UNIVERSITY OF CALICUT

SCHEME AND SYLLABI

FOR

FIFTH SEMESTER

OF

BACHELOR OF TECHNOLOGY

IN

PRODUCTION ENGINEERING

FROM 2004 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

PE: PRODUCTION ENGINEERING

FIFTH SEMESTER

Code	Subject	Hours/Week			Internal Marks	University Examination	
		L	T	P/D		Hrs	Marks
PE04 501	Numerical Methods in Engineering	3	1	-	50	3	100
PE04 502	Design of Machine Elements	3	1	-	50	3	100
PE04 503	Metal Casting	3	1	-	50	3	100
PE04 504	Welding and Allied Processes	3	1	-	50	3	100
PE04 505	Engineering Materials	3	1	-	50	3	100
PE04 506	Machining of Materials	3	1	-	50	3	100
PE04 507 (P)	Material Testing Lab	-	-	3	50	3	100
PE04 508 (P)	Manufacturing Sciences Lab	-	-	3	50	3	100
		18	**6**	**6**	**400**		**800**
***At least two industrial visits and subsequent report presentation compulsory** ***Types of Industry – Foundry/Welding units**							

FIFTH SEMESTER

PE 04 501 : NUMERICAL METHODS IN ENGINEERING

3 hours lecture and 1 hour tutorial per week

Objectives:
The course is meant to develop analytical capabilities in students to formulate and solve real life engineering situation.

Module I (13 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 (13 hours)
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 (13 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 (13 hours)
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:-

1. Narayanan S., Manickavachagom Pillai & Dr Ramanaiah G., *Advanced Mathematics for Engineering Students Vol. III*, S Viswanathan Publishers
2. Sasthri S.S., *Numerical Analysis*, Prentice Hall of India Publishers
3. Jain M.K., Iyengar S R K, & Jain R.K., *Numeric Methods for Scientific and Engineering Computation*, Wiley Eastern Publishers
4. Carl Erik Fooberg, *Introduction to Numerical Analysis*, Second Edition, Addison Wesley Publishers.
5. James M.L, Smith C.M. & Wel Bord J.C., *Introduction to Numerical Analysis*, Tata McGraw Hill Publishers
6. Hildebrand F B, *Introduction to Numerical Analysis*, Tata McGraw Hill

Internal work assessment
60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher. (At least one assignment should be computer based using spread sheet or suitable tools)
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern
Q I - 8 short type questions of 5 marks each, 2 from each module
Q II - 2 questions of 15marks each from module I with choice to answer any one
Q III - 2 questions of 15marks each from module II with choice to answer any one
Q IV - 2 questions of 15marks each from module III with choice to answer any one
Q V - 2 questions of 15marks each from module IV with choice to answer any one
(QII to V can have 2 subdivisions.)

PE 04 502 : DESIGN OF MACHINE ELEMENTS

(3 hours lecture and 1 hour tutorial per week)

Objectives:
The objective of this subject is to acquaint the students with the analytical and mathematical tools together with practical consideration used for the design and selection of the machine components.

Module I (13 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 (13 hours)
Welded joints - stresses welded joints - strength of welded joints - fatigue loading of welded joints - design of bolts and screws.

Module III (13 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 (13 hours)
Couplings - rigid and flexible coupling - common types of keys, pins and retainers and their applications – Design of journal bearing – Antifriction bearing , types and selection.

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*

Reference 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
3. Doughter & Valance, *Design of Machine Elements*, McGraw Hill publishers
4. Johnson, *Optimum Design of Mechanical Elements*, John Wiley

Internal work assessment
60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern
Q I - 8 short type questions of 5 marks each, 2 from each module
Q II - 2 questions A and B of 15marks each from module I with choice to answer any one
Q III - 2 questions A and B of 15marks each from module II with choice to answer any one, numerical problems expected
Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one, numerical problems expected
Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one, numerical problem Expected
(QII to V should contain 2 subdivisions. At least 60% weightage for numerical problems.)

PE 04 503 : METAL CASTING

(3 hours lecture and 1 hour tutorial per week)

Objectives:
The subject deals with the fundamental aspects related to metal casting viz. melting, solidification, moulding, pattern making, sand castings and special casting process.

Module I (12 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 (13 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 (14 hours)
Sand casting, pressure die casting, centrifugal casting, Investment casting, shell molding, 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 likes aluminium, copper etc. - introduction into steel casting.

Text book:-
1. Hine, Lopper 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

Internal work assessment
60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern
Q I - 8 short type questions of 5 marks each, 2 from each module
Q II - 2 questions of 15marks each from module I with choice to answer any one
Q III - 2 questions of 15marks each from module II with choice to answer any one
Q IV - 2 questions of 15marks each from module III with choice to answer any one
Q V - 2 questions of 15marks each from module IV with choice to answer any one
(QII to V can have 2 subdivisions. Preferably all questions are of descriptive type..)

PE 04 504 : WELDING AND ALLIED PROCESSES

3 hours lecture and 1 hour tutorial per week

Objectives:
The student is expected to get an understanding of different joining techniques, metallurgical aspects of welding, testing and quality control etc of weldments .

Module I (13 Hours)

Introduction - classification of processes –soldering, brazing, welding, gouging, arc and gas cutting
Welding symbols -joints -terminology - weldability of materials- distortion - residual stresses -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, electroslag, plasma arc, stud 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 and explosion welding.

Module IV (13 Hours)
Defects in welds - inspection and testing of welds - destructive and non destructive testing - visual, radiography, magnetic particle, eddy current and dye penetrant testing.

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
4. R.S.Parmar - *Welding processes and technology*. Hanna Pub.
5. H.B.Cary - *Modern welding technology*, Prentice Hall
6. R.Halmshaw, *Non destructive testing*, Edward Arnold 1987

Internal work assessment
60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern
Q I - 8 short type questions of 5 marks each, 2 from each module
Q II - 2 questions of 15marks each from module I with choice to answer any one
Q III - 2 questions of 15marks each from module II with choice to answer any one
Q IV - 2 questions of 15marks each from module III with choice to answer any one
Q V - 2 questions of 15marks each from module IV with choice to answer any one
(QII to V can have 2 subdivisions. Preferably all questions are of descriptive type..)

PE 04 505 : ENGINEERING MATERIALS

3 hours lecture and 1 hour tutorial per week

Objective

The subject "Engineering Materials" is meant for under graduate engineering students who have completed their basic course in material science.The prime objective of introducing the subject is to give a detailed exposure of various materials used in Engineering. On completion of this course the student is expected to have knowledge about Ferrous as well as non Ferrous materials, Processes applied for modification/improvement of metal properties. Also an introduction to advanced materials like Ceramics, Composite, polymer etc.included.

Module I (13 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 (13 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 (8 hours)

Non-ferrous metals – Copper and its alloys – Aluminium and its alloys – Nickel and its alloys – Titanium and its alloys

Module IV (18 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

Reference 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 work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module
Q II - 2 questions of 15marks each from module I with choice to answer any one
Q III - 2 questions of 15marks each from module II with choice to answer any one
Q IV - 2 questions of 15marks each from module III with choice to answer any one
Q V - 2 questions of 15marks each from module IV with choice to answer any one
(QII to V can have 2 subdivisions.Preferably all questions are of descriptive type..)

PE04 506 MACHINING OF MATERIALS

3 hours lecture and 1 hour tutorial per week

Objective

Machining is one of the important production processes. The paper aims giving the students the basic concepts, processes and analysis of basic machining processes and selection of processes, tools, etc.

Module I (13 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 (13 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.

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

Internal work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module
Q II - 2 questions A and B of 15marks each from module I with choice to answer any one
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Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one, numerical problems expected
Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one, numerical problems Expected
(QII to V should contain 2 subdivisions. At least 50% weightage for numerical problems.)

PE 04 507(P) : MATERIAL TESTING LAB

3 hours practical per week

Objectives:
The lab 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 work assessment	
Practicals & Record	= 25
Test	= 20
Regularity in Class	= 5
Total marks	= 50

PE04 508(P) : MANUFACTURING SCIENCES LAB

3 hours practical per week

Objective

Objective of this lab is to train students to conduct experiments in manufacturing sciences. This in turn will enable the student to formulate and conduct experiments to evaluate practical situations. Some of the experiments are done to provide experimental evidence to certain theories.

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 work assessment

Practicals & Record	= 25
Test	= 20
Regularity in Class	= 5
Total marks	= 50