PE14 601	**Machining of Materials**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 602	**Mechatronics**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 603	**Industrial Engineering**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 604	**Industrial Quality Control**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 605	**Industrial Automation**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 606	**Engineering Materials**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 607(P)	***Manufacturing Sciences Lab***	**-**	**-**	**3**	**50**	**100**	**3**	**2**
PE14 608(P)	***CAD/CAM Lab***	**-**	**-**	**3**	**50**	**100**	**3**	**2**
	Total	**18**	**6**	**6**	**400**	**800**		**28**

7th Semester

Code	Subject	Hours/week			Marks		End-sem duration-hours	Credits
		L	T	P/D	Inte-rnal	End-sem		
PE14 701	**Machine Tool Design**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 702	**Operations Research-I**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 703	**Tool Design**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 704	**Elective I**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 705	**Elective II**	**3**	**1**	**-**	**50**	**100**	**3**	**4**
PE14 706(P)	***Industrial Engineering Lab***			**3**	**50**	**100**	**3**	**2**
PE14 707(P)	***Metrology Lab***	**-**	**-**	**3**	**50**	**100**	**3**	**2**
PE14 708(P)	***Project***	**-**	**-**	**4**	**100**		**3**	**4**
		-	**-**			**-**	**-**	
	Total	**15**	**5**	**10**	**450**	**700**		**28**

Elective I

PE14 704(A) Human Resources Management
PE14 704(B) Project Managent
PE14 704(C) Facilities Planning and Plant lay-out
PE14 704(D) Design for manufacture
PE14 704(E) Geometric Modelling For CAD
PE14 704(F) Industrial Tribology

Elective II

PE14 705(A)) Financial Management
PE14 705(B) Supply Chain Management
PE14 705(C) Total Quality Management
PE14 705(D) Finite Element Methods
PE14 705(E) Artificial Intelligence in Manufacturing
PE14 705(F) Concurrent Engineering

8th Semester

Code	Subject	Hours/week			Marks		End-sem duration-hours	Credits
		L	T	P/D	Inte-rnal	End-sem		
PE14 801	Computer Integrated Manufacturing	3	1	-	50	100	3	4
PE14 802	Maintenance Engineering & Management	3	1	-	50	100	3	4
PE14 803	Production Management	3	1	-	50	100	3	4
PE14 804	Elective III	3	1	-	50	100	3	4
PE14 805	Elective IV	3	1		50	100	3	4
PE14 806(P)	Seminar			3	100			2
PE14 807(P)	Project	-	-	7	100	-	-	5
PE14 808(P)	Viva Voce	-	-	-		100	-	3
	Total	15	5	10	450	600		30

TOTAL CREDIT: 212

Elective III

PE14 804(A) Marketing Mangement
PE14 804(B) Technology Management
PE14 804(C) Entrepreneurship
PE14 804(D) Software Engieering
PE14 804(E) Modern Manufacturing Concepts
PE14804(F) Linear System Analysis

Elective IV

PE14 805(A) Industrial psychology
PE14 805(B) Management Information Systems
PE14 805© Energy Management
PE14 805(D) Simulation of manufacturing systems
PE14 805(E) Integrated Product development
PE14805(F) Lean and agile manufacturing

EN14 301: ENGINEERING MATHEMATICS III

(Common for all branches)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

- *To provide a quick overview of the concepts and results in complex analysis that may be useful in engineering.*
- *To introduce the concepts of linear algebra and Fourier transform which are wealths of ideas and results with wide area of application.*

Module I: Functions of a Complex Variable (13 hours)

Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: e^z, sinz, coshz, $(z+{}^1/_z)$– Mobius Transformation.

Module II: Functions of a Complex Variable (14 hours)

Definition of Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Independence of path – Cauchy's integral formula – Derivatives of analytic functions (Proof not required) – Taylor series (No proof) – Laurent series (No proof) – Singularities - Zeros – Poles - Residues – Evaluation of residues – Cauchy's residue theorem – Evaluation of real definite integrals.

Module III: Linear Algebra (13 hours) – (Proofs not required**)**

Vector spaces – Definition, Examples – Subspaces – Linear Span – Linear Independence – Linear Dependence – Basis – Dimension– Orthogonal and Orthonormal Sets – Orthogonal Basis – Orthonormal Basis – Gram-Schmidt orthogonalisation process – Inner product spaces – Definition – Examples – Inequalities ; Schwartz, Triangle (No proof).

Module IV: Fourier Transforms (14 hours)

Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations – Fourier transforms – transforms of some elementary functions – Elementary properties of Fourier transforms – Convolution theorem (No proof) – Fourier Sine and Cosine transforms – transforms of some elementary functions –Properties of Fourier Sine and Cosine transforms.

Text Books

Module I:

Erwin Kreysig, *Advanced Engineering Mathematics, 8e*, John Wiley and Sons, Inc.
Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.9

Module II:

Erwin Kreysig, *Advanced Engineering Mathematics, 8e*, John Wiley and Sons, Inc.
Sections: 13.1, 13.2, 13.3, 13.4, 14.4, 15.1, 15.2, 15.3, 15.4

Module III:

Bernaed Kolman, David R Hill, *Introductory Linear Algebra, An Applied First Course*, Pearson Education.
Sections: 6.1, 6.2, 6.3, 6.4, 6.8, Appendix.B.1

Module IV:

Wylie C.R and L.C. Barrett, *Advanced Engineering Mathematics*, McGraw Hill.
Sections: 9.1, 9.3, 9.5

Reference books

1. H S Kasana, *Complex Variables, Theory and Applications*, 2e, Prentice Hall of India.
2. John M Howie, *Complex Analysis*, Springer International Edition.
3. Anuradha Gupta, *Complex Analysis*, Ane Books India.
4. Shahnaz bathul, *Text book of Engineering Mathematics, Special functions and Complex Variables*, Prentice Hall of India.
5. Gerald Dennis Mahan, *Applied mathematics*, Springer International Edition.
6. David Towers, *Guide to Linear Algebra*, MacMillan Mathematical Guides.
7. Inder K Rana, *An Introduction to Linear Algebra*, Ane Books India.
8. Surjeet Singh, *Linear Algebra*, Vikas Publishing House.
9. Howard Anton, Chris Rorres, *Elementary Linear Algebra, Applications Version*, John Wiley and Sons.
10. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, Pearson Education.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN14 302 COMPUTER PROGRAMMING IN C

(Common for all branches)

Teaching scheme Credits: 4

3 hours lectures and 1hour lab per week

Objectives

- *To impart the basic concepts of computer and information technology*
- *To develop skill in problem solving concepts through learning C programming in practical approach.*

Module I (8 hours)

Introduction to Computers: CPU, Memory, input-output devices, secondary storage devices, Processor Concepts - Evolution and comparative study of processors. Machine language, assembly language, and high level language. Inside a PC, Latest trends and technologies of storage, memory, processor, printing etc. Concept of Program and data, System software - BIOS, Operating System- Definition-Functions-Windows, and Linux. Compilers and assemblers, Computer networks, LAN, WiFi.

Module II (9 hours)

Basic elements of C: Flow chart and algorithm – Development of algorithms for simple problems. Structure of C program – Operators and expressions – Procedure and order of evaluation – **Input and Output functions.** *while*, *do-while* and *for* statements, *if*, *if-else*, *switch*, *break*, *continue*, *goto*, and *labels*. Programming examples.

Module III (10 hours)

Functions and Program structures: Functions – declaring, defining, and accessing functions – parameter passing methods – **Recursion** – Storage classes – *extern*, *auto*, *register* and *static*. Library functions. Header files – C pre-processor. Example programs. **Arrays**: Defining and processing arrays – passing arrays to functions – two dimensional and multidimensional arrays – application of arrays. Example programs.

Module IV (9 hours)

Structures – declaration, definition and initialization of structures, unions, **Pointers**: Concepts, declaration, initialization of pointer variables simple examples **Concept of a file** – File operations File pointer.

Text Books

1. P. Norton, *Peter Norton's Introduction to Computers*, Tata McGraw Hill, New Delhi.
2. E. Balaguruswamy, *Programming in ANSI C*, 3rd ed., Tata McGraw Hill, New Delhi, 2004

Reference Books

1. B. Gottfried, *Programming with C*, 2nd ed, Tata McGraw Hill, New Delhi, 2006
2. B. W. Kernighan, and D. M. Ritchie, *The C Programming Language*, Prentice Hall of India, New Delhi, 1988
3. K. N. King. *C Programming: A Modern Approach*, 2nd ed., W. W. Norton & Company, 2008
4. P. Norton, *Peter Norton's Computing Fundamentals*, 6th ed., Tata McGraw Hill, New Delhi, 2004.
5. S. Kochan, *Programming in C*, CBS publishers & distributors
6. M. Meyer, R. Baber, B. Pfaffenberger, *Computers in Your Future*, 3rd ed., Pearson Education India

Internal Continuous Assessment *(Maximum Marks-50)*

30% - Lab Practical Tests
20% - Assignments
20% - Main Record
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 303: ELECTRICAL DRIVES AND AUTOMATION

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Electric drives*
- *To give concepts on microprocessors, PLC automation*
- *To give awareness on specific applications in industries*

Module I (14 Hours)

D.C Machines and Transformers:

Transformers: Single Phase transformers – Construction - Principle of operation - e.m.f.equation – equivalent circuit – phasor diagram - O.C. and S.C test – efficiency – voltage regulation

D.C. machines: D.C. Generators – construction details – e.m.f.equation – different types – magnetization and load characteristics – D.C. motors – Principle of operation – torque and speed equations – back e.m.f. – Performance characteristics and applications of shunt, series and compound motors.

Module II (13 hours)

Induction motor – Construction – types - principle of operation – slip - torque equation – torque slip characteristics.- startors, speed control.Single phase induction motors – double field revolving theory - capacitor start motors – capacitor start and run motors – applications.

Module III (13 hours)

Digital systems and Microprocessors

Review on Digital circuits (gates, flip flops) – Half adder & full adder -.

Introduction to Microprocessor – block diagram of microcomputer – CPU – architecture of Intel 8085– Programming of microprocessors instruction types – addressing modes – Intel 8085 instruction set – simple assembly language programs and examples – Microprocessor applications

– Microprocessor based temperature control – Microprocessor based speed control (Block diagram approach only).

Module IV (14 hours)
Industrial drives and control
Introduction to Electric drives – control schemes – Speed control – Components of Electric drives: Motors, Power electronic controllers (Block diagram approach)
Industrial applications of electric drives: Induction motor drives, D C motor drives. Selection of drives for general factory – Cement mill, Rolling mill, Paper mill, Coal mines, textile mill, machine tool drives.
PLC automation : Introduction – Overview of PLC systems – Theory of operation – Ladder logic – Programming concepts – simple program – Case study of simple PLC system

Text Books
Module I & II
1. D.P. Kothari, I.J.Nagarath, *Electric Machines* ,Tata Mcgraw Hill.
2. J.B.Gupta, *Theory and Performance of Electrical machines*, S.K.Kataria and Sons

Module III
1. B.RAM,*Microporocessors*, Dhanpat Rai & Sons

Module IV
1. N.K.De, P.E.Sen, *Electric drives*, Prentice hall India
2. W.Bolton , *Programmable Logic Controllers* , Academic Press.

Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 304: MECHANICS OF SOLIDS

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To acquaint with the basic concepts of stress and deformation in solids.*
- *To practise the methodologies to analyse stresses and strains in simple structural members, and to apply the results in simple design problems.*

Module I (14 hours)

Simple Stress and Strain: Introduction to analysis of deformable bodies – internal forces – method of sections – assumptions and limitations. Simple stresses – stresses due to normal, shear and bearing loads – strength design of simple members. Axial and shear strains –
Material behaviour – uniaxial tension test – stress-strain diagrams – concepts of orthotropy, anisotropy and inelastic behaviour – Hooke's law for linearly elastic isotropic material under axial and shear deformation – deformation in axially loaded bars – thermal effects – statically indeterminate structures – principle of superposition. Elastic strain energy for uniaxial stress. Definition of stress and strain at a point (introduction to stress and strain tensors and its components only) – Poisson's ratio – biaxial and triaxial deformations – Bulk modulus - Relations between elastic constants.

Module II (14 hours)

Torsion: Torsion theory of elastic circular bars – assumptions and limitations – polar modulus - torsional rigidity – economic cross-sections – statically indeterminate problems – design for torsional load (shaft and flanged bolt coupling) – torsion of inelastic circular bars (introduction only).
Axial force, shear force and bending moment: Diagrammatic conventions for supports and loading - axial force, shear force and bending moment in a beam – differential relations between load, shear force and bending moment - shear force and bending moment diagrams by direct and summation approach - use of singularity functions – elastic curve – point of inflection.

Module III (13 hours)

Stresses in beams: Pure bending – flexure formula for beams – assumptions and limitations – section modulus - flexural rigidity - economic sections – beam of uniform strength.
Shearing stress formula for beams – assumptions and limitations - shear flow – design for flexure and shear (reinforced beams, fliched beams, etc.) – inelastic bending (introduction only).
Deflection of beams: Moment-curvature relation – assumptions and limitations - double integration method - singularity functions – Macculays method – superposition techniques – moment area method and conjugate beam ideas for simple cases – elementary treatment of statically indeterminate beams.

Module IV (13 hours)

Transformation of stress and strains: Plane state of stress - equations of transformation - principal stresses. Plane state of strain – analogy between stress and strain transformation - Mohr's circles of stress and strain – strain rosettes.
Compound stresses: Combined axial, flexural and shear loads – eccentric loading under tension/compression - kern of a section (rectangular and circular section) - combined bending and twisting loads.
Theory of columns: Buckling theory –Euler's formula for long columns – assumptions and

Text Books

1. E. P. Popov, *Engineering Mechanics of Solids*, Prentice Hall of India
2. A. Pytel, F. L. Singer, *Strength of Materials*, Harper & Row Publishers, New York
3. P. N. Singh, P. K. Jha, *Elementary Mechanics of Solids*, Wiley Eastern Limited, New Delhi

Reference Books

1. S. P. Timoshenko, D. H. Young, *Elements of Strength of Materials*, McGraw Hill
2. I. H. Shames, *Introduction to Solid Mechanics*, Prentice Hall of India
3. F. Beer, E. R. Johnston, J. T. DeWolf, *Mechanics of Materials*, McGraw Hill
4. S. H. Crandal, N. C. Dhal, T. J. Lardner, An *Introduction to the Mechanics of Solids*, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, etc.
10% - Regularity in the class

University Examination Pattern

PART A:Analytical/problem solving SHORT questions 8x 5 marks=40 marksCandidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.PART B:Analytical/Problem solving DESCRIPTIVE questions4 x 15 marks=60 marks Two questions from each module with choice to answer one question. Maximum Total Marks: 100

PE14 305: METALLURGY AND MATERIAL SCIENCE

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide basic knowledge in metallurgical aspects of material and its properties*
- *To give an exposure on materials and their structures*
- *To create general awareness regarding instruments and techniques used for material characterization*

Module 1 (14 hours)

History of materials, Metallic Materials, Non metallic Materials, Composites- Structure of solids- Crystal Structure, Metallic crystal structures, Directions & Planes
Crystallization of pure metals- Nuclei Formation, Crystal growth, Grain size.
Crystal defects- Point defects, Line defects, planar defects

Module II (14 hours)

Text Books

1. R Sreenivasan, *Engineering materials & metallurgy*, Tata Mc GrawHill Publishers

References

1. William D. Callister, *Material Science and Engineering*, John Wiley and sons Inc
2. George.E.Diter, *Mechanical Metallurgy*, Mc Graw Hill
3. R.A.Higgins, *Engineering Metallurgy applied to physical Metallurgy*, VIVA (Low Priced)
4. Sir.Allan Cottrel, *An Introduction to Metallurgy*, University Press

Metallurgical microscope-Mechanical testing of materials-Hardness test, Impact test, Fatigue test, Creep test.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, ec.
10% - Regularity in the class

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 306: MACHINE TOOL TECHNOLOGY

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart basic knowledge about different machine tools*

Module I (14 hours)
Lathe - Different classifications - constructional features - driving mechanisms - tool and work holding devices - operations - speed, feed, depth of cut and machining time calculations – specifications - Capstan, turret and automatic lathes - constructional features - tool layout - tool and work holding devices – operations

Module II (14 hours)
Abrasives and abrasive tools - types of abrasives and their properties - manufacture of grinding wheels - types of bond, grit, grade, structure - nomenclature of a grinding wheel - selection of a grinding wheel, dressing truing and balancing of grinding wheels - Grinding machines - classification of grinding machines - constructional features - tool and work holding devices - operations - cylindrical, surface, centreless, thread, form, tool and cutter grinding – specifications - Surface finishing lapping, honing, super finishing -equipments - tolerance and finish, buffing - applications.

Module III (13 hours)
Milling, Drilling and boring machines - Classification - constructional features - driving mechanisms - tool and work holding devices - types of tools - operations – specifications - Gear

generation methods - Gear shaping, gear hobbing, gear shaving, gear grinding, gear lapping - bevel gear generators

Module IV (13 hours)
Shaper, planer, slotter and broaching machines - Different types and their field of application - constructional features - driving mechanisms - tools used - tool and work holding devices - operations – specifications

Text Books
1. Hajra Choudhary,*Elements of workshop technology, Vol. II*, Media Promoters & Publications
2. Chapman *Workshop technology*, Vol. II, III, ELBS
3. P.N. Rao,*Manufacturing Technology-Volume II*,Tata McGraw Hill

Reference Books
1. Lindberg, *Processes and materials for manufacture*, Prentice Hall.
2. ASME Tool Engineering Handbook
3. H.M.T, *Production Technology*, Tata McGraw Hill

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 307(P): PRODUCTION ENGINEERING DRAWING

Teaching scheme **Credits:** 2
3 Hours drawing per week

Objectives

- *To impart the basic concepts of production drawing*
- *To develop understanding about how to draw a machine assembly*
- *To help the students how to translate design concepts to drawing*

Module I (12 hours)

Sketching:-

Preparation of freehand, dimensioned sketches of the following. Hexagonal bolt and nut with washer - Square headed bolt - Common types of bolts- various types of nuts for locking - locking of bolt head - foundation bolts - various types of screw heads - studs - various types of keys - pipe joints and fittings

Module II (12 hours)

Joints: cotter, knuckle, spigot and socket, flanged coupling, and universal coupling, muff coupling. Preparation of drawings

Bearings. : Footstep - Plummer block, swivel, self-aligning ball bearing, and stuffing box.

Valves - simple stop valve and non-return valve.

Module III (12 hours)

Production machines and jigs.

Lathe tailstock, chuck, tool post, bench vice and machine swivel vices, and jigs for milling and drilling, drill holder.

Text Books

1. P.S.Gill, Text *Book of Machine drawing,* S.K. Kataria Pub.
2. P .I. Varghese, *Machine Drawing*, VIP Publishers, Thrissur
3. K .C John, *Machine Drawing*, Jet Publications, Thrissur

Reference Books

1. N.D.Bhatt, *Machine drawing*, Charotra Pub.
2. Laxmi narayana, *Machine drawing*,
3. N.Sidheswar, *Machine drawing*, Tata McGraw Hill

Internal Continuous Assessment *(Maximum Marks-50)*

60%- Minimum of 3 sheets from Module I, 4 sheets from Module II and III
30%- Test/s
10%- Regularity in the class

The end semester examination shall be conducted by the University as per the model of question paper below

University Examination Pattern

Question 1	*Four questions of 15 marks each for freehand sketching from Module I with choice to answer any two*	*2x15 marks=30 marks*
Question II:	*Two questions of 70 marks each from Modules II and III with choice toanswer any one.*	*1 x 70 marks=70 marks*

Maximum Total Marks: 100

PE14 308(P): MACHINE TOOL LAB-I

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To develop the machining skills*
- *To have clear understanding of working of machine tools*
- *To have an idea about the difficulty and work content in machining operations*

1. Study of different types of lathes - machine specifications - process capability – centre – capstan - turret and automatic lathes and their accessories – chucks – faceplate - steady rest - follower rest - tool post -centre collets
2. Selection of cutting parameters - speed, feed and depth of cut based on work - tool combination - coolant types.
3. Exercise on plain - step, taper turning and eccentric turning.
4. Screw cutting - external threads – multi start thread cutting.
5. Inspection and measuring of machined lathe components using vernier caliper – micrometer - thread plug and ring gauges - dial indicators and surface finish measuring instruments.
6. Turret lathe and copying lathe operation/ demonstration.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

EN14 401(A): ENGINEERING MATHEMATICS IV

(Common for ME, CE, PE, CH, BT, PT, AM, and AN)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

- *To provide a comprehensive introduction to those models and methods most likely to be encountered and used by students in their careers in engineering.*
- *To provide an introduction to some important partial differential equations*

Module I: Probability Distributions (13 hours)

Random variables – Mean and Variance of probability distributions – Binomial Distribution – Poisson Distribution – Poisson approximation to Binomial distribution – Hyper Geometric Distribution – Geometric Distribution – Probability densities – Normal Distribution – Uniform Distribution – Gamma Distribution.

Module II: Theory of Inference (14 hours)

Population and Samples – Sampling Distribution – Sampling distribution of Mean (σ known) – Sampling distribution of Mean (σ unknown) – Sampling distribution of Variance – Interval Estimation – Confidence interval for Mean – Null Hypothesis and Tests of Hypotheses – Hypotheses concerning one mean – Hypotheses concerning two means – Estimation of Variances – Hypotheses concerning one variance – Hypotheses concerning two variances – Test of Goodness of fit.

Module III: Series Solutions of Differential Equations (14 hours)

Power series method for solving ordinary differential equations – Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Generating functions (No proof) – Relation between Bessel functions – Orthogonality property of Bessel functions (Proof not required).

Module IV: Partial Differential Equations (13 hours)

Introduction – Formation of PDE – Complete Solution – Equations solvable by direct integration – Linear PDE of First order, Legrange's Equation: $Pp + Qq = R$ – Non-Linear PDE of First Order, $F(p,q) = 0$, Clairaut's Form: $z = px + qv + F(p,q)$, $F(z,p,q) = 0$, $F_1(x,q) = F_2(y,q)$ – Classification of Linear PDE's – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables.

Text Books

Module I:
Richard A Johnson, CB Gupta, *Miller and Freund's Probability and statistics for Engineers, 7e*, Pearson Education- Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7

Module II:
Richard A Johnson, CB Gupta, *Miller and Freund's Probability and statistics for Engineers, 7e*, Pearson Education- Sections: 6.1, 6.2, 6.3, 6.4, 7.2, 7.4, 7.5, 7.8, 8.1, 8.2, 8.3, 9.5

Module III:
Erwin Kreysig, *Advanced Engineering Mathematics, 8e*, John Wiley and Sons, Inc.-
Sections: 4.1, 4.4, 4.5

Module IV:
N Bali, M Goyal, C Watkins, *Advanced Engineering Mathematics, A Computer Approach, 7e*, Infinity Science Press, Fire Wall Media- Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9
Erwin Kreysig, *Advanced Engineering Mathematics, 8e*, John Wiley and Sons, Inc.
Sections: 11.2, 11.3, 9.8 Ex.3, 11.5

Reference books

1. J.S.Chandan, *Statisitcs for Business and Economics*, Vikas Publishing House.
2. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, Pearson Education.
3. Parthasarathy, *Engineering Mathematics, A Project & Problem based approach,* Ane Books India.
4. B V Ramana, *Higher Engineering Mathematics*, McGrawHill.
5. J K Sharma, *Business Mathematics, Theory and Applications,* Ane Books India.
6. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
7. Wylie C.R and L.C. Barret, *Advanced Engineering Mathematics*, McGraw Hill.
8. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
9. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II*., Prentice Hall of India.
10. Michael D Greenberg, *Advanced Engineering Mathematics*, Pearson Education.
11. Babu Ram, *Engineering Mathematics Vol.I & II*, Pearson Education.
12. S.Palaniammal, *Probability and Random Processes*, Prentice Hall of India.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

EN14 402 ENVIRONMENTAL SCIENCE

(Common for all branches)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the problems of pollution, loss of forest, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues*
- *To create awareness among the students to address these issues and conserve the environment in a better way.*

Module I (13 hours)

The Multidisciplinary nature of environmental science. Definition-scope and importance-need for public awareness. Natural resources. Renewable and non-renewable resources: Natural resources and associated problems-forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their defects on forests and tribal people-water resources: Use and over utilization of surface and ground water, floods, drought , conflicts over water, dams-benefits and problems.- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.- Food resources: World food problems, changes caused by agriculture over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.-Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Module II (14 hours)

Ecosystems-Concept of an ecosystem-structure and function of an ecosystem – producers, consumers, decomposers-energy flow in the ecosystem-Ecological succession- Food chains, food webs and Ecological pyramids-Introduction, types, characteristics features, structure and function of the following ecosystem-Forest ecosystem- Grassland ecosystem –Desert ecosystem-Aquatic ecosystem(ponds, streams, lakes, rivers, oceans , estuaries)

Biodiversity and its consideration Introduction- Definition: genetic, species and ecosystem diversity-Bio-geographical; classification of India –value of biodiversity: consumptive use, productive use, social ethical , aesthetic and option values Biodiversity at Global, national , and local level-India at mega –diversity nation- Hot spot of biodiversity-Threats to biodiversity: habitat loss, poaching of wild life, man , wild life conflicts – Endangered and endemic species of India-Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Module III (13 hours)

Environmental pollution Definition-Causes, effects and control measures of Air pollution-Water pollution –soil pollution-Marine pollution-Noise pollution-Thermal pollution-Nuclear hazards-Solid waste management: Causes, effects and control measures of urban and industrial wastes-Role of an individual in prevention of pollution. Pollution case studies-Disaster management: floods , earth quake, cyclone and landslides-Environmental impact assessment

Module IV (14 hours)

Environment and sustainable development-Sustainable use of natural resources-Conversion of renewable energy resources into other forms-case studies-Problems related to energy and Energy auditing-Water conservation, rain water harvesting, water shed management-case studies-Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust-Waste land reclamation Consumerism and waste products-Reduce, reuse and recycling of products-Value education.

Text Books:

1. Daniels & Krishnaswamy, Environmental studies, Wiley India pvt ltd, 2009

2. Raman Sivakumar, Introduction to environmental science and engineering, 2nd edn, .Tata McGraw Hill, 2010

3. Anindita Basak, Environmental Studies, Pearson Education, 2009

4. Suresh K.D, Environmental Engineering and Management, Katson Books, 2007

5. Benny Joseph, Environmental studies, 2nd edn, McGraw Hill, 2009

References:

1. Raghavan Nambiar,K Text book of Environmental Studies,Scitech Publishers(India) Pvt. Ltd

2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009

3. P N Palanisamy, P Manikandan,A Geetha, Manjula Rani, Environmental Science, Pearson Education, 2012

3. D.L. Manjunath, Environmental Studies, Pearson Education, 2011

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

Note: Field work can be Visit to a local area to document environmental assets-river/forest/grass land/mountain or Visit to local polluted site-urban/rural/industrial/agricultural etc. or Study of common plants, insects, birds etc. or Study of simple ecosystems-pond, river, hill slopes etc. or mini project work on renewable energy and other natural resources , management of wastes etc.

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 403: THEORY OF MACHINES

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *The student shall learn to conduct the kinematic analysis of machinery*
- *The paper exposes the student to various kinds of mechanisms used in machines*
- *This paper should serve as a primer for learning dynamic analysis of machinery*

Module I (18 hours)

Introduction- definition and explanations of link - kinematic pair - mechanism and machine - Kinematic chains – classification - Inversions of four bar - single slider and double slider crank chains - Slotted lever and Whitworth quick return mechanisms – Mechanisms :– Pantograph - Exact and approximate straight-line mechanisms.

Kinematics - Velocity and acceleration in mechanisms - graphical solution - Corioli's component of acceleration – instantaneous centres – Kennedy’s theorem – velocity analysis using instantaneous centres

Module II (18 hours)

Toothed gearing - Law of gearing - Cycloidal and involute profiles - gear terminology and standard proportions - length of arc of contact - path of contact and contact ratio - Interference and number of teeth to avoid interference - Gear trains - simple, compound, epicyclic and reverted gear trains - Gear ratio calculations.

Module III (18 hours)

Cams - classification of cams and followers - graphical determination of profiles for different followers and different types of motion

Belt and rope drives – open and crossed belt drives- velocity ratio- length of belt-ratio of centres-power transmitted – centrifugal tension – initial tension and creep

Module IV (18 hours)

Vibration - kinematics of vibratory motion - vibration systems - vibration systems having single degree of freedom - undamped free vibration - forced vibration without damping - transverse vibrations of shafts - Dunkerly's method - energy method - critical or whirling speeds - torsional vibrations.

Balancing – Static and dynamic balancing – balancing of several masses in a plane - balancing of masses rotating in several transverse planes- balancing machines.

Text Book

1. 1. S S Rattan, *Theory of Machines*, Tata McGraw Hill

Reference Books

1. J E Shigliey, *Kinematic Analysis of Mechanism*, McGraw Hill
2. P L Ballaney, *Theory of Machines*, Khanna Publishers
3. R K Bansal, *Theory of Machines*, Dhanpat Rai PublicaitonsReference Books

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

404: FLUID MECHANICS AND MACHINERY

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To develop understanding about the basic principles, concepts, mathematical and analytical tools of Fluid Mechanics.*
- *To develop understanding about the construction, working principle and characteristics of Hydraulic Machines.*

Module I (14 hours)

Definitions and properties of fluids: – Density, gas laws, equations of state, viscosity, vapour pressure, compressibility, surface tension and capillarity etc.

Fluid pressure and its measurement: - intensity of pressure, Pascal's law, Variation of pressure in static fluid:- compressible and incompressible fluids, pressure head – manometers

Fluid statics: - hydrostatic forces on submerged surfaces, buoyancy and floatation, Archimedes principle, metacentre, stability of submerged and floating bodies.

Module II (14 hours)

Types of flow – stream line, path line, streak line-continuity equation- Bernoulli's theorem for the flow of incompressible fluids-

Flow through pipes – laminar and turbulent flow- critical Reynolds number- Hagen Poiseuille Law, development of boundary layer in pipes-pipe losses

Fluid flow measurements: - pitot tube, venturimeter, orifice meter, nozzle meter

Module III (13 hours)

Dimensional analysis - Physical dimensions - dimensional homogeneity - Buckingham's theorem - geometric, kinematic and dynamic similarities - theory of models

Pumps :- reciprocating pumps - principle of working, work done, effect of acceleration, frictional resistance, separation, air vessel etc.

Hydraulic devices - Hydraulic ram, accumulators, and intensifier - principles of working, gear pumps

Module IV (13 hours)

Impact of jets: - force exerted by fluid jet on (i) stationary curved vane (ii) moving curved vane.

Turbines - classification - reaction and impulse turbines - Pelton wheel, Francis, Kaplan, turbines etc.

Centrifugal pumps - work done by the impeller, - head and efficiency - specific speed - testing of pumps. (Simple problems)

Text Books

1. Modi P.N., Seth S.M, *Hydraulics and Fluid Mechanics*, Standard Book House.
2. D S Kumar, *Fluid Mechanics and Fluid Power Engineering*, S K Kataria & Sons Pub.

Reference Books

1. Daugherty and Franzini - *Fluid mechanics with engineering applications*, McGraw Hill
2. Massey - *Mechanics of fluids*,-ELBS
3. Dr.Jagdish Lal. - *Hydraulic machinery*, Metropolitan book House Co.
4. Kumar K.L., *Engineering Fluid Mechanics*, Eurasia Publications Limited, NewDelhi

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

PE14 405: DESIGN OF MACHINE ELEMENTS

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To acquaint the students with the analytical and mathematical tools of mechanical design.*
- *To familiarise the students with practical consideration used for the design and selection of the machine components*

Module I (14 hours)
Principles of mechanical design - estimation of design load - design for steady, fluctuating and dynamic stresses - effects of stress concentration - consideration of creep and thermal stresses in design - influence of production processes in design - tolerances and fits per I.S specifications - principles of standardization - selection of materials - considerations like wear environment - human and aesthetic aspects.

Module II (14 hours)
Welded joints - stresses welded joints - strength of welded joints - fatigue loading of welded joints - design of bolts and screws.

Module III (16 hours)
Mechanical springs - design of helical springs - helical torsion spring - critical frequency of helical springs - energy storage capacity - common types of leaf springs - shafts - stresses in shafts - equivalent twisting and bending moments - effect of keyways - transmission shafts - determination of shaft size for strength - design of shafts for deflection - critical speeds for shafts - operating speeds - shafts subjected to steady and alternating loads.

Module IV (10 hours)
Couplings - rigid and flexible coupling - common types of keys, pins and retainers and their applications

The following data books may be permitted for the examination
1. Prof. Narayana Iyengar & Prof. Lingiah, *Design Data bookVol 1 &2*
2. *Design Data book of PSG College of Technology*

Text Books
1. Bhandari V.B., *Design of Machine Elements*, Tata McGraw Hill publishers

2. Shigly J.E., *Mechanical Engineering Design*, McGraw Hill, International student edition

Reference Books

1. Doughter & Valance, *Design of Machine Elements*, McGraw Hill publishers
2. Johnson, *Optimum Design of Mechanical Elements*, John Wiley

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 406: THERMAL ENGINEERING

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To acquaint the students with the fundamental concepts of Thermodynamics and Heat Transfer*
- *To equip the students to analyse and interpret various thermodynamic cycles and heat energy transfer systems*

Module I (14hours)

Laws of thermodynamics – zero'th law and temperature – energy transfer as work – first law of thermodynamics and internal energy —first law applied to flow processes, second law of thermodynamics – reversibility and availability – entropy as a property – clausius theorem – clausius inequality –steady flow energy equation – control volume approaace - enthalpy – absolute entropy and third law of thermodynamics

Module II (14 hours)

Working substance and their properties – property charts and tables – representation of changes of state and process on T-S, H-S and P-h charts – characteristics of thermodynamic systems – ideal and practical cycles – Carnot, Otto, Diesel and Brayton cycles – theoretical efficiencies – Rankine cycle– calculation of output and efficiencies

Module III (13 hours)

Gas compressors - reciprocating and rotary compressors - principle of operation of compressors – Refrigeration systems – Reversed heat engine cycle –Refrigerator and heat pump, Ideal COP, vapour compression and absorption systems - principle of operation of refrigeration systems

Module IV (13 hours)

Conduction - Fourier heat conduction equation - thermal conductivity - one-dimensional heat conduction through planes - cylinders and spheres - extended surfaces – Convection - elementary ideas of free and forced convection – Radiation - principle of radiation heat transfer

Text Books

1. P.K.Nag, *Engineering Thermodynamics*, Tata Mc Graw-Hill

Reference Books

M. Achuthan, *Engineering Thermodynamics*,*PHI*

J.P Holman,*Heat transfer*, Tata Mc Graw-Hill

Ballaney,*Thermal Engineering*, Khanna Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 407(P): ELECTRICAL AND ELECTRONICS LAB

Teaching scheme **Credits:** 2

3 hours laboratory classes per week

Objectives

- *The lab provides an opportunity to understand the basic electrical theories by conducting experiments. This will also provide them with sufficient experience in designing experiments to demonstrate or validate electrical theory.*

1. Study of starters (i) 3 point and 4 point starters for DC motors (ii) Star-delta, auto-transformer, DOL and rotor resistance starters for induction motors.

2. (a)(i)Obtain the Open Circuit Characteristics of the DC shunt generator at the rated speed and determine the shunt field critical resistance. (ii) Pre-determine the OCC at the given speed (b) Perform load test on the given DC shunt generator and plot the external characteristics.

3. Perform Break test on DC shunt and series motors and plot the following characteristics (i) output v/s efficiency (ii)) output v/s line current (iii) speed v/s torque (iv) line current v/s torque.

4. (a)Perform OC and SC test on single phase transformer and pre-determine the following (i) equivalent circuit (ii) efficiency (iii) regulation.

   (b) Perform load test on single phase transformer and determine efficiency and regulation.

5. Perform load test on three phase cage induction motor and plot the following Characteristics (i) efficiency v/s output (ii) slip v/s output (iii) power factor v/s output (iv) torque v/s output.
6. Calibrate the given single phase energy meter by (i) direct loading (ii) Phantom loading.
7. (i) Familiarization with electronic components, devices and equipments (ii) Study of CRO.
8. Design and set up half adder and full adder circuit.
9. Study the given 8085 microprocessor kit. Write and execute an assembly language program to add N numbers.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PE14 408(P): MECHANICAL ENGINEERING LAB

Teaching scheme **Credits:** 2
3 hours Practical per week

Objectives

- *To plan and conduct experiments to study and validate the performance of various measuring instruments and equipment*
- *To train the students to plan experiments for evaluating practical situations*
- *To understand how experiments shall be set up for experimental studies*

1. Estimation of hydraulic coefficients of orifices and mouth pieces
2. Calibration of venturimenter, orifice meter and flow nozzle meter
3. Calibration of triangular and rectangular notches
4. Performance list on rotodyanamic and reciprocating pumps
5. Performance lists on two stroke and four stroke petrol and diesel engine
6. Calibration of pressure gauge
7. Calibration and use of temperature sensing devices – thermo couple, resistance thermo meters and pyrometers

8. Calibration and use of vibration pickups, displacement pickups and accelerometers

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PE 14 501: ENGINEERING ECONOMICS & PRINCIPLES OF MANAGEMENT

Teaching scheme **Credits: 4**
3 hours lecture and 1 hr tutorial per week

Objectives

- *To have a basic knowledge on economic theories, and their applications, management concepts, functions of management, human behaviour at work etc.*

Module I (14 hours)
Basic Economics – Economic reasoning, Fundamental economic problems, Circular Flow in an economy, Law of supply and demand, Demand forecasting, Concepts of elasticity, Economic efficiency. Money and Banking. Inflation and deflation: concepts and regulatory measures. Economic Policy Reforms in India since 1991: Industrial policy, Foreign Trade policy, Monetary and fiscal policy, Impact on Industry.

Module II (14 hours)
Factors of production, Concepts of Total product, average product, Marginal product. Concept of Productivity and its measurement, Laws of returns, Input-output analysis,
Production function analysis (Cobb-Douglas and CES), Internal and external economies of scale Analysis of costs, Accounting and economic costs, Total/Average/Marginal costs,
Sunk cost, Private and Social cost, Opportunity cost. Characteristic features of Perfect competition, Monopolistic competition and Monopoly.

Module III (13 hours)
Introduction to Management – definition – Principles – Philosophy and development of management thought – Functions of management – Planning - Organizing – staffing – leading – controlling – Different types of Organizational structures and relationships -
Decision making – Types of Decisions – Decision making under uncertainties,risk and certainty – criteria.

Module IV (13 hours)
Human behaviour and management – skills of manager at various levels in an organisation-

Text Books

1. PaneerSelvam, R, *Engineering Economics*, Prentice Hall of India, New Delhi, 2002.
2. Koontz & Weirich, *Management*, McGraw-Hill Publishers.

Reference Books

1. Koutsoyiannis A, *Modern Micro economics*, McMiklllan, 2004
2. Barthwal, R.R *Industrial Economics*, Himalaya publishers, Mumbai, 2005.
3. Vohra, *Quantitative techniques in management*, McGraw hill Publishers.
4. Hersey Paul and Blanchard, *Management of Organisational behaviour*, Prentice Hall.
5. Luthans, *Organisational Behaviour*, Mc Graw Hill Publishers.
6. Jit S Chandran, *Organisational Behaviour*, Vikas Publishing.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 502: COMPUTATIONAL METHODS IN ENGINEERING

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To develop analytical capabilities*
- *To formulate and solve real engineering situation*

Module I (14 hours)
Errors in numerical calculations - sources of errors - significant digits - numerical solutions of polynomial and transcendental equations - bisection method - Regula-Falsi method - Newton-Raphson Method - method of iteration - rates of convergence of Newton-Raphson Method - Graeffe's root squaring method for polynomial equations - Bairstow's method for extracting quadratic factors in the case of polynomial equations - Newton's method for non-linear simultaneous equations

Module II (13hours)
Solutions of system of linear algebraic equations - Gauss elimination methods - Crout's triangularization methods - Gauss - seidel iteration method - relaxation methods - power method for the determination of Euigen values - polynomial interpolation – Lagrange's interpolation polynomial - divided differences - Newton's divided differences interpolation polynomial - finite differences - Gregory - Newton - forward and backward differences interpolation formula (elementary treatment only)

Module III (14 hours)
Numerical differentiation - differentiation formulas in the case of equally spaced points - numerical integration - trapezoidal and Simpson's rule - errors of interpolation and integration formulas - 2 points and 3 points Gauss Legendre and Gauss-Chebyshev quadratic formulas - numerical solution of ordinary differential equations - single step methods Taylor series methods - Euler's method - modified Euler's method - Picards iteration method - Runge-Kuta methods - 4^{th} order formulae - multi step methods - Milne's predictor corrector formula

Module IV (13hours)
Solution of linear difference equations with constant coefficients - numerical solutions of boundary value problems in ordinary differential equations - finite difference methods for solving two-dimensional laplaces equations for a rectangular region - finite difference method of solving heat equation and wave equation with given initial and boundary conditions

Reference Books:
Narayanan S., Manichavachagom Pillai & Dr Ramanaiah G., *Advanced Mathematics for Engineering Students Vol III*, S Viswanathan Publishers
Sasthri S S *Numerical Analysis*, Prentice Hall of India Publishers
Jain M K., Iyengar S R K & Jain R K, *Numerical Methods for Scientific and Engineering Computation*, Wiley Eastern Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 503: WELDING AND ALLIED PROCESSES

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives
- *To understand different joining techniques, metallurgical aspects of welding, testing and quality control of weldments*

Module I (14 hours)
Introduction - classification of processes –soldering, brazing, welding, gouging, arc and gas cutting

Welding symbols -joints -terminology - weldability of materials- distortion control- residual stresses – Heat affected zone and welding metallurgy.

Module II (13 Hours)
Gas and arc welding processes, equipment, electrodes, power source etc. of carbon arc, shielded metal arc, TIG, MIG, submerged, electro slag, plasma arc, Laser beam welding and EBM - applications.

Module III (13 Hours)
Resistance and other welding processes - resistance welding - spot, seam, projection, resistance butt, percussion, Thermit, laser beam, forge, friction, friction stir and explosion welding.

Module IV (14 Hours)
Metal transfer in welding, dilution control in welding, under water welding, welding of plastics
Defects in welds - inspection and testing of welds - destructive and non destructive testing - visual, radiography, magnetic particle, eddy current and dye penetrant testing.

Text Books:

1. Parmar R.S., *Welding Processes and Technology*, Khanna Pub.,
2. Srinivasan N.k., *Welding Technology*, Khanna Publications

Referance books
1. Little.R.L. - *Welding and welding technology*, Tata McGraw Hill
2. Hourdcraft P.T. - *Welding process technology*.,Camdridge University press.
3. Rossy. - *Welding and its applications*, McGraw Hill
5. Howard.B.Cary. *Modern welding technology"*, Prentice Hall
6. R.Halmshaw, *Non destructive testing*, Edward Arnold 1987
7. P N Rao, *Manufacturing Technology*, Vol I, Tata Mc Graw Hill Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 504: METAL CASTING

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To acquaint the student with the fundamental aspects related to metal casting viz. melting solidification , pattern making, sand casting and special casting process*

Module 1 (14 hours)

Melting - Melting and Pouring of Metals - Crucible, Cupola, Oil Fired Furnaces – Electrical Furnaces – Induction Furnaces - Arc Fired Furnaces - Calculation of Cupola Charges - Temperature Control and Measurements in Furnaces - Degasification of Metals - Inoculation.

Module II (14 Hours)

Solidification - Freezing of Metals and Alloys - Properties Related to Freezing Mechanisms - Effect of Composition and Rate of Cooling on The Structure of Cast Iron - Metallurgical advantages of Casting - Metallurgy of Non-Ferrous Casting Alloys.

Module III (13 Hours)

Moulding: Pattern Making, Moulding Methods - Processes, Materials and Equipments, Cores and Core Making - Moulding Sands - Properties, Control and Testing, Casting Design - Pouring and Feeding of Castings - Simple Examples of Riser Design for Steel Castings.

Module IV (13 Hours)

Sand Casting, Pressure Die Casting, Centrifugal Casting, Investment Casting, Shell Moulding, Carbon Dioxide Process, Continuous Casting etc. - Quality Control In Castings - Inspection and Testing in Castings - Salvaging - Mechanization of Foundries - Material Handling Equipments used in Foundry - Introduction to Casting of Non-Ferrous Metals like Aluminium, Copper etc. - Introduction to Steel Castings.

Text Book

1. Heine, Loper and Rosenthal - *Principles of Metal Casting*, Tata Mcgraw Hill.

Reference Books

1. Wulf, Taylor and Flemings - *Foundry Engineering*, Wiley Eastern
2. Howard - *Modern Foundry Practice*, Asia Pub.
3. Ekey and Winter - *Foundry Technology*, Mcgraw Hill
4. Dhanpatrai and M.Lal. - *A Textbook of Foundry Technology*.
5. Serope Kalpakjian Steve.R.Schmid, *Manufacturing Process for Engineering Materials*, Pearson Education
6. P N Rao, *Manufacturing Technology*, Vol I, Tata Mc Graw Hill Publishers

Internal continuous assessment *(maximum marks-50)*

60% - tests (minimum 2)
30% - assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 505: METAL FORMING

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide an exposure to the basic concepts of plasticity which is essential for in the analysis of metal forming processes*
- *To get familiar with the metal forming techniques, tools and processes*

Module I (14 hours)

Theory of stress – Stress tensor – Spherical and Deviator stress tensors – Transformation equations – Principal stresses – Invariants – Octahedral stress – Maximum shearing stress – Theory of strain – Strain tensor – Spherical and Deviator strain tensors – Transformation equations – Principal Strains – Invariants – Octahedral strain – Compatibility equations

Module II (14 hours)

Theory of Plasticity – Von-Mises and Tresca yield criteria – Failure theories – Plastic stress-strain relations – Saint Venent's theory of plastic flow – Reuss theory of elasto-plastic deformation – Hencky's theory of small plastic deformations – Two dimensional Plastic flow – Equilibrium equations referred to arbitrary Cartesian co-ordinates – Equilibrium equations referred to slip lines

Module III (13 hours)

Forging :- Type of forging operations – design of forging dies – defects in forging – NDT – Extrusion – Equipment for extrusion – Processes of extrusion – Properties of extruded metal – Defects in extruded products – Hot and cold drawing - properties –formability, formability limit diagram, defects – Deep drawing, defects in deep drawing,- stretch forming.

Module IV (13 hours)

Rolling: - Rolling process – Rolling mills – properties of rolled components – stresses in rolling – rolling load calculation - Sheet metal work – Sheet metal and press working – Sheet metal joints – Types of presses and dies – Shearing and spinning of metals

Introduction to powder metallurgy

Text Books

1. L S Srinath, *Advanced Mechanics of solids*, Prentice Hall of India

Reference books

1. Timonshinko & Goodyear, *Theory of Elasticity*, Tata Mc Graw Hill
2. Dr.Sadhu Singh, *Theory of Plasticity*, Khanna
3. L.S.Srinath, *Theory of Plasticity*
4. Hoffman & Sachs, *Introduction to theory of Plasticity for Engineers*, Mc Graw Hill
5. Dieter, *Principles of Mechanical Working of Metals*
6. Johnson, *Forging Products*
7. Pearson, *Extrusion of Metal*

8. G.W. Row, *Fundamentals of Metal Forming*
9. Dr. R Narayanaswamy, *Metal forming technology*
10. Dr. Sadhu singh, *Applied Stress analysis*, Khanna Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 506: METROLOGY AND INSTRUMENTATION

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

- *To impart knowledge in fundamentals of measurements.*
- *To acquaint the student with the inspection procedures and instruments used in industrial production.*

Module I (13 hours)

Introduction to metrology - Limits, Fits and tolerances – reason for systems of limits – definitions and terminology – shaft based and hole based systems – types of fits – Tolerances – specifications – compound tolerancing – tolerance grades – Taylor's principles – limit gages.

Linear and angular measurements – comparators – tool maker's microscope – autocollimator – profile projector.

Module II (14 hours)

Geometric features – basic definition of straightness, flatness, parallelism, roundness, circularity, squareness etc. – principles and equipments for measurement – principles of interferometry Surface roughness – Definitions – General considerations – Tally surf – Profilometer – roughness indicators – symbols in geometric features.

Gears – measurements and inspections of spur gears – tooth thickness, pitch, base pitch etc. – gauging of gears. Screws – Terminology – measurement and inspection of threads – major, minor, effective diameters, pitch. – gauging of screws.

Module III (13 hours)

Static performance characteristics of measuring instruments – accuracy ,precision, sensitivity etc. – errors in measurements – statistical treatment of data – treatment of single sample data and multisampling data.
Functional elements of measuring system – various types and classification of transducers, modifying systems and display systems

Module IV (14 hours)
Measurement of pressure – manometers – diaphragms – bourdon gage – strain gage pressure cell and electrical resistance pressure cell
Measurement of force and torque – elastic transducers – strain gage load cells – mechanical and hydraulic dynamometers
Measurement of flow –obstruction meters – variable area meters – magnetic and ultrasonic flow meters- strain gage flow meters – turbine type flow meters
Measurement of temperature – bimetallic thermometers – thermo couples – pressure thermometers – optical and radiation pyrometers
Measurement of vibration – micrometers – accelerometers – seismic instruments

Reference Books
1.R.K.Jain, Industrial metrology,Khanna Publishers
2. Gupta I C , A text book of Engineering Metrology,
Dhanpatrai Publishers
3.Nakra BC & Choudhary K K , *Instrumentation, Measurements And Analysis*
4. Beckwith, *Mechanical Measurements*, Oxford & IBH

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 507(P): MACHINE TOOL LAB II

Teaching scheme **Credits:** 2
3 hours laboratory classes per week

Objectives
- *To understand the operation of equipment*
- *To evaluate and calibrate various equipment*
- *To understand how experiments shall be set up for experimental studies*

Module I

Shaping, planing and slotting:- working principles of crank shapers - hydraulic shaper - speeds and feeds in shaping - planing operations - shaper and planer tools - types of planers and their relative merits - Differences between vertical shaper and slotter- description of slotting machines and types of work done.

Exercises - Shaping and planing, surfacing, T- slots, grooving, dove tail cutting and keyways in flat and cylindrical surfaces. Slotting: - Keyway cutting and grooving.

Module II

Milling:- types of milling machines - principles of milling - milling machine attachments - speeds and feeds in milling operations - grooves, splines, dove tail and cam milling, climb and conventional milling, string and gang milling.

Exercises - indexing head, simple and differential indexing, plain milling, cutting of spur and helical gears.

Module III

Grinding and Drilling: - Types of grinding machines, surfaces, cylindrical, universal, selection of grinding wheels, - tool and cutter grinders – live and dead centre grinding – taper grinding.

Drill geometry – drilling - boring and reaming – types of drilling machines

Exercises –demonstration of cylindrical and taper grinding operations and drilling operation.

[Note: - At least four models to be prepared]

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PE14 508(P): MATERIAL TESTING LAB

Teaching scheme **Credits:** 2

3 hours laboratory classes per week

Objectives

- *To provide the Students an opportunity to verify the theoretical concepts they have learned and also the complexity and requirements of planning experts in this area.*

1. Tension test on M.S. rod
2. Shear test on M.S. rod
3. Hardness test - Brinell, Rock well, Vickers and rebound
4. Impact test - Izod and Charpy
5. Torsion test on M.S. rod
6. Spring test
7. Torsional pendulum - determination of ‘ N’ of wires
8. Compression tests - bricks, concrete cubes

9. Tests on timber - compression and bending

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give the student basic concepts, processes and analysis of machining processes*

Module I (14 hours)

History and development of tool materials - general requirements of tool materials-tool geometry-systems of cutting tool nomenclature- single point and multipoint tools- different machining processes and selection of tools. - Simple problems.

Module II (14 hours)

Mechanics of metal cutting- mechanism of chip formation – forces on cutting tool- merchant's circle – tool dynamometers- tool force measurements- friction in metal cutting. - Simple problems.

Module III (13 hours)

Temperature in machining – temperature distribution - effect of machining variables on temperature – measurement of temperature.
Tool life and tool wear – effect of machining parameters on tool wear- selection, properties and application of cutting fluids. Simple problems.

Module IV (13 hours)

Economics of machining – choice of parameters – metal removal rates.
advanced machining processes – introduction – operating principles – process parameters and application of USM,AJM,WJM,ECM,ECG,EDM,EBM,LBM,PAM and chemical milling.

Text Books

1. Shaw M.C., *Metal cutting principles*, Oxford university press.

Reference books

1. Geoffrey Boothroyd, *Fundamentals of metal machining and machine tools*., Tata Mc Graw hill
2. Sen and Bhattacharya, *Principles of metal cutting*, New central publishers.
3. Venkatesh and Chandrasekharan, *Experimental technics in metal cutting*., Prentice hall India.
4. G R Nagpal, *Tool Engineering & Design*, Khanna Publishers
5. P N Rao, *Manufacturing Technolgoy*, *Vol II*, Tata McGraw Hill Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 602 MECHATRONICS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Course Objectives:

1 *To impart knowledge on the fundamentals of the following*
2 *i. Control systems*
3 *ii. Controls in NC machine*
4 *iii. Fluidic Controls and*
5 *iv. Process control Pneumatics.*

Module I (14 Hours)

Introduction - multidisciplinary scenario - evolution of mechatronics - Definition, Mechatronics in manufacturing, products and design. Comparison between Traditional and Mechatronics approach - measurement systems - control systems - Electronics: Review of fundamentals of electronics, logic gates and their operations, Data conversion devices, sensors, micro sensors, transducers, electrical contacts, actuators, and switches, contactless input devices, signal processing devices; relays, output devices.

Module II (14 Hours)

Mechanical: Ball screws, linear motion bearings, transfer systems.

Hydraulics: Hydraulic elements, actuators and various other elements.

Control Systems: Open loop and closed loop control, block diagrams, transfer functions, Laplace transforms;

Module III (14 Hours)

Mathematical model of physical system; PI and PID controllers, 8085 microprocessor, PLC controller

Ladder diagrams, hydrualic and pneumatic controllers; Time domain analysis, transient response of first and second order systems

Module IV (12 Hours)

Introduction to nonlinear control; State space analysis, optimal and adaptive control;

Introduction to discrete-time systems and Z-transform. Design and fabrication of Mechatronics systems

Text books

1. Automatic Control Engineering by F.H.Raven, 5th ed., McGrawHill International
2. Anthony Esposito, „*Fluid Power with applications, 6/E'*, Pearson Education, 2009
3. Machine design for mobile and industrial applications by G.W.Kurtz, J.K.Schueller, P.W.Claar, SAE.
4. Mechatronics, Mohali, TMH
5. Machine design for mobile and industrial applications by G.W.Kurtz, J.K.Schueller, P.W.Claar, SAE.

Reference Books:

1. Mechatronics, Bolton, Pearson Education
2. Ogata Katsuhiko , „*Modern Control Engineering*", Printice Hall of India , 2005.
3. YoranKoren, „*Computer control of Manufacturing Systems*", Tata McGraw Hill Publishers, New Delhi, 2005.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 603: INDUSTRIAL ENGINEERING

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide a basic knowledge on various industrial engineering principle and tools and need for analyzing engineering activities.*
- *To familiarise the students with the design, improvement and installation of integrated systems of men, materials and equipments*

Module I (14 hours)

Introduction to Industrial Engineering – Definition – Functions- Historical Development of Industrial engineering – Applications of Industrial Engineering - Productivity – Input output model - factors affecting Productivity – Productivity Ratios - Improving productivity – Indian Industry – Productivity of Indian industry

Module II (14 hours)

Product design and development – Good Product Design – Product planning – Product development – Product life Cycle - Products and services – Product Standardization, Simplification, Specialization and Interchangeability – Value Analysis - Value Engineering

Module III (13 hours)

Work Study – Scope and Objectives – Method Study Procedure – Process Charts – Flow diagram- Principles of motion economy – Micro motion study – Cycle graph- Chronocyclegraph – SIMO Chart – Work Measurement – Time study – Performance rating – standard time – allowances – Work sampling – PMTS – Standard data

Module IV (13 hours)

Industrial safety – Safety management – Industrial accidents and accident prevention- Safety Organization, Councils and safety meetings, safety audits – Safe workplace layout- personal protective equipments - Safety motivation – Hazard analysis – Industrial pollution and pollution control – Environmental impact assessment- Environmental Management Systems

Reference books

Donald R Herzog, *Industrial Engineering Methods and Controls*, Prentice Hall
H.B. Maynard, *Industrial Engineering Handbook*, McGraw-Hill Publishers
W Grant Ireson, Eugene L Grant, *Handbook of Industrial Engineering management*- Prentice Hall
Marvin Mundel, *Motion and Time Study*, Prentice Hall India
ILO, *Introduction to Work Study*, Universal Book Corporation
Harold T Amrine,John A Ritchey etal.., *Manufacturing Organization &management*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

PE14 604 : INDUSTRIAL QUALITY CONTROL

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives:

To impart knowledge on the concept of quality tools for analyzing quality statistical tools in quality acceptance sampling and life tests.

Module I (13 hours)
Introduction to concept of quality – quality control – quality assurance – quality management – quality and total quality – small q and big Q – concept of total quality management – TQM axioms – major contributions of Deming, Juran and cross by to quality management – enablers for total quality – strategic quality management.

Module II (14 hours)
Quality costs - analysis of quality costs – loss functions – Taguchi methods – total quality tools – Pareto charts –Fish bone diagram - check sheet – histograms – scatter diagrams – run charts – flow diagram – bench marking –
Module III (13 hours)
over view of ISO 9000: 2000 certification – quality circles – experimental design – guidelines – overview of factorial experiments, replication, general idea on process optimization – process robustness studies – quality function deployment , failure mode, effect and criticality analysis, continuous process improvement- the PDSA cycle – Kaizen

Module IV (14 hours)
Statistical tools in quality – making predictions using the normal, Poisson, and binomial probability distributions –statistical process control – control charts for variables – X and R charts – process capability indices – control charts for attributes – p, np, c and u charts.
Acceptance sampling –lot by lot acceptance using single sampling by attributes – OC curve – average out going quality and the AOQL – double sampling – multiple and sequential sampling – ATI and AFI

Textbooks

1. Dale H, Bester Field. "Total Quality Management" 3rd edition, Pearson Education.
2. Juran J M, Gryna I M, "Quality Planning and Analysis" Tata McGraw Hill Publishing Company.
3. Montgomery, Douglas C2001 "Introduction to Statistical Quality Control", 4th Edition, John Wiley & Sons.
4. Gerals M Smith-2004, "Statistical Process Control and Quality Improvements", 5th Edition, Pearson Education.
5. Grant, "Statistical Quality Control", McGraw Hill.

PART A:	*Analytical/problem solving SHORT questions*	*8x 5 marks=40 marks*
	Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	
PART B:	*Analytical/Problem solving DESCRIPTIVE questions*	*4 x 15 marks=60 marks*
	Two questions from each module with choice to answer one question.	

Maximum Total Marks: 100

PE 14 605: INDUSTRIAL AUTOMATION

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the concept of Automation, hardware generally used logics related to Automation*

Module I (13 hours)

Fundamental concepts in manufacturing automation –Definition – reasons-types of production, types of automation strategies, levels, automated flow line, work piece transport, transfer mechanisms, buffer storages, part feeders

Module II (14 hours)

Low cost automation, use of hydraulics and pneumatics in automation, fluids selection and study of hydraulic components and hydraulic power pack, counter devices and other elements – Simple sequential logical circuits design for single – multi cylinders, fluidic elements and programmable logic controllers – electro pneumatic circuits – simple circuit design

Module III (13hours)

Introduction into CNC, Flexible manufacturing system, robotics and computer aided quality control advantages of CNC, open and closed loop control, classification of CNC machine tools, structural features-turning and machining centers, Automatic tool changers, pallet changer and NC

Tooling, CNC drives. Manual and computer aided part programming, canned cycles, APT., CMM, automated inspection and computer integrated manufacturing.\

Module IV (14 hours)
Assembly automation – Automatic assembly transfer system, continuous, intermittend and indexing – automatic feeding and orienting devices, vibratory feeder, mechanics of vibratory feeder, orientation of parts, typical orienting systems (introduction only) Mechanical feeders – rotary disc feeder, center board hopper feeder, magazines.

Reference books

1. Mikell P Groover, *Automation, Production systems and computer aided manufacturing*, Prentice Hall, 1980
2. Radhakrishnan P. *Computer numerical controlled machines*
3. Kundra & Thiwari, *NC Machine Tools and computer aided manufacturing*, TMH 1991
4. John Pippanger and Tyles Hicks, *Industrial Hydraulics*
5. *Geoffrey Boothroyd, assembly automation and product design, Taylor and francis.*

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 606 ENGINEERING MATERIALS

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give a detailed exposure of various materials used in Engineering.*
- *To have knowledge about Ferrous as well as non ferrous materials like Ceramics, Composite, polymer etc.*

Module I (14 hours)
Physical properties of metals:- Melting point – density – Thermal properties – Electrical properties – Magnetic properties – Optical properties – Mechanical properties:- Tensile strength – Modulii of elasticity – Hardness – Brinell, Rockwell and Vickers hardness – Impact Strength – Izod and Charpy tests – Toughness – Fatigue - Creep

Module II (14 hours)
Ferrous metals: – Iron-Carbon equilibrium diagram – Time-Temperature Transformation curves – Heat treatment of carbon steels: – Annealing – Spheroidising – Normalizing – Tempering – Hardening – Effect of alloying elements – Stainless steel –cast iron.

Module III (13 hours)
Non-ferrous metals – Copper and its alloys – Aluminium and its alloys – Nickel and its alloys – Titanium and its alloys

Module IV (13 hours)
Ceramics :– Mechanical properties – Brittle fracture – Static fatigue – Creep – Thermal shock – Optical properties – Refractive index – Reflectance - Transparency – Translucency and opacity
Polymers: – Polymerization – Structural features of polymers – Thermoplastics and thermosetting polymers – additives – Mechanical properties –Optical properties
Composites: – Fiber reinforced composites – Aggregate composites –Mechanical properties

Text Books

1. William D Calister *Material Science and Engineering*, , John Wiley and sons Inc
2. Donald R Askeland, *The Science and Engineering of materials*, PWS-KENT Publishing co
3. Sidney H Avener, *Physical Metallurgy*, Mc Grow Hill
4. R A Higgins, *Engineering Metallurgy*, VIVA (Low Priced Student Edition)
5. Kingeri, *Introduction to Ceramics*,

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 607(P): MANUFACTURING SCIENCES LAB

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To train students to conduct experiments in manufacturing sciences*
- *To train the students to plan experiments for evaluating practical situations*

1. Specimen preparation for microscopic inspection
2. Study and use of metallurgical microscope, microstructure of ferrous and non - ferrous materials
3. Heat treatment processes - study of various parameters - hardness
4. Determination of cutting forces in turning - lathe tool dynamometer
5. Determinations of tool wear - tool makers microscope
6. Preparation of specimen for sand mould testing - tension, compression, hardness, porosity
7. Sand sieve analysis
8. Spark testing & scratch testing of materials
9. Preparation of specimens for welding - gas, arc welding processes - specifications
10. Measurement of HAZ - structural changes, NDT of welded joints

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PE14 608 (P): CAD/CAM LAB

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *Experiments are aimed at providing the student an atmosphere in which he will be exposed to some of the basic CAD/CAM techniques*

CAD - Laboratory

1. Modelling of machine components
2. Assembly modelling
3. Preparation of detail drawing from solid model
4. Finite element modelling and analysis
5. Mechanism modelling and analysis

CAM – Laboratory

1. Programming of CNC Lathes
2. Programming of machining centres

3. NC Programming from CAD models

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PE14 704(B): PROJECT MANAGEMENT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give exposure to the major aspects of project viz.. Project, Planning, Analysis, Selection, Implementation and review*

Module I (14 hours)
Planning - Capital Expenditures – Phases of Capital Budgeting – Levels of decision Making – Facets of Project analysis- Feasibility Study – Objectives of Capital Budgeting – Resource Allocation framework- Key Criteria- Elementary Investment strategies – Portfolio planning tools – Generation of project Ideas – Monitoring the environment – Corporate appraisal – Scouting for project ideas – Preliminary Screening – Project rating index – Sources of Positive net present value

Module II (14 hours)
Analysis – Market and demand analysis – Situational analysis and specification of objectives – Collection of secondary information - Conduct of market survey – Characterization of Market – demand Forecasting – Market planning – Technical analysis- Material inputs and utilities – Manufacturing process/technology – Product Mix – Plant capacity – Location and site -machineries and equipments – Structures and civil works – Project charts and layouts – Work schedule – Financial Analysis – Cost of project – means of finance – Estimates of sales and Production – Cost of production – Working capital requirements and its financing – Profitability projections – Break even point – projected cash flow statements and balance sheets

Module III (13 hours)
Project Cash flows – Basic Principles for measuring cash flows – Components of cash flow – Cash flow illustrations – Viewing a project from different points of view – Time value of money – Future Value of a single amount – Future value of an annuity – Present value of a single amount – Present Value of an annuity- Cost of capital – Cost of debt capital – cost of preference capital – Rate of return – Cost of external equity and retained earnings - Determination of weights – Appraisal criteria – Net present value – Cost benefit ratio- Internal rate of return- Urgency – payback period

Module IV (13 hours)
Implementation- Forms of Project organization – Project planning – Project control – Human Aspects of Project management – Network Techniques – Development of Network – Time

estimation – Critical path determination – Scheduling under limited resources – PERT Model – CPM Model – Network Cost System – Project review- Initial; review – Performance evaluation – Abandonment analysis

Text Books

1. Prasanna Chandra, *Projects Planning, Analysis, Selection, Implementation and Review, Fourth Edition*, Tata McGraw -Hill

Reference Books

1. Dennis Lock, *Project Management*, Grower Publications
2. Prasanna Chandra, *Financial Management Theory and Practice*, Tata McGraw -Hill Publishers
3. Parameswar P Iyer, *Engineering Project management*, Vikas Publishers
4. Gido & Clements, *Successful Project Management*, Vikas Publishers
5. Harold.T..Amrine John.A.Ritchey, *Manufacturing Organisation and Management*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 607(P): MANUFACTURING SCIENCES LAB

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To train students to conduct experiments in manufacturing sciences*
- *To train the students to plan experiments for evaluating practical situations*

11. Specimen preparation for microscopic inspection

12. Study and use of metallurgical microscope, microstructure of ferrous and non - ferrous materials

13. Heat treatment processes - study of various parameters - hardness

14. Determination of cutting forces in turning - lathe tool dynamometer

15. Determinations of tool wear - tool makers microscope

16. Preparation of specimen for sand mould testing - tension, compression, hardness, porosity

17. Sand sieve analysis
18. Spark testing & scratch testing of materials
19. Preparation of specimens for welding - gas, arc welding processes - specifications
20. Measurement of HAZ - structural changes, NDT of welded joints

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give knowledge about various machine components and installation and testing of machine tools*

Module I (18 hours)

Machine beds and columns - relative merits of different types of beds and columns as regards to materials - construction - stiffness and rigidity - design considerations of beds and columns - concrete and metallic foundation - sources and effects - equipment for the study of vibration - vibration isolation

Module II (18 hours)

Slides ways - different types of slide ways - wear adjustments - design consideration - lubrication surface finish - straightness and hardness requirements of slide way

Module III (18 hours)

Drive systems - selection of range of feeds and speeds - layout in AP, GP and LP - standardisation of speeds and feeds - ray diagram for machine tool gear boxes - various types of drives such as sliding and clutched drives - Rupert drives - feed gear box analysis - Norton and meander drives - stepless drive

Module IV (18 hours)

Erection and testing - equipment needed for erection - erection procedure - commissioning - check list - safety - I.S. specification for testing machine tools - acceptance tests for lathe - milling - drilling - grinding machines - maintenance and reconditioning of machine tool - need for maintenance - maintenance policies - maintenance organisation - principles of reconditioning - repair methods for beds - slides - spindles - gears - lead ,screw and bearings

Text Books

1. Mehta N.K., *Machine Tool Design* , Tata McGraw Hill
2. *Machine Tool Design Hand Book* , CMTI

Reference Books

1. *Machine Tool Design*, Achorkhan, (ED)Mir Publications
2. Sen & Bhatacharyya, *Principles of Machine Tools* ,New Central Book Agency
3. Koenigsberger, Pergamon, *Design and Construction of Metal Cutting Machine Tools*
4. Garg M.P., *Industrial Maintenance*

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 702: OPERATIONS RESEARCH

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give a quantitative perspective to the decision making process*

Module I (14hours)

History and development of O.R. – Linear programming – formulation – graphical solution – Simplex method – two phase method – dual and its solutions – sensitivity analysis

Module II (13 hours)

Transportation and assignment problems – formulation and solutions – tests for optimality – cases of degeneracy – Network techniques – net works : PERT / CPM – Critical path – crashing and resource levelling

Module III (13 hours)

Queuing theory – types of queues - Poisson arrival exponential service – single server and multiple server queues

Introduction to simulation techniques – Monte Carlo simulation (No Problems)

Module IV (14 hours)

Decision theory: - Environments – decision making under certainty – decision making under risk, decision making under uncertainty – Game theory – two persons zero sum games – pure strategy and mixed strategy – Decision Tree.

Text Books

1. Kalavathy, *Operation Research,*Vikas Publications
2. N D Vohra, *Quantitative Techniques in Management*, Tata McGraw Hill

Reference Books

1. N.Ramanathan, *Operation Research,*Tata Mcgrawhill
2. P.C.Tulsian, *Quantitative Techniques*, Pearson Education
3. Taha.H.A., *Operations Research,* PHI
4. Anderson Sweeney Williams,*Quantitative Methods for Business*,Cengage learning

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 703: TOOL DESIGN

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an exposure on different cutting tools, clamping and fixing methods, jigs used for different operations like turning, milling, drilling etc*
- *To give exposure to piercing and blanking operations*

Module I (14 hours)

Design of Cutting Tools :- Brief history of metal cutting process - design of single point cutting tools for turning, boring, shaping, planning and slotting - design of multi point cutting tools :- milling cutters, drills, reamers, taps and dies – classification of multipoint cutting tools – simple problems

Module II (13 hours)

Principles of location and clamping – locating and clamping methods and devices – design of drill jig – types of drill jigs – general considerations in the design of drill jig – drill bushings – methods of construction – jigs in modern manufacturing – problems on design of simple jigs

Module III (12 hours)

Design of Fixtures :- Fixtures and fixture economics – types of fixtures – Vice fixtures – Milling fixtures – Boring fixtures – Broaching fixtures – Lathe fixtures – grinding fixtures – problems on design of simple fixtures.

Module IV (15 hours)

Design of sheet metal blanking and piercing dies: - Introduction to die cutting operations – Presses – Cutting action in punch & die operations – die clearance – blanking & piercing die construction – pilots – strippers & pressure pads – simple problems – design of dies for plastic injection molding

Text Book

1. Cyril Donaldson, George.H.Lecain, V.C.Goold, *Tool Design,* TMH publishing Co., 3rd edition

Reference Books

1. ASTME, *Fundametals of tool design*

2. HMT, *Produciton Technology*, Tata Mc Graw Hill Publishers

3. G R Nagpal, *Tool Engineering & Design*, Khanna Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To have an insight into fundamental aspects related to Human Resource Management viz. Jobs, Recruitment, appraisal, remuneration and Employee relations*

Module I (14 hours)

Personnel management in organizational context - personnel environment - objectives of personnel management - the role of personnel function - personnel activities - structure of the personnel department - analyzing and design of jobs - job analysis - job description - job specification - role analysis - the job design – Merit Rating

Module II (14 hours)

Recruitment - selection - placement - induction - internal mobility - separations – labour turnover - performance appraisal - performance appraisal system - assessing potential - design of an effective appraisal system – wages and incentives

Module III (13 hours)

Pay and benefits - pay structures - methods of payments - fringe benefits - occupational health and safety - working conditions occupational health and safety - social background and working conditions - ergonomics - regulatory environment - organization commitment - measures for occupational health and safety

Module IV (13 hours)

Employee relations - management employee relations - managing discipline - managing grievance - managing stress - counselling - industrial relations implications of personnel policies - nature of employment relationships - place of unions in organizations - industrial conflict - managing for good industrial relations

Text Books

Venkata Ratnam C.S. & Srivasthava B.K., *Personnel Management and Human Resources*

Reference Books

1.Monappa A,Saiyaddin & Mirza S., *Personnel Management*,Tata McGraw Hill Publishers
2. Hersey Paul & Kenneth H Blanchard, *Management of Organizational Behavior*, Prentice Hall
3. Mc Greger Douglas, *The Human side of Enterprise* ,McGraw Hill
4**.** Subramanyam K.N, Gin V.V., *Industrial Relations in India*
5. Garry Dessler, *Human Resource management*, Person education
6. Biswanatah Ghosh, *Human resource Development and Management*, Vikas Publishing Co.
7. Snell, Bohlander, *Human Resource Management*, Cengage Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 704(B): PROJECT MANAGEMENT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give exposure to the major aspects of project viz.. Project, Planning, Analysis, Selection, Implementation and review*

Module I (14 hours)

Planning - Capital Expenditures – Phases of Capital Budgeting – Levels of decision Making – Facets of Project analysis- Feasibility Study – Objectives of Capital Budgeting – Resource Allocation framework- Key Criteria- Elementary Investment strategies – Portfolio planning tools – Generation of project Ideas – Monitoring the environment – Corporate appraisal – Scouting for project ideas – Preliminary Screening – Project rating index – Sources of Positive net present value

Module II (14 hours)

Analysis – Market and demand analysis – Situational analysis and specification of objectives – Collection of secondary information - Conduct of market survey – Characterization of Market – demand Forecasting – Market planning – Technical analysis- Material inputs and utilities – Manufacturing process/technology – Product Mix – Plant capacity – Location and site -machineries and equipments – Structures and civil works – Project charts and layouts – Work schedule – Financial Analysis – Cost of project – means of finance – Estimates of sales and Production – Cost of production – Working capital requirements and its financing – Profitability projections – Break even point – projected cash flow statements and balance sheets

Module III (13 hours)
Project Cash flows – Basic Principles for measuring cash flows – Components of cash flow – Cash flow illustrations – Viewing a project from different points of view – Time value of money – Future Value of a single amount – Future value of an annuity – Present value of a single amount – Present Value of an annuity- Cost of capital – Cost of debt capital – cost of preference capital – Rate of return – Cost of external equity and retained earnings - Determination of weights – Appraisal criteria – Net present value – Cost benefit ratio- Internal rate of return- Urgency – payback period

Module IV (13 hours)
Implementation- Forms of Project organization – Project planning – Project control – Human Aspects of Project management – Network Techniques – Development of Network – Time estimation – Critical path determination – Scheduling under limited resources – PERT Model – CPM Model – Network Cost System – Project review- Initial; review – Performance evaluation – Abandonment analysis

Text Books
1. Prasanna Chandra, *Projects Planning, Analysis, Selection, Implementation and Review, Fourth Edition*, Tata McGraw -Hill

Reference Books
1. Dennis Lock, *Project Management*, Grower Publications
2. Prasanna Chandra, *Financial Management Theory and Practice*, Tata McGraw -Hill Publishers
3. Parameswar P Iyer, *Engineering Project management*, Vikas Publishers
4. Gido & Clements, *Successful Project Management*, Vikas Publishers
5. Harold.T..Amrine John.A.Ritchey, *Manufacturing Organisation and Management*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 704(A): SAFETY ENGINEERING

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart an awareness about the importance of safety in industrial operations*
- *To understand various techniques available for ensuring safety in industries*

Module I (14 hours)
Importance of safety in industrial operations-Safety information systems-Accident information and reporting-safety performance and reporting-safety education and training

Module II (14 hours)
Hazards-physical-chemical-electrical-biological-ergonomichazards-risk analysis-map method-tabular method-fault tree analysis-hazop analysis

Module III (13 hours)
Fire protection systems-Fire chemistry-industrial fire protection system-water sprinkler-fire hydrant, alarm and detection system-explosion protection system-suppression system-carbondioxide system foam system-halon system-portable extinguisher

Module IV (13 hours)
Safety in engineering industry-safety in metal working machinery-principles of machine guarding-safety in welding and gas cutting-safety in cold forming and hot working of metals-safety in finishing-inspection and testing

Text Books

1. N.V. Krishnan, *Safety in industry*, Jaico publishing house
2. Gupta R.S., *Handbook of fire technology*,Orient Longman
3. James D.,*Fire Prevention Handbook*, Butterworths,london 1996

Reference Books

1. Welding institute, U.K., Health *and Safety in welding and Allied processes*,high Tech. Publishing ltd.,London
2. John V.Grimaldi and Rollin H. Simonds,*Safety management*, All India Travellers Book Seller,New Delhi

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 704(C): FACILITIES PLANNING AND PLANT LAYOUT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To introduce various techniques and tools of layout and other facilities planning in detail so that the student can approach a layout study in the most systematic and scientific way*

Module I (14 hours)

Plant location - factors affecting selection of plant site - influence of location on plant layout - location theory models - plant layout - objectives of good plant layout - types of layout - methods showing flow - design of workstations - line balancing - RPW method - Moodi Young method - storage space requirements - simple problems

Module II (14 hours)

Quantitative and qualitative techniques of plant layout designs cross chart – Activity relationship diagrams, systematic layout planning - spiral analysis - travel charts - plot plan by travel charting - assignment algorithm - sequence demand - Wimmerts method - level curves - general consideration in overall design - basic philosophy and approach to computer software like CRAFT, CORELAP, ALDEP etc - simple problems

Module III (13 hours)

Production and physical plant services - receiving storage - warehousing - shipping, tool room, tool cribs etc. industrial buildings - construction - floor coverings - lighting - heating - ventilation - air conditioning - administration and personnel services - space determination and allocation planning of space for office, production, storage etc. allowance for expansion

Module IV (13 hours)

Material handling - principles of material handling - basic handling systems - handling systems to layout - integrated handling systems - material handling and operation research - transportation problems and sequencing – loading – Johnson's Rule – CDS algorithm – simple problems.

Text Books

1. G K Agarwal, *Plant Layout and Material Handling*, Jain Brothers (New Delhi)
2. S C Sharma, *Plant Layout and Mterial Handling*, Khanna Publishers
3. Moore J.M., *Plant Layout and Design*, Macmillan

Reference Books

1. Richard L Francis, *Facility layout and Location*, Prentice Hall of India
2. Theodore H allegri, *Materials Handling*, CBS Publishers
3. Rosaler & Rice, *Standard H Plant Engg*
4. Garg H.P., *Plant Maintenance*
5. Immer J.R., *Materials Handling*, McGraw HilL

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 704(D): DESIGN FOR MANUFACTURE

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives
To impart knowledge about the manufacturing concerns that should be considered while designing a component so as to create a manufacturable design

Module I (14 hours)
Introduction: General design principles for manufacturability-strength and mechanical factors, mechanisms selection, evaluation method, Process capability-Feature tolerances-Geometric tolerances- Assembly limits-Datum features-Tolerance stacks.

Module II (14 hours)
Factors influencing form design: Working principle, Material, Manufacture, Design-Possible solutions-Materials choice-Influence of materials on form design-form design of welded members, forgings and castings – Design and manufacturing of gauges – Go gauge, No Go gauge

Module III (13 hours)
Component design-machining considerations**:** Design features to facilitate machining-drills-milling cutters-keyways-Doweling procedures, countersunk screws-Reduction of machined areas-simplification by separation-simplification by amalgamation –Design for machinability-Design for economy-Design for clampability-Design for accessibility-design for assembly.

Module IV (13 hours)
Component design –Casting considerations: Design of casting based on parting line considerations-Minimizing core requirements, machined holes, redesign of cast members to obviate cores.
Re-design for manufacture and case studies: Identification of uneconomical design –Modifying the design – group technology. Computer Application for DFMA.

Reference Books
1. Harry peck, "*Design for manufacture*", Pitman Publication, 1983
2. Robert Matousek, "*Engineering Design- A systematic approach*", Blackie&sons Ltd.,1963
3. James G.Bralla, "*Handbook of Product design for manufacturing*", Mcgraw hill co.,,1986
4. Swift K.G. "*Knowledge based design for manufacture*, Kogan Page Ltd.,1987
5. Yousef Haik.``*Engineering Design Process*",VIKAS

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 704 (E) GEOMETRIC MODELING FOR CAD

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

To impart knowledge about the principles of geometry; which is the backbone of computer aided design and manufacture.

Module I (14 hours)
Curve and surface geometry- Curve vector equation- tangent vectors- Curve nature parameter equation- local coordinate system – Curvature and torsion – surface vector equation- partial derivative vectors – tangent plane and unit normal vectors – surface curvature, normal, principle and Gaussian curvature- advantages of parametric description

Module II (14 hours)
Geomtric Transformation and Projections – Introduction to transformation – representation of 2D geometry - two dimensional transformations, scaling, translation,rotation – composite 2D transformations, reflection, shearing
Three dimensional coordinate geometry, representation of 3D geometry, - three dimensional transformations, scaling, translation,rotation

Module III (13 hours)
Ruled surfaces – Rules surface, Tabulated cylinders, developable surfaces, surface of revolution, Bi-cubic expression of ruled surface- Spline curves and surfaces – physical and mathematical splines – cubic splines – parametric cubic splines
Bezier curves and surfaces – Bezier curve, sub division and inverse algorithm, composite Bezier curves, Bezier surfaces – Bezier bi-cubic – composite Bezier surface

Module IV (13 hours)
B- spline curves and surfaces – Cubic B-spline – B-spline curves – geometric properties and algorithms of B-spline curves – Non uniform Bspline curve – B-spline curves with multiple vertices - B-spline curves with multiple knots – Bi cubic Bspline surfaces
Rational Ball curves – Rational splines – Rational surfaces – NURBS
Text. 'surface engineering geometry for computer aided design and manufacture', Ding Qiulin and B.J.Davies, John Wiley & Sons
'Computer Graphics and Geometric modeling for engineers', Vera B. Anand, John wiley & Sons

Text Books
1. Qiulin and B.J.Davies Ding Surface engineering geometry for computer aided design and manufacture', , John Wiley & Sons
2.'Computer Graphics and Geometric modeling for engineers', Vera B. Anand, John wiley & Sons

Reference Books
1 Sivasubaramanian, Ibrahim Zeid, Tata McGraw-Hill Education
2**.** Hagen Roller Encarnacao Bo Foley Guedj Ten Hagen Hopgood Hosaka Lucas Geometric Modeling: Methods and Applications (Computer Graphics-Systems and Applications, Springer Verlag

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 704(F): INDUSTRIAL TRIBOLOGY

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To have knowledge about the various modes of friction, wear mechanisms, types of lubrication and bearings and also the various surface engineering techniques.*

Module I (14 hours)
Surfaces and Friction: - Topography of Engineering surfaces – Contact between surfaces – Sources of sliding Friction – Adhesion Ploughing – Energy dissipation mechanisms – Rolling friction – Sources of Rolling Friction – Stick slip motion – Measurement of Friction

Module II (14 hours)
Wear: - Types of wear – Simple theory of Sliding - Wear Mechanism of sliding wear of metals – Abrasive wear – Materials for adhesive and abrasive situations – Corrosive wear – Surface Fatigue wear situations – Brittle fracture wear – wear of ceramics and polymers – wear measurements

Module III (13 hours)
Lubricants and Lubrication types :- Types and properties of Lubricants – Testing methods – Hydrodynamic Lubrication – Elasto hydrodynamic lubrication – Boundary Lubrication – Hydrostatic Lubrication – Solid lubrication

Module IV (13 hours)
Surface Engineering and Materials for Bearings :- Surface modifications – Transformation Hardening, Surface fusion – Thermo chemical processes – Surface coatings – Plating and anodizing – Fusion processes – Vapour Phase processes – Materials for rolling Element bearings – Materials for fluid film bearings – Materials for marginally lubricated and dry bearings

Text Books

1. I.M.Hutchings, "*Tribology, Friction and Wear of Engineering Material"* Edward Arnold 1992

Reference Books

1. Ernest rabinowicz *"Friction and wear of materials"* , John wiley& sons
2. E.P.Bowden and Tabor.D., *"Friction and Lubrication"*,Heinemann Educational Ltd.,1974
3. A.Cameron, *"Basic Lubrication theory*, Longman, U.K.1981
4. M.J.Neale (Editor), *"Tribology Handbook"*, Newnes.Butter worth,Heinemann,U.K.,1975

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 705(A): FINANCIAL MANAGEMENT

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an insight into various aspects of financial management and management accounting*

Module I (18 hours)

Introduction to Financial Management – functions and role – fundamentals of accounting – understanding financial statements and its analysis – ratio analysis

Module II (18 hours)

Management accounting – cost concepts – elements of cost and cost sheet – cost-volume-profit analysis – costing for decision making – control and responsibility accounting – budgetary control

Module III (18 hours)

Time value of money – Capital budgeting – methods of appraisal – cost of Capital and its measurement – capital structure planning - valuation of firms – dividend policy

Module IV (18 hours)

Management of current assets – management of receivables – inventory costs – introduction to international finance

Text books

1. I.M.Pandey., *Financial Management* Vikas Publications
2. I.M.Pandey., *Management Accounting* Vikas Publications
3. Khan & Jain, *Financial Management,* TMH

Reference books

1. Prasannachandra, *Financial Management*, TMH
2. Dhameja & Sastry, *Finance & Accounting*, Wheeler Publishing
3. A A Atkinson *Management Accounting* Pearson Education
4. Jame C.Van Horne, *Financial Management*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 705(B): SUPPLY CHAIN MANAGEMENT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the inventory control techniques, purchasing functions and supply chain strategies of different kinds of industries.*

Module I (14 hours)
Supply chain management (SCM) - concept of logistics and SCM - decision phases - design, planning and operation - decision areas - type of supply chain views - flows in supply chain - supply chain and competitive performance - performance measures for SCM - strategic fit - drivers of supply chain

Module II (14 hours)
Design of the supply chain network – role of distribution – factors influencing the distribution network design – Design options – Value of distributions – Network design in supply chain – role of network, factors to be considered – impact of uncertainty – discounted cash flow analysis – planning demand and supply in a supply chain – demand forecasting – characteristics of forecasting – role of forecasting – aggregate planning strategies. Planning of supply & demand - predictable variability – managing supply, demand.

Module III (13 hours)
Planning & Managing Inventories – role of cycle inventory – Economics of scale to exploit fixed costs & quantity discount – safety Inventory – supply uncertainty – optional level of product availability – Managerial levers to improve the supply chain profitability – sourcing in a supply chain – supplier selection – procurement processes – Transportation in supply Chain – modes of transportation – transportation network design.

Module IV (13 hours)
Revenue management for multiple customer, perishable assets, seasonal demand, bulk & spot contracts - Co-ordinators in supply chain – bull whip effect, Lack of co-ordination on performance, obstacles to co-ordination, Managerial levers to achieve co-ordination .Strategic partnership & thrust – IT in Supply Chain – Customer Relationship Management, Internal Supply Chain Management, Supply Relationship Management – Future of IT in supply chain – role of e-business in supply chain.

Text Books

Chopra S. & Meindl P., *Supply Chain Management: Strategy, Planning, and Operation*, Pearson Education.,Asia

Reference Books

1. Christopher M., *Logistics and Supply Chain Management*, Pitman Publishing Company
2. John Mortimer (Editor), *Logistics in Manufacturing: An IFS Executive Briefing*, IFS Publications, U.K. & Springer-Verlag.
3. Narasimhan S.L., Mcleavy D.W. & Billington P.J., *Production Planning and Inventory Control*, Prentice Hall of India.
4. Raghuram G. & Rangaraj N., *Logistics and Supply Chain Management: Cases and Concepts*, Macmillan India Limited
5. Dobler D.W. & Burt D.N., *Purchasing and Supply Management: Text and Cases*, Tata McGraw Hill Publishing Company Limited
6. Tersine R.J., *Principles of Inventory and Materials Management*, Fourth Edition , Prentice Hall Inc.
7. Starr M.K. & Miller D.W., *Inventory Control: Theory and Practice*, Prentice Hall of India.
8. David Taylor & David Brunt, *Manufacturing Operations and Supply Chain Management;The Lean Approach*,Vikas Publishers
9. Arjan J van Weele,*Purchasing and Supply chain Management Analysis,Planning and Practice 2nd Edition*,Vikas Publishers

Vollmann, *Manufacturing Planning & Control for Supply Chain Management*, Tata Mc Graw Hill Publishers
Joel D Wisner, *Principles of Supply Chain Management A Balanced Approach*, Cengage Learning

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

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gg.

PE14 705(C): TOTAL QUALITY MANAGEMENT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart knowledge on the concept of quality tools for analysing quality statistical tools in quality acceptance sampling life tests*

Module I (14 hours)
Definition of quality-internal and external customers- vision statement – mission statements – objectives – goals – targets- evolution of TQM – Defining TQM – stages in TQ M implementation-TQM models

Module II (14 hours)
SWOT analysis-strategic planning-customer focus-quality function deployment-customer satisfaction measurement-seven new management tools-Deming wheel-zero defect concept-bench marking-six sigma concepts-failure mode and effect analysis-poke yoke

Module III (13 hours)
Five S for quality assurance-quality circle philosophy-failure rate analysis-mean failure rate-mean time to failure (MTTF)-Mean time between failure (MTBF)-hazard models-system reliability-availability- maintenance

Module IV (13 hours)
Quality and cost-characteristics of quality cost-micro analysis of quality cost-measurement of quality-TQM road map- ISO 9000 series certification-ISO 9001:2000 certification-ISO 14000 certification-QS 9000 auditing-Quality auditing- quality awards

Text Books

1. L Suganthi, Anand A Samuel, *Total Quality Management*, PHI
2. Lt.Gen. Lal H, *Total Quality Management*, Wiley Eastern Limited

Reference Books

1. Greg Bounds, *Beyond Total Quality Management*, McGraw Hill Publishers
2. Menon H G, *TQM in New Product Manufacturing*, McGraw Hill Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 705 (D) FINITE ELEMENT METHOD

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

1 *To acquaint with basic concepts of finite element formulation methods.*
0 *To practise finite element methodologies through simple structural and heat transfer problems.*

Module 0 (2 hours)

Review: Matrices and matrix operations – solution of system of linear equations – Gauss elimination. Basic equations of elasticity – strain-displacement relations – compatibility - stress-strain relationship – boundary condition – St. Venant‟s principle - theorem of minimum potential energy – principle of virtual work. Steady state heat conduction equation

– Fourier‟s law – boundary conditions. (No direct questions from the above part)

Module I (13 hours)

Introduction:Finite element method as a numerical tool for design – basic concepts – formulation procedures – historical development.

FE modelling Direct approach: 1-D bar element– element stiffness – assembly of elements – properties of [K] matrix – treatment of boundary conditions – temperature effects – stress computation – support reaction – simple problems. Analogous (1-D) problems of torsion, heat conduction and laminar pipe flow.

Beam element:Beam relationships – 1-D beam element FE formulation - element stiffness matrix – load considerations – boundary conditions – member end forces.

Module II (13 hours)

FE modelling Direct approach : Plane truss element formulation – coordinate transformation – local and global coordinates – element matrices – assembly of elements – treatment of boundary conditions – stress calculation – simple problems - band width of the stiffness matrix – node numbering to exploit matrix sparsity – conservation of computer memory.

Interpolation – shape function – Lagrange interpolation - 1D linear and quadratic, 2D linear triangle and bilinear rectangular elements.

FE formulation from virtual work principle – B-matrix – element matrices for bar and CST elements – load considerations – consistent nodal loads – simple problems.

Module III (13 hours)

Variational methods : – Functionals – weak and strong form – essential and non- essential boundary conditions - Principle of stationary potential energy – Rayleigh-Ritz method – simple examples.

FE formulation from a functional: 2-D steady state heat conduction – element matrices for a triangular element – boundary conditions – simple problems. FE formulation for 2-D stress analysis from potential energy - element matrices - plane bilinear element.

Convergence requirements – modelling aspects – symmetry – element size and shape – sources of error.

Module IV (13 hours)

Weighted residual methods: Galerkin FE formulation – axially loaded bar – heat flow in a bar.

Isoparametric formulation: Natural coordinates – linear and quadratic bar element – linear triangle and plane bilinear elements for scalar fields – jacobian matrix – element matrices - Gauss quadrature – requirements for isoparametric elements – accuracy and mesh distortion.

Text Books

1 1. T. R. Chandrupatla, *Finite Element Analysis for Engineering and Technology*, University Press

2 2. R. D. Cook, D. S. Malkus, M. E. Plesha, R. J. Witt, *Concepts & Applications of Finite Element Analysis,* John Wiley & Sons

3 3. P. Seshu, *Text Book of Finite Element Analysis,* PHI Learning Pvt. Ltd.

Reference Books

1 1. J. N. Reddy, *An Introduction to the Finite Element Method,* McGraw Hill International Edition

2 2. S. S. Rao, *The Finite Element Method in Engineering*, Butterworth Heinemann

3 3. K. J. Bathe, *Finite Element Procedures in Engineering Analysis,* Prentice Hall of India

O. C. Zienkiewics, R. L. Taylor, *The Finite Element Method,* Vol I & II, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

Module I (14 hours)
Introduction: Components of knowledge base systems, knowledge representation, types, and comparison of knowledge representation schemes.
Knowledge base system: Inference engine, knowledge acquisition, optimization and knowledge base systems for machines.

Module II (14 hours)
Intelligent manufacturing: System components, system architecture and data flow system operation
Flexible machining system: Flexible assembly systems, tool management.
Technology based systems: Design of mechanical elements, refinement approach, and model based approach, design of mechanisms, feature based design, and knowledge based design for automated assembly.
Process planning: Feature recognition, machining optimization, knowledge based systems.

Module III (13 hours)
G Technology: Group technology, models and algorithms, cluster analysis method, knowledge based systems for GT, models and algorithms for machine layout, knowledge based systems for machine layout, scheduling, models and algorithms.

Module IV (13 hours)
Application of artificial neural networks, fuzzy logic and genetic algorithms in manufacturing, ANN for tool wear monitoring, fuzzy control of machine tools, Introduction to neural networks, synaptic integration and neuron models, essential vector operators, back propagation algorithms, application of neural networks to process modelling control, neural network based feed forward active control systems, neural network application to tool condition monitoring in turning machine, condition monitoring in tapping, neural networks in robotics.

Text Books
1. Andrew Kusiak, *Intelligent Manufacturing Systems*, Prectice Hall, 1990

Reference Books
1. Mohammed Jamshidi, *Design and Implementaton of Intelligent Manufacturing Systems*. Prectice Hall, 1995
2. Mitsuogen Runwelding, *General Algorithms in Engineering Design*, John Wiley.1997
3. Ibrahim Zeid. *CAD/CAM Thoery and Practice*, MacGraw Hill, 1991
4. Elaine Rich. *Artificial intelligence*. Tata McGraw Hill, 1995

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 705(F): CONCURRENT ENGINEERING

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart knowledge about principles, implementation, scheduling , evaluation of products , design cost and application of expert systems is relation to Concurrent Engineering*

Module I (14 hours)

Principles of concurrent engineering: Overview, approaches to CE, computer based CE, various models and trends in CE.
Implementation: Common failure modes and success factors, failure modes, causes and structure, overcoming barriers to the implementation of CE, seven common organization/ technical barriers, actions to overcome above barriers.

Module II (14 hours)

Scheduling concurrent manufacturing projects: Precedence relaxation, composite allocation factor, a decision based approach to CE, frame of reference, decision support problem technique, application and implementation issues.
Concurrent optimization of product design and manufacture: Concept, simultaneous evaluation of product performance and cost, methodologies for concurrent decision making, a cost based DFM system.

Module III (13 hours)

Evaluating product machinability for concurrent engineering: Generative feature interpretation, process selection, machinability evaluation, design for human factors, controls and displays, use of anthropometry, manual material handling.
Designing to cost: Methodologies to reduce cost, aids in designing for cost, quick cost estimation, designing to a cost goal, activity based costing, economic design in concurrent engineering, approaches, issues, integrated product and process design.

Module IV (13 hours)
Application of expert system to engineering design: knowledge representation paradigms, spatial reasoning, integration with CAD database, a generic approach to DFM system description.
Modelling the design process with Petri nets: Concept, properties, time based Petri nets, neuro computing and concurrent engineering, artificial neural networks, manufacturing feature recognition, contributions of ANN for CE. Introduction to current product development techniques.

Text Books
1. Hamid R. Parasaeie, William. G. Sullivan, *Concurrent Engineering Contemporary Issues and Modern Design tools,* Chapman and Hall London 1993

Reference Books

1. Edward., .G.Haug (Editor), *Concurrent Engineerng Tools and Techonologies for Mechanical Systems Design*, Springer Verlag Publishing Co.
2. *Proceedings of the nato Advanced system Institute on Concurrent Engineering*, Jowa City, May 25, June 5, 1992

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 706 (P): INDUSTRIAL ENGINEERING LAB

Teaching scheme **Credits:** 2
3 hours Practical per week

Objectives

- *To plan and conduct experiments to study and evaluate theoretical concepts in industrial engineering and quality control*
- *To train the students to plan experiments for evaluating practical situations*

1. Study and Experimentation on Central Limit Theorem_- for different population distributions, Triangular Distribution, Rectangular Distribution and Normal Distribution
2. Factorial Experimentation - Analysis of variance and test of Significance on different process/product parameters._
3. Motion Study – Preparation of Flow process chats, outline process charts flow diagram and multiple activity charts, two handed process charts, for industrial operations.
4. Application of Principles of Motion economy – determination of time savings by improving work methods
5. Time Study – Determination of standard time of an operation by stopwatch method.
6. Plant layout and material handling – Layout planning and optimization of material handling using techniques of string diagram travel charting etc.
7. Variable control charts – Plotting and interpretation of variable control charts for X and R and Process capability determination.
8. Attribute Control charts – Plotting and interpretation of attribute control charts P-Charts and C- Charts
9. Acceptance sampling by attributes – Plotting and interpretation of Operating Characteristic curves, determination of AQL, LTPD, Risks and AOQL
10. Measurement of effect of Work on Human Body – Using ECG, BP Monitor, Tread Mill etc and ergonomical design.
11. Measurement and analysis of productive Skills - Direct and indirect eye hand co ordination measurement using co ordination testers
12. Measurement and analysis of dexterity, speed, skill, visual sensation and tactile sensation abilities – Using coin sorters and match board equipments
13. Measurement and analysis of human visual fields, depth perception – using Depth perception tester and Perimeter.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PE14 707(P): METROLOGY LAB

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To provide information of how actual measurements are conducted and also about the selection of measuring instruments for different purposes*

1. Testing of gears
2. Determination of cutting forces on tool bits - lathe, drilling machine, milling machine and grinding machine
3. Measurement of surface roughness

5. Use of comparators - mechanical, optical, electrical & pneumatic
6. Determination of cutting tool temperature using thermocouples
7. Use of profile projectors
8. Acceptance Test of machine tools - lathe, shaper, milling and grinding machines
9. Flatness measurement (Toolmakers microscope - tool geometry)
10. Measurement of vibrations
11. Measurement of area
12. Measurement of sound
13. Measurement of speed

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PE14 708(P) : PROJECT

Teaching scheme **Credits:4**
4 hours practical per week

Objectives

- *To judge the capacity of the students in converting the theoretical knowledge into practical systems/investigative analysis.*

Project work is for duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. Project evaluation committee consisting of the guide and three/four faculty members specialised in the above field shall perform the screening and evaluation of the projects.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent. Literature survey and 40% of the work has to be completed in the seventh semester.

Students should execute the project work using the facilities of the institute. However,

external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

Each student has to submit an interim report of the project at the end of the 7th semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7th semester.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment
20% - Technical relevance of the project
40% - Literature survey and data collection
20% - Progress of the project and presentation
10% - Report
10% - Regularity in the class

PE14 801: COMPUTER INTEGRATED MANUFACTURING

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an idea of advanced manufacturing and various elements and sub systems that go into it*

Module I (13 hours)
Introduction - evolution of CAD/CAM and CIM - scope of CIM - segments of generic CIM - computers and workstations - an overview of CIM software - product development through CAD and CAE - geometric modelling techniques - automated drafting - graphic standards - engineering analysis -optimization - principles of concurrent engineering

Module II (14 hours)
Automated process planning - process planning - general methodology of group technology - code structures variant and generative process planning methods - AI in process planning - process planning software - CNC technology - principle of numerical control - types of CNC machines - features of CNC systems - programming techniques - capabilities of a typical NC CAM software - integration of CNC machines in CIM environment - DNC - flexible manufacturing systems

Module III (14 hours)
Robotics and automated assembly - types of robots and their performance capabilities - programming of robots - hardware of robots - kinematics of robots - product design for robotized manufacturing - selecting assembly machines - feeding and transfer of arts - applications of robots in manufacture and assembly - sensors - simulation and automated quality control - types of

simulation - simulation methodology - simulation languages and packages - applications - statistical process control - objectives of CAQC - types of CMM - non-contact inspection methods - in process and post process metrology - flexible inspection systems

Module IV (13 hours)
Data communications and technology management - technology issues - configuration management - database systems - management of technology - networking concepts LAN, MAN and WAN - SQL fundamentals - MAP/TOP fundamentals - CIM models - IBM - Siemens, DEC, ESPRIT - CIM OSA model - economics of CIM - implementation of CIM

Text Books
1. David Bedworth et al., *Computer Integrated Design and Manufacturing*, McGraw Hill Book Co.
2. Radhakrishnan P., *Computer Integrated Manufacturing*, Dept. of Production Engineering, PSG College of Technology

Reference Books
1. Eric Teicholz & Joel Orr, *Computer Integrated Manufacturing Handbook*, McGraw Hill Book Co.
2. Ranky P.G., *Computer Integrated Manufacturing*, Prentice Hall of India
3. Mikell.P.Groover, *Automation, Production systems and Computer Integrated Manufacturing*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 802: MAINTENANCE ENGG. & MANAGEMENT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To expose the students how the deterioration of plant machinery equipment and other*

facilities are taking place

- *To make them aware of various testing methods, preventive/corrective and timely actions to take including repair replacement etc*

Module I (13 hours)

Corrosion - harmful effects – electrochemical mechanism of corrosion - forms of corrosion - corrosion by special environments in industries such as chemical, petrochemical, iron and steel industry - corrosion prevention and control - material selection for corrosion environments - corrosion inhibitors - cathodic and anodic protection –corrosion testing and measurements

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Module II (13 hours)

Wear of machine parts - mechanism of wear - different types of wear - effect - factors influencing wear –wear measurements - bearing and lubrication – Types of bearings - bearing material and their requirements - lubricants - basic properties - additives - synthetic lubricants.

Module III (14 hours)

Scope and importance of maintenance - types of maintenance – corrective maintenance - preventive maintenance - concepts of total maintenance - terro technology - strategies and policies of organizing a preventive maintenance programme – monitoring techniques – vibration and noise monitoring analysis – vibration severity chart-shock pulse method-vibration signature analysis-ferrography-spectrometric oil analysis programme.

Module IV (14 hours)

Reliability - definition of reliability - product reliability - time depending relationship to quality assurance - measures of reliability - failure rate - failure distribution curves - MTBF - bath tub curve - reliability improvement - redundancy and its uses - maintainability and availability - safety and house keeping - replacement analysis - useful and economic life of equipment - reasons for replacement - factors affecting replacement decisions - economic analysis replacement criteria - group replacement – simple problems

TextBooks

1. Collacott, *Vibration Monitoring and Diagnosis - Technique for Cost Effective Plant Maintenance*, John Willey

Reference Books

1.Kenneth, Mc Brady M. & W. Kuer J., *Modern Maintenance Management*

2.Uhlig H.H., *Corrosion & Corrosion Control*, John Wiley Publishers

3.Neele M.J., *Tribology Handbook*, Butter Worths publications

4.Maj Gen Apthe S.S., *Plant Maintenance*, Delhi Productivity Council

5.Srinath, *Concept of Reliability*, Affiliated East West Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz,

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

PE14 803: PRODUCTION MANAGEMENT

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an exposure to the different aspects of Production Management,viz., Production Planning and Control, materials Management and Quality management*

Module I (13 hours)

Production and Operations planning - _Production Systems - Forecasting of Demand- Variables – Opinion and Judgmental Methods - Time series methods – Regression & Correlation – Aggregate planning- Objectives - Aggregate planning Methods - Master Scheduling – Objectives – Methods of Master Scheduling

Module II (14 hours)

Material and Capacity requirements planning – MRP Concepts – MRP Logic – System refinements – Capacity management – Manufacturing resource planning (MRP II) – Scheduling and controlling of production activities – Objectives - Scheduling strategy and guidelines - methodology – priority control – capacity control - Scheduling for Job shop, Batch shop and high volume continuous systems- Concepts of ERP

Module III (13 hours)

Materials management- functions of purchasing and materials management – quality – inspection – sources of supply – pricing – inventory management – EOQ- models of replenishment – deterministic and probabilistic – P and Q systems of Inventory – Selective inventory management – ABC,VED,FSN,HML analysis of Inventory – Concept of JIT and zero inventory

Module IV (14 hours)

Plant layout and material handling – plant location - factors affecting selection – plant site - influence of location on plant lay out – location theory models – plant lay out – objectives of good plant layout – types of layout – methods showing flow

Text Books

1. Joseph G Monks, *Operations Management*, *Theory and Problems*, McGraw-Hill International edition
2. Setharama, L Narasimhan etal.. *Production Planning and Inventory Control*, Prentice Hall India

Reference Books

1. S N Chary, *Production and Operations management*, Tata McGraw-Hill Publishing co. Ltd
2. Panneerselvam, *Production management*, Prentice Hall of India
3. N G Nair, *Production and operations Management*, Tata McGraw-Hill
4. Goplalakrishnan, *Materials Management*, McGraw-Hill publishers
5 Krajewsky, *Operations Management – Strategy*, Pearson education
6. Harold T Amrine, John A Ritchey, *Manufacturing Organization and Management,* Pearson Education
7. B Mahadevan, *Operations Management,* Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 804(A): MARKETING MANAGEMENT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an exposure on various aspects of marketing management viz. Environment, Consumer behaviour, Product management, Promotion decisions, and marketing research*

Module I (14 hours)
Understanding marketing management – Defining marketing – Company orientation – Adopting markets to new economy – E-business building customer satisfaction, value and retention – Customer value – Customer relation ship management.

Module II (13 hours)
Analyzing market opportunities -Gathering information & measuring market demand - Marketing research system -Forecasting – Analyzing consumer markets and buyer behaviour – Buying decision process – Identifying market segments and selecting target markets – Market segment & targeting.

Module III (14 hours)
Developing market strategies – Positioning & differentiating market through product life cycle – Differentiating tools – Determining new market offerings- Setting the product and branding strategy – Product mix and line – Brand decisions.

Module IV (13 hours)
Managing & defining market program – Managing intergraded marketing communication – Effective communication process – Managers advertising, sales promotion, public relation & direct marketing – Managing the sales force– Personal selling.

Text Books
1. Philip kotler – *Marketing management* – Pearson Education Asia

Reference Books
1. Rajan Saxena, *Marketing Manageme*, Tata McGrawhill Publishing Co,
2. Green P.E. & Tall D.S., *Research for Marketing Decisions*,PHI
3. Czinkota, Kotabe, *Marketing management*, Thomson Sour western
4. M.Govindarajan, *Industrial Marketing Management*, Vikas Publishers
5. Joel R Evans, Barry Berman, *Marketing Management*, Cengage Learning

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give exposure to the fundamental aspects related to Technology management viz.*

Technology - Evolution, Environment. Diffusion Innovation, Intelligence and Technology Strategy

Module I (14 hours)
Management of Technology- Definition and Characteristics- Technological environment- Developments in Technological environment- Innovation-components of innovation – Innovation dynamics at firm level – Technology Evolution – S-Curve- Levels of Technology Development – Characteristics of innovative firms

Module II (14 hours)
Technology Diffusion- Dynamics of diffusion – Factors affecting process of diffusion – Influence of environmental trends – Technology and Competition – Competitive consequences of technological change – Characteristics of competitive domains – Dynamics of change in competitive domains – Influence of environmental trends

Module III (13 hours)
Process innovation – value chains and organization – Modes of value chain configuration – Value chain configuration and organizational characteristics – Technology Intelligence – Mapping Technology Environments – Analytical Tools

Module IV (13 hours)
Technology Strategy- Definition – Technology Business Connection – Key Principles – Technology Strategy types – Framework for formulating technology strategy – Appropriation of Technology - - Evolution – Third Generation approach – External sourcing of technology portfolio – Productivity of In-house Research and Development.

Text Books
1. V K Narayanan, *Managing Technology and Innovation for Competitive Advantage*, Pearson Education Asia

Reference Books
1. Tarek Khalil, *Management of Technology – The key to competitiveness and Wealth creation* , McGraw-Hill International Edition.
2. Frederick Betz, *Strategic Technology Management*, McGraw-Hill International Edition.
3. Norma Harrison, Danny Samson, *Technology Management*, Text and International Casers, McGraw-Hill

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 804(C): ENTERPREUNERSHIP

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an idea on entrepreneurial perspectives*

Module I (14 hours)
Entrepreneurial perspectives- understanding of entrepreneurship process- entrepreneurial decision process- entrepreneurship and economic development- characteristics of entrepreneur- entrepreneurial competencies- managerial functions for enterprise.

Module II (14 hours)
Process of business opportunity identification and evaluation- industrial policy- environment- market survey and market assessment- project report preparation-study of feasibility and viability of a project-assessment of risk in the industry

Module III (13 hours)
Process and strategies for starting venture- stages of small business growth- entrepreneurship in international environment- entrepreneurship- achievement motivation- time management creativity and innovation structure of the enterprise- planning, implementation and growth

Module IV (13 hours)
Technology acquisition for small units- formalities to be completed for setting up a small scale unit- forms of organizations for small scale units-financing of project and working capital-venture capital and other equity assistance available- break even analysis and economic ratios technology transfer and business incubation

Text Books

1. Harold Koontz & Heinz Weihrich,*Essentials of Management*, McGraw hill International
2 Hirich R.D. &Peters Irwin M.P., *Entrepreneurship*, McGraw Hill
3. Rao t.V., Deshpande m.V.,Prayag Metha &Manohar S. Nadakarni, *Developing Entrepreneurship A Hand Book*, Learning systems
4. Donald Kurado & Hodgelts R.M., *Entrepreneurship A contemporary Approach*,The Dryden Press
5. Dr. Patel V.G.,*Seven Business Crisis*, Tata McGraw hill
Timmons J.A., *New venture Creation- Entrepreneurshipfor 21 st century*,McGraw hillInternational
6. Patel J.B.,Noid S.S., *A manual on Business Oppurnity Identification*, selections,EDII
7. Rao C.R.,*Finance for small scale Industries*
8. Pandey G.W., *A complete Guide to successful Entrepreneurship*,Vikad Publishing

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

PE14 804(D): SOFTWARE ENGINEERING

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide basic concepts and requirements regarding the design validation, implementation and evaluation of Software systems*

Module I (14 hours)

Introduction - FAQs about software engineering - professional and ethical responsibility - system modelling - system engineering process - *the software process* - life cycle models - iteration - specification - design and implementation - validation - evolution - automated process support - *software requirements* - functional and non-functional requirements - user requirements - system requirements - SRS - *requirements engineering processes* - feasibility studies - elicitation and analysis - validation - management - *system models* - context models - behaviour models - data models - object models - CASE workbenches

Module II (14 hours)

Software prototyping - prototyping in the software process - rapid prototyping techniques - *formal*

specification - formal specification in the software process - interface specification - behaviour specification - *architectural design* - system structuring - control models - modular decomposition - domain-specific architectures - distributed systems architecture - *object-oriented design* - objects and classes - an object oriented design process case study - design evolution - *real-time software design* - system design - real time executives - *design with reuse* - component-based development - application families - design patterns - *user interface design* - design principles - user interaction - information presentation - user support - interface evaluation

Module III (13 hours)
Dependability - critical systems - availability and reliability - safety - security - critical systems specifications - critical system development - *verification and validation* - planning - software inspection - automated static analysis - clean room software development - *software testing* - defect testing - integration testing - object-oriented testing - testing workbenches - critical system validation - *software evolution* - legacy systems - software change - software maintenance - architectural evolution - software re-engineering - data re-engineering

Module IV (13 hours)
Software project management - project planning - scheduling - risk management - *managing people* - group working - choosing and keeping people - the people capability maturity model - *software cost estimation* - productivity estimation techniques - algorithmic cost modelling, project duration and staffing *quality management* - quality assurance and standards - quality planning - quality control - software measurement and metrics - *process improvement* - process and product quality - process analysis and modelling - process measurement - process CMM - *configuration management* - planning - change management - version and release management - system building - CASE tools for configuration management

Text Books
1. Ian Sommerville, *Software Engineering*, Pearson Education India

Reference Books
1. Pressman R.S., *Software Engineering*, McGraw Hill
2. Mall R., *Fundamentals of Software Engineering*, Prentice Hall of India
3. Behferooz A. & Hudson F.J., *Software Engineering Fundamentals*, Oxford University Press.
4. Jalote P., *An Integrated Approach to Software Engineering*, Narosa

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 804(E): MODERN MANUFACTURING CONCEPTS

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To acquaint the student about the current scenario in modern manufacturing*

Module I (14 hours)
Introduction-product development and strategies-computer automated engineering-simultaneous engineering –JIT,SMED,KANBAN,KAIZEN,FMEA,SCM,ERP.Total quality management, seven statistical tools and seven new tools ,product development- strategically quality management-quality circle ,introduction to ISO and QS standard .
Total Productive maintenance,-evaluation, and maintenance management.

Module II (14 hours)
Green and Agile manufacturing – introduction – agility through group technology, concept of failure mode effect analysis
ERP – Evolution, advantages, integrated management information, integrated data modelling

Module III (13 hours)
Rapid prototyping – Stereo lithography, laminated object manufacturing , selective laser sintering , fused deposition modelling , 3 D inkjet printing , application of rapid prototyping – modular and reconfigurable machine system – fixtures and dies – parallel kinematic structure for machine tools , Stewarts platform , hexapod , application of hexapod in robotics and CMM.

Module IV (13 hours)
Material application – Nano materials – shape memory alloys – working of SMA,SMART material – applications - Micro machining introduction – Laser micro machining – surface micro machining processing techniques – bonding techniques – precision machining – micro assembly techniques – micro manipulators, bulk micro machining.

Reference Books

1. Gibson P, Green Halgh G, Kerr. R. Manufacturing management Chapman & Hall,
2. Jack M Wacker, *Hand book of Manufacturing engineering*, Marcel Decker Inc, USA 1992

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 804 (F) LINEAR SYSTEM ANALYSIS

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives
• To enable the students to model mechanical systems and also to analyze different linear time-invariant systems.

Module I (14 hours)
System concepts and modeling of systems: Systems – system variables & parameters - classification of systems – continuous-time/discrete-time, static/dynamic, linear/non-linear, distributed/lumped, time invariant/variant, stochastic/deterministic systems – system modeling & approximations - superposition principle —
Module II: (14 hours)
Modeling of mechanical systems: Modeling of translational and rotational mechanical systems – differential equations for mass, spring, dashpot elements – D'Alembert's principle – rotational inertia, stiffness & bearing friction - dynamic equations & transfer function for typical mechanical systems – analogous systems - gear trains – equivalent inertia & friction referred to primary and secondary shafts – resistance & capacitance of thermal system, liquid level system & pneumatic systems – dynamic equations & transfer function for simple systems – electromechanical systems.
Module III: (13 hours)
Time domain analysis : Open loop & closed loop control systems – response to arbitrary inputs – convolution integral – convolution theorem - Time domain analysis – standard test signals - step, ramp, parabolic, impulse – transient and steady state response – first order systems – unit impulse, step & ramp responses of first order systems - second order systems – under damped and over damped systems - unit step response – time domain specifications - time response of higher order systems – steady state error – static position, velocity & acceleration error constants.
Module IV: (13 hours)
State space analysis and stability of systems: Concept of state - state space and state variables - advantage over transfer function approach - state equation for typical electrical , mechanical and electromechanical systems - representation for linear time varying and time invarient systems -

solution of state equation for test inputs - zero state and zero input response - concept of stability - bounded input bounded output stability - Routh-Hurwitz criterion of stability for single input,single output linear systems described by transfer function models.

Text Books

1. TripathiA.N., Linear Systems Analysis, NewAge International (P) Limited

Reference Books

1. Nagrath & Gopal, Control Systems Engineering, NewAge International (P) Limited
2. Cheng D.K. Addison Wesley, Linear Systems Analysis,Addison Wesley
3. Katsuhiko Ogata, Modern Control Engineering, Pearson Education

Syllabus - B.Tech. Production Engg.

Teaching scheme Credits: 4

3 hours lecture and 1 hour tutorial per weekUniversity of Calicut
Syllabus - B.Tech. Production Engg.

Internal Continuous Assessment (Maximum Marks-30)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) 5 x 2 marks=10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

PE14 805(A): INDUSTRIAL PSYCHOLOGY

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give awareness on the Human and Industrial Psychology*

Module I (14 hours)

Introduction- psychology as a science- area of applications – study of individual- individual differences- study of behaviour- stimulus- response behaviour- heredity and environment- human mind- cognition- character- thinking- attention- memory- emotion- traits- attitude- personality

Module II (14 hours)

Organizational behaviour- definition –development- fundamental concept- nature of people- nature of organization – an organizational behaviour system- models- autocratic model- hybrid model- understanding a social-system social culture- managing communication- downward, upward and other forms of communication

Module III 13 hours)

Motivation- motivation driver- human needs- behavior modification- goal setting- expectancy model- comparison models- interpreting motivational models- leadership- path goal model- style – contingency approach

Module IV (13 hours)

Special topics in industrial psychology- managing group in organization- group and inter group dynamics- managing change and organizational development- nature planned change- resistance- characteristic of OD-OD process

Text Books

1. Davis K. & Newstrom J.W.,*Human Behaviour at work*, Mcgraw Hill International

Reference Books

1. Schermerhorn J.R.Jr.,Hunt J.G &Osborn R.N.,Managing, *Organizational Behaviour*,John Willy
2. Luthans,*Organizational Behaviour*, McGraw Hill,International
3. Morgan C.t.,King R.A.,John Rweisz &John Schoples, *Introduction to Psychology*, McHraw Hill
4. Blum M.L. Naylor J.C., Horper & Row, *Industrial Psychology*,CBS Publisher

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 805(B): MANAGEMENT INFORMATION SYSTEMS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an awareness of information sources, flow and it's processing for making correct*

decisions.

Module I (14 hours)
Information systems-functions of management – levels of management- framework for information system- sequence of development of MIS- systems approach- systems concepts – systems and their environment- effects of system approach in information system design – using systems approach in problem solving- strategic use of information technology

Module II (14 hours)
A brief overview of computer hardware and software components- file and database management systems- communication system elements- introduction to network components-topologies and types- remote access- reasons for managers to implement networks- distributed systems- the internet and office communications.

Module III (13 hours)
Application of information system to functional, tactical and strategic areas of management, decisions support systems and expert systems

Module IV (13 hours)
Information system planning- critical success factor- business system planning- ends/means analysis-organising the information systems plan- systems analysis and design- alternate application development approaches-organisation of data processing-security and ethical issues of information systems

TextBooks

1. Schultheis R. & Mary Sumner, *Management Information Systems-the Manager's View*, Tata McGraw Hill

Reference Books

1. Laudon K.C. & Laudon J.P., Management *Information Systems-organisation and Technology*, Prentice Hall of India
2. Sadagopan S., *Management Information Systems*, Wheeler Publishing
3. Alter S., *Information Systems: A Management Perspective,*Addison Wesley
4. Effy Oz.,*Management Information systems,* Thomson, Vikas Publishing House

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 805 '(C) ENERGY ENGINEERING AND MANAGEMENT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives
• To provide knowledge on energy conservation and management.
• To impart the basics of renewable energy technology

Module I (13 hours)

Energy and environment: Introduction – fossil fuel reserves – world energy consumption – green house effect – global warming – renewable energy sources – environmental aspects utilization – energy prices – energy policies

Module II (14 hours)

Energy conservation: Industrial energy use – energy surveying and auditing – energy index – energy cost – energy conservation in engineering and process industry, in thermal systems, in buildings and non conventional energy resources schemes.

Module III (14 hours)

Energy technologies: Fluidized bed combustion – fluidized bed boilers – waste heat recovery systems – heat pump and refrigerators – wind energy collectors and storage systems – insulated pipe work systems.

Module IV (13 hours)

Energy management: Energy management principles – energy resources management – energy management information systems – computerized energy management.

Costing techniques – cost optimization – optimal target investment schedule –

financial appraisal and profitability.

TextBooks

1.W. R. Murphy, G. Mc Kay, Energy Management, Butterworths, London
2.

Reference Books

1. O. Callaghn, Design and Management for energy conservation, Pergamon Press, Oxford
2. D. Merick, Energy - Present and Future Options, vol 1 and 2, John Wiley and Sons
3. N. A. Chaigier, Energy Consumption and Environment, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 805(D): SIMULATION OF MANUFACTURING SYSTEMS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To know about the technique of simulating actual industrial scenario*

Module I (14 hours)

Introduction to simulation: Areas of application-system and system environment-components of a system-discrete and continuous systems-model of system-types of models-discrete-event system simulation-steps in a simulation study.

Module II (14 hours)

Random number generation: Properties of random numbers-generation of pseudo random numbers-techniques for generating random numbers-tests for random numbers. Random Variable generation: Inverse transforms technique, Exponential-uniform-weibull-triangular-empirical-continous-discrete distribution-direct transformation for the normal distribution-acceptance-rejection technique-Poisson-gamma

Module III (13 hours)

Input Modelling: Data collection-identifying the distribution with data-parameter estimation-goodness of fit tests-selecting input models with out data.

Design and evaluation of simulation Experiments: Length of simulation runs variance reduction techniques-experimental layout-validation

Module IV (13 hours)

Manufacturing Systems Examples: Simulation of single machine job shop-two machine job shop-simulation of inventory system and simulation of project networks.

Introduction of GPSS: Programming of discrete event using GPSS, case studies

Text Books

1. Jerry Banks and John S., *Carson,Discrete Event System Simulation*,Prentice, Hall of India
2. Gordon G.,*Systems Simulation*, Prentice Hall of India Ltd.
3. Narsingh Deo,*Systems simulation with digital computer*, Prentice Hall of India

Reference Books

1. A.M & Kelton W.D, *Simulation Modelling and Analysis*, McGraw Hill
2. Carrle A, *Simulation of Manufacturing Systems*, John Wiley and Sons Inc.,

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 805(E): INTEGRATED PRODUCT DEVELOPMENT

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart knowledge on development of a product development strategy using computer and information technology.*

Module I (14 hours)

Introduction: - Product Development- product development phases- conceptual design, embodiment design, detailed design, manufacturing, servicing, discard /recycle-
Product Development Organization: - Concurrent engineering - Definition – CE Design Methodologies – CE organization – collaborative product development – co design -
Requirement definition- product requirement and definition-

Module II (14 hours)

Product modelling – Unified modelling of products, application of UML - Product data management – Concept – function – architecture- product structure – product process – configuration management – Repository management

Module III (13 hours)

Management of product variety, version management – document management –
Use of Information technology in Product Development - Work flow – IT tools for PDM
Physical approach supporting PDM- An intelligent design for manufacturing system - JIT system – Manufacturability evaluation- Design Manufacturing Integration approaches – Meta data based approach- Feature based approach

Module IV (13 hours)

Product data exchange – standardization- STEP – IGES – web based standards – XML – PDML - Integration of systems CAD/ CAM/CAE -

Design for X –manufacturing, supply chain and logistics, customer service and maintenance, environment Integrated information system- development and design- DABA – Virtual enterprise -

Text Books

1. John W. Priest and Jose M. Sanchez , *Product Development and design for manufacturing*, Marcel Dekker Inc.
2. Karl T. Ulrich and Steven D Eppinger, *Product Design and Development*, McGRAW-Hill

Reference Books

1. Rodger J. Burden., *Product Data Management*,
2. Andrew Kusaik, *Concurrent Engineering: Automation Tools and Technology*, Wiley, JOhn and Sons Inc.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, *The unified modeling language user guide*, Pearson Education
4. Ibrahim Zeid, *CAD/CAM Theory and Practice* , McGraw-Hill
5. Otto, Otto *Kevin Product design* Pearson Education India,

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

PE14 805(F) LEAN AND AGILE MANUFACTURING

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart knowledge on application lean and agile concepts for manufacturing strategies*

Module I

Introduction to Lean and Agile Manufacturing – Emergence of Lean and Agile Manufacturing – Lean manufacturing through elimination of waste – Tools and Techniques – Value stream Mapping - Primary and secondary icons for the construction of VSM– development of Value stream mapping.

Module II

5S Concepts – 5S for waste elimination – Application of Kaizen in Lean Manufacturing – Single Minute Exchange Die – Theory and design – Waste elimination through SMED – Strategic elements for SMED.

Module III

Pull production through Kanban – Kanban systems – Kanban implementation – Fundamentals of one piece flow production system – Lean manufacturing through one piece flow and implementation procedure – Visual management - fundamental concepts and tools.

Module IV

Lean manufacturing through Total Productive maintenance – Principles of TPM – Pillars of TPM – Losses in TPM – Overall equipment effectiveness – Road map for implementation of lean manufacturing – Agile manufacturing - organizational structure for achieving agility.

Text Books

Text Book : Devadasan, S. R. , Sivakumar, V. Mohan , Murugesh, r. , Shalij, P. R. Lean and Agile Manufacturing : Theoretical, Practical and Research futurities, PHI publishers 2012

Reference Books

1. Gopalakrishnan N, Simplified Lean Manufacture: Elements, Rules, Tools and Implementation, Gopalakrishnan PHI Publishers 2012
2. Lawrence O. Levine, Joseph C. Montgomery, The Transition To Agile Manufacturing : Staying Flexible for Competitive Advantage, ASQ Books 2012

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To assess the ability of the student to study and present a seminar on a topic of current relevance in the field of production engineering or allied areas*

It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report, based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members will evaluate the seminar.

Internal Continuous Assessment (Max. Marks : 100)
20% - Relevance of the topic and literature survey 50% - Presentation and discussion 20% - Report 10% - Regularity in the class and Participation in the seminar

PE14 807 (P) : PROJECT

Teaching scheme **Credits:** 5

7 hours practical per week

Objectives

- *To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model or a system.*

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the

project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation.

Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the guide, and three/four faculty members specialised in Production Engineering ,Industrial Management ,Industrial Engineering etc.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment *(Maximum Marks - 100)*
40% - Design and development/Simulation and analysis
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class

PE14 808 (P) : VIVA VOCE

Credits: 3

Objectives

- *To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination*

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. Course, mini project (if there is), seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level.

For final viva-voce, candidates should produce certified reports of mini project, seminar, and project. If he/she has undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

Allotment of marks for viva-voce shall be as given below.

Assessment in Viva-voce *(Maximum marks – 100)*

40% - Subjects
30% - Project and Mini Project
20% - Seminar
10% - Industrial training/industrial visit/educational tour or Paper presented at National-level