SCHEME AND SYLLABI FOR

SIXTH SEMESTER

OF

BACHELOR OF TECHNOLOGY IN

PRODUCTION ENGINEERING

FROM 2009 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

6th Semester

Code	Subject	Hours/week			Marks		Sem- end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
PE09 601	Tool Engineering	4	1	-	30	70	3	5
PE09 602	Metal Forming	3	1	-	30	70	3	4
PE09 603	Industrial Engineering	3	1	-	30	70	3	4
PE09 604	Instrumentation and Control	3	1	-	30	70	3	4
PE09 605	Inspection and Quality Control	2	1	-	30	70	3	3
PE09 Lxx	Elective I	3	1	-	30	70	3	4
PE09 607(P)	*Manufacturing Sciences Lab*	-	-	3	50	50	3	2
PE09 608(P)	*CAD/CAM Lab*	-	-	3	50	50	3	2
	Total	**18**	**6**	**6**				**28**

Elective I

PE09 L01 Human Resource management
PE09 L02 Marketing Management
PE09 L03 Machine Tool Design
PE09 L04 Mechatronics
PE09 L05 Advanced Materials and Processing

PE09 601: Tool Engineering

Teaching scheme **Credits:** 5

4 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 (18 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 (18 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 (18 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 (18 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

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-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

PE09 602: 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-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

PE09 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-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

PE09 604 Instrumentation and Control

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an exposure to the concepts and techniques of control systems*
- *To create knowledge about the various instruments and instrumentation techniques*

Module I (14 hours)

Control systems – principle of automatic control – open and closed loop systems – practical examples – transfer function approach – transfer functions of control components – simple physical systems – analogous systems – error and closed loop transfer functions – signal flow graphs – control system components – DC and AC servomotors – hydraulic and pneumatic systems – process control – concept of stability of linear systems – Routh's criterion of stability

Module II (13 hours)

State space analysis of systems – introduction to state concept – state space representation- state equations of linear continuous data systems – matrix representation of state equation – solution of time invariant state equations – introduction to sample data and digital control systems

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

Text Books
For control systems 1. Nagarath.J& Gopal M. *Control Systems Engineering*, Wiley Eastern Limited
2. K.Ogata, *Modern Control Engineering*, Pearson Edition

Reference Books
1. Kuo, Aoutomatic *Control Systems*, Prentice Hall Of India
2. Eugine Xavier S.P, Joseph Cyril Babu J, *Principles of Control Systems*, S. Chand & Company
3.S.Palani, *Control Systems Engineering* TMH
4.Nakra BC & Choudhary K K , *Instrumentation, Measurements And Analysis*
5. Beckwith, *Mechanical Measurements*, Oxford & IBH

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

PE09 605: Inspection and Quality Control

Teaching scheme **Credits:** 3

2hours lecture and 1 hour tutorial per week

Objectives

- *To provide an insight to various methods of measurements and inspection*
- *To provide an understanding of the statistical methods of quality control*

Module I (9 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 (11 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 (8 hours)

Introduction to the concept of quality – quality control - 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.

Module IV (8 hours)

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

Text Books:

1. R K Jain, *Industrial Metrology*, Khanna Publishers
2. Gupta I C, *A text book of Engineering Metrology*, Dhanpat Rai Publications
3. Gerals M Smith, *Statistical Process Control and Quality Improvements*, 5th Edition, Pearson Education, 2004
4. E L Grant, *Statistical Quality Control*, McGraw Hill

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

PE09 L01: Human Resource Management

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-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

PE09 L02: 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-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

PE09 L03: Machine Tool Design

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 (14 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 (14 hours)
Slides ways - different types of slide ways - wear adjustments - design consideration - lubrication surface finish - straightness and hardness requirements of slide way

Module III (13 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 (13 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-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

PE09 L04: Mechatronics

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To acquire an understanding of sensors, actuating devices, signal processing etc to have a clear idea about advanced manufacturing systems*

Module I (10 hours)

Introduction to Mechatronics: - Mechatronics – Integrated Design issues – Key elements – Design process – Advanced approaches in Mechatronics

Module II (**14 hours)**
Sensors and Transducers :- Introduction to sensors and transducers – Sensors for motion and position measurement – Force, Torque and tactile sensors – Flow sensors – Temperature sensing devices – Ultrasonic sensors – Vibration control using magneto strictive transducers – Fibre optic devices in mechatronics

Module III (16 hours)
Actuating devices, Signals, Systems & Controls: - DC and AC Drives-Stepper motor – Servo motor – fluid power-design elements – piezoelectric actuators – Introduction to Signals – systems and controls – system representation – Linearisation of Non-linear systems – time delays – measures of system performance.

Module IV (14 hours)
Advanced Applications in Mechatronics: - Sensors for condition monitoring – Mechtronic control in automated manufacturing – Artificial Intelligence

Text Books

1. Devadas Shetty, Richard.A.Kolk,,*Mechatronics System Design*,PWS publishing company1997

Reference Books

1. Bosch, *Mechatronics Theory and Application*.,1998
2. W.Bolton, *Mechatronics*, Longmen,1999
3. *Mechatronic*, Edited by HMT, Bangalore,1998
4. Bradly.D.A, Dawson.D, Burd.N.C,Loadeer.A.J, *Mechatronics, Electronics in Products and Processes*, Chapmall and Hall 1993

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

PE09 L05: Advanced Materials and Processing

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give exposure to newer materials used in manufacturing*
- *To give exposure to the advanced techniques used in manufacturing*
- *To enable the student to select the appropriate process according to the materials used*

Module I (14 hours)
Introduction – conventional materials, limitation, need for composites, classification and characteristics of composites, resin matrices, reinforcements, other constituents of fibre, fibre reinforced plastics, ceramics and metal matrix composites – manufacturing of metal matrix composites, solid and liquid state processing – testing of composites – applications

Module II (14 hours)
Introduction to powder metallurgy (P/M) processes – design considerations for P/M tooling – types of compaction – sintering at different atmospheres – liquid phase sintering – secondary processes – P/M applications specifically to cutting tool, bearing and friction materials – nano materials and their applications.

Module III (13 hours)
Special material removal processes – chemical machining, electro chemical machining, electrical discharge machining wire EDM, water jet machining – high speed machining – micro machining-casting of non-ferrous metals

Module IV (13 hours)
Surface structure and properties – surface coatings, hard facing, thermal spraying, vapour deposition, ion implantation, hot dipping – coating of cutting and forming tools

Reference Books

1. Serope Kalpakjian and Steven R Schmid – *Manufacturing Engineering and Technology*, Addison Wesley Longman (Singapore) Pvt. Ltd., New Delhi, 2000
2. L Carl Love – *Welding Procedures and Applications*, Prentice Hall Inc., 1993
3. H M T – *Production Technology*, Tata McGraw Hill Publishing Co., 2002
4. R W Heine, C R Loper and P C Rosenthal – *Principles of Metal Casting*, Tata McGraw Hill Publishing Co., 1991

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

PE09 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

Semester End Examination *(Maximum Marks-50)*

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

PE09 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
4. Design of moulds from CAD models

Internal Continuous Assessment *(Maximum Marks-50)*

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

Semester EndExamination *(Maximum Marks-50)*

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

PE09 701: Production Management

Teaching scheme **Credits:** 5
4 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*