BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA
PRODUCTION ENGINEERING

5th SEMESTER				6th SEMESTER			
Theory		*Contact Hrs*	*Credit*	*Theory*		*Contact Hrs*	*Credit*
		L-T-P				L-T-P	
HSSM 3302	Optimization Engineering	3-0-0	3	PCME 4404	Production and Operation Management	3-0-0	3
HSSM 3303	Environmental Engineering and Safety	3-0-0	3	PCMF 4302	Tool Design	3-0-0	3
PCME 4303	Design of Machine Elements	3-0-0	3	PCME 5306	CAD/CAM	3-0-0	3
PCPR 4301	Principle of Machine Tools	3-0-0	3	PCMF 4301	Materials Deformation Process	3-0-0	3
	Professional Elective - I (Any one)	3-0-0	3		**Professional Elective - II (Any one)**	3-0-0	3
PEMF 5302	Advanced Casting and Welding			FEME 6301	Finite Element Methods		
PEMF 5303	Maintenance Engineering and Management			PETX 5412	Management Information System		
PEME 5303	Rapid Prototyping			PEME 5305	Robotics and Robotics Apllication		
	Free Elective - I (Any one)	3-0-0	3		**Free Elective - II (Any one)**	3-0-0	3
PEME 5408	Composite Material			PEME 5308	Non Conventional Energy Sources		
FEME 6302	Project Management			FEME 6303	Heat Power Engineering		
PEME 5304	Tribology			PEIT 5301	E Commerce		
BECS 2212	C++ and Object Oriented Programming						
	Credits (Theory)		18		Credits (Theory)		18
	PRACTICALS/SESSIONALS				*PRACTICALS/SESSIONALS*		
PCMF 7305	Metallurgy and NDT Lab	0-0-3	2	PCMF 7304	Tool Design Sessional	0-0-3	2
PCMF 7302	Machine Design Sessional	0-0-3	2	PCPR 7301	NTM Lab	0-0-3	2
PCMF 7305	Manufacturing Lab-3(Machine Shop)	0-0-3	2	PCMF 7301	Manufacturing Lab-4	0-0-3	2
	Credits (Practicals / Sessionals)		6		Credits (Practicals / Sessionals)		6
	TOTAL SEMESTER CREDITS		24		TOTAL SEMESTER CREDITS		24
	TOTAL CUMULATIVE CREDITS		133		TOTAL CUMULATIVE CREDITS		157

PRODUCTION ENGINEERING *5th semester*

HSSM3302 OPTIMIZATION ENGINEERING   (3-0-0)

Module-I   (10 Hours)

 Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling. Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming

Module-II   (10 Hours) Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method Assignment problems: Hungarian method for solution of Assignment problems Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Module-III   (10   Hours) Non-linear programming: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming Introduction to Genetic Algorithm.

Recommended text books

1. A. Ravindran, D. T. Philips, J. Solberg, " Operations Research- Principle and Practice", Second edition, Wiley India Pvt Ltd
2. Kalyanmoy Deb, " Optimization for Engineering Design", PHI Learning Pvt   Ltd
Recommended Reference

 Books:
1.Stephen G. Nash, A. Sofer, " Linear and Non-linear Programming", McGraw Hill
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis," Engineering Optimization",   Second edition, Wiley India Pvt. Ltd
 3.H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, "Operations Research", Eighth Edition, Pearson Education
4. F.S.Hiller, G.J.Lieberman, " Operations Research", Eighth Edition, Tata McDraw Hill 5. P.K.Gupta, D.S.Hira, "Operations Research", S.Chand and   Company Ltd.

HSSM3303 ENVIRONMENTAL ENGINEERING & SAFETY (3-0-0)

Module - I
Ecological Concepts: Biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Oxygen cycle, Nitrogen cycle etc., Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law. Chemistry in Environmental
Engineering: Atmospheric chemistry, Soil chemistry. Noise pollution- Noise standards,
measurement and control. Water Treatment: water quality standards and parameters,
Ground water. Water treatment processes, Pre-treatment of water, Conventional process,
Advanced water treatment process.

Module - II :

(a)Waste Water Treatment: DO and BOD of Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production.
(b)Air Pollution   : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change -greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.
(c) Solid waste, Hazardous waste management, Solid Waste Management, Source classification and composition of MSW: Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous Waste Management, Hazardous waste and their generation, Transportation and treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing,

Module - III : Occupational Safety and Health Acts, Safety procedures, Type of Accidents, Chemical and Heat Burns, Prevention of Accidents involving Hazardous substances, Human error and Hazard Analysis. Hazard Control Measures in integratednsteel industry, Petroleum Refinery, L.P.G. Bottling, Pharmaceutical industry. Fire Prevention - Detection, Extinguishing Fire, Electrical Safety, Product Safety. Safety Management- Safety Handling and Storage of Hazardous Materials, Corrosive Substances, Gas Cylinders, Hydro Carbons and Wastes. Personal Protective Equipments.

Text Book :
1. Environmental Engineering Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Environmental Engineering by Prof B.K. Mohapatra, Dhanpat Rai & Co Publication
3. Industrial Safety Management, L. M. Deshmukh, Tata McGraw Hill Publication.

Reference Books
1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGraw Hill International Edition, 2004
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
6. Industrial Safety Management and Technology, Colling. D A - Prentice Hall, New Delhi

PCME4303 DESIGN OF MACHINE ELEMENTS (3-1-0)

Module-I (12 hours)

Stages in design, Standardization, Interchangeability, Preferred numbers, Fits and Tolerances, Engineering materials, Ferrous, Non-ferrous, Non-metals, Indian standard specifications for Ferrous materials, Fundamentals of Machine Design, Allowable stress, Factor of safety, Use of Code/Data books.

Design of Joints: Riveted joints, Boiler joints, Welded and bolted joints based on different types of loading. Illustrative problems with solutions.

Module-II (14 hours)

Design of Cotter joints with socket and spigot, with a Gib. Design of knuckle joint. Illustrative problems with solutions.

Design of shafts, solid and hollow based on strength and on rigidity. Illustrative problems with solutions.

Design of keys and pins, Suck key, Feather key, Taper pin. Illustrative problems with solutions.

Design of shaft couplings : Rigid Flange coupling, Flexible Flange coupling.

Module-III (14 hours)

Design of circular section, Helical springs, Tension and compression types, Design of leaf springs: Cantilever and semi-elliptical types. Illustrative problems with solutions. Levers, classification, Design of Foot levers, Hand lever, Cranked lever, Lever of lever loaded - safety - valve. Design of belt and pulley Power screw design with square thread, such as screw jack. Illustrative problems with solutions.

[Only specified data book as mentioned in the syllabus is permitted during examination]

TEXT BOOKS:

1. Mechanical Engineerng Design, J.E.Shigley, C.R.Mischke, R.G.Budynas and K.J.Nisbett, TMH
2. Machine Design, P.Kanaiah, Scietech Publications

REFERENCE BOOKS:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

2. Machine Design, P.C.Sharma and D.K.Agrawal, S.K.Kataria & Sons

3. Machine Design, Pandya and Shah, Charotar Book Stall

4. Machine Design, Robert L. Norton, Pearson Education Asia, 2001.

5. Machine Design, A CAD Approach: Andrew D Dimarogonas, John Wiley Sons, Inc, 2001.

6. Fundamentals of Machine Component Design, Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007

7. A Text Book of Machine Design, R.S.Khurmi and J.K.Gupta, S.Chand Publication

8. Machine Design, H.Timothy and P.E.Wentzell, Cengage Learning

9. Computer Aided Analysis and Design, S.P.Regalla, I.K.International Publishing

DESIGN DATA HAND BOOKS:

1. P.S.G.Design Data Hand Book, PSG College of Tech Coimbature

2. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed. 2003.3. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications

PRINCIPLE OF MACHINE TOOLS

Module-1   **14 Hrs**

conventional machining process and machine tools-Turning, Drilling, Shaping, Planning, Milling, Grinding Machine tools for these processes, their specifications and various techniques used, calculation of cutting time, speed, feed ,MRR etc.

Module-2

principle of machine tools: kinematics of machine tools ,speed transmission from motor to spindle, speed reversal mechanism, mechanism for feed motion, Tool holding and job holding methods in different machine tools, Types of surface generated, Indexing mechanism and thread cutting mechanism, Quick return mechanism.

Module-3

Production Machine tools-Capstan and turret lathes, single spindle and multi spindle semiautomatics, Gear shaper and Gear hopping machines, Coping lathe and transfer machine

PROFESSIONAL ELECTIVE-I
PEMF5302 ADVANCED CASTING & WELDING (3-0-0)

MODULE- I   (12 hours)

MELTING AND POURING: Principles of melting practice-fluxing- Degasification and inoculation- types of furnaces- Crucibles, Cupola, Oil fired furnaces - Electric arc and induction furnaces -Melting practice of cast iron, SG iron, steel, aluminium and copper alloys.

CASTING DESIGN: Solidification of pure metals and alloys-shrinkage in cast metals-design of sprue, runner, gate and risers-problems in design and manufacture of thin and unequal sections designing for directional solidification, minimum distortion and for overall economy - design problems of L, T, V, X and Y junctions.

MODULE II   (10 hours)

WELD DESIGN AND WELDING METALLURGY: Design of welded components-symbolic representation of welds on drawings- welding classes-residual stresses in welds-weld distortions-design consideration-strength consideration of welded joints-analysis of statistically loaded welded joints-welded structures subjected to fatigue loads.

MODULE III   (12 hours)

SPECIAL CASTING AND WELDING PROCESSES: Evaporative pattern casting-ceramic mould casting -electro magnetic moulding-squeeze casting -investment casting-shell moulding-PAW-electron beam welding-laser beam welding- friction welding-ultrasonic welding -diffusion welding-high velocity oxy fuel processes

QUALITY CONTROL AND AUTOMATION : Cleaning and inspection of castings - Casting defect and remedies - foundry automations-moulding machines-Automation of sand plant, moulding and fettling sections of foundry-Dust and fume control-Welding defects -causes and remedies - Non Destructive tests - arc welding using robots-weld positioner and manipulators -weld seam tracking-vision system-arc sensing welding

TEXT BOOKS
1. PARMAR, R.S., Welding Processes and Technology, Khanna Publishers, 1997.
2. JAIN, P.L., Principles of Foundry Technology, Tata McGraw Hill, 2003.
REFERENCES
1. A.S.M Hand book, vol 15, casting, ASM international, 1988
2. KLAS WEMAN, welding processes hand book, CRC press, 2003
3. CARY and HOWARD,B., Modern Welding Technology, Prentice-Hall, 1989.
4. HEINE, R.W., LOPER.L.R., and ROSENTHAL,C, Principles of Metal Casting, TMH
5. MINKOFF,J., solidification and cast structure,wiley.1986
6. DAVIES, A.C., Welding (10th Edition), Cambridge University Press, 1996.

PEMF5303 MAINTENANCE ENGINEERING & MANAGEMENT (3-0-0)

MODULE- I (12 hours)

MAINTENANCE CONCEPTS:

Objectives and functions - Tero technology - Reliability Centered Maintenance (RCM) - maintainability prediction - availability and system effectiveness- maintenance costs   - maintenance organization, Minimal repair   - maintenance types   - balancing PM and breakdown maintenance- PM schedules: deviations on both sides of target values - PM schedules: functional characteristics - replacement models

MODULE- II (10 hours)

TOTAL PRODUCTIVE MAINTENANCE: Zero breakdowns - Zero Defects and TPM - maximizing equipment effectiveness - autonomous maintenance program - five pillars of TPM - TPM small group activities - TPM organization - management decision - educational campaign - creation of organizations - establishment of basic policies and goals - formation of master plan. - TPM implementation

MODULE- III (13 hours)

MAINTENANCE LOGISTICS : Human factors in maintenance - maintenance manuals - maintenance staffing methods - queuing applications - simulation - spare parts management - maintenance planning and scheduling

DIAGNOSTIC MAINTENANCE: Leak detection-wear monitoring-Temperature monitoring Vibration monitoring-Signature analysis-Shock monitoring-Lubricant-Analysis-Methodology-Equipments-Applications

ONLINE MONITORING: Condition Monitoring Techniques- Vibration Monitoring, Signature Analysis - Wear Debris Monitoring - Maintenance Management Information System - Expert systems -Corrosion Monitoring and Control

TEXT BOOKS

1. Seiichi Nakajima, Introduction to TPM, Productivity Press, Chennai, 1992.

2. Gopalakrishnan, P. and Banerji, A.K., Maintenance and Spare Parts Management,

3. Prentice - Hall of India Pvt. Ltd., 1991.

REFERENCES

1. Goto, F., "Equipment planning for TPM Maintenance Prevention Design", Productivity Press, 1992.

2. Shirose, K., "Total Productive Maintenance for Workshop Leaders", Productivity Press, 1992.

3. Shirose, K., "TPM for Operators", Productivity Press, 1996.

4. Suzuki, T., "New Directions for TPM", Productivity Press, 1993.

5. Kelly, A.., "Maintenance Planning and Control", Butterworth, London, 1991.

PEMF5404RAPID PROTOTYPING (3-0-0)

MODULE -I (12 hours)

INTRODUCTION: History - Development of RP systems - Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle - Fundamental - File formatOther translators - medical applications of RP - On demand manufacturing - Direct material deposition - Shape Deposition Manufacturing.

LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS: Classification - Liquid based system - Stereo lithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system- Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

MODULE -II (11hours)

POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective Laser Sintering - principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing - process, major applications, research and development. Direct shell production casting -key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

MODULE -III (12hours)

MATERIALS FOR RAPID PROTOTYPING SYSTEMS: Nature of material - type of material -polymers, metals, ceramics and composites liquid based materials, photo polymer development -solid based materials, powder based materials - case study.

REVERSEENGINEERING AND NEW TECHNOLOGIES :Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-pre-processing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

TEXT BOOKS

1. Rafiq I. Noorani, Rapid Prototyping - Principles and Applications, Wiley & Sons, 2006.
2. Chua C.K, Leong K.F and Lim C.S, Rapid Prototyping: Principles and Applications, second edition, World Scientific, 2003.

REFERENCES

1. N.HOPKINSON, R.J.M, HAUGE, P M, DICKENS, "Rapid Manufacturing - An Industrial revolution for the digital age", Wiley, 2006
2. IAN GIBSON, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototyping", Wiley, 2006
3. Paul F.Jacobs, Rapid Prototyping and Manufacturing, "Fundamentals of Stereo lithography", McGraw Hill 1993.
4. D.t.Pham and S.S.Dimov, "Rapid Manufacturing", Springer Verlog 2001.

FREE ELECTIVES -I

PEME5408 COMPOSITE MATERIALS

Module - I (14 hours)

1. Introduction :

Classification and characteristics of composite materials, mechanical behaviour of composites, constituents, Reinforcements, Matrices, Fillers, Additives, Applications and advantages of composites.

2. Processing :

Initial form of constituent materials, Manufacturing procedures for fibre-reinforced plastics, quality control.

3. Macromechanical Behaviour :

Stress strain relations of anisotropic materials - Engineering constants for orthotropic materials, Stress strain relations for specially orthotropic lamina. Transformation relationships for a lamina of arbitrary fibre orientation.

Module - II (12 hours)

Testing of Composites, Evaluation of Engineering Constants and Strengths.

Micromechanical Analyses of orthotropic lamina, Evaluation of Engineering Constants using Micromechanical principles, Rules of Mixtures, Kelly Davis Model for Minimum and Critical Volume Fractions.

Module - III (10 hours)

FRP Composite Laminate designation and codes, Macromechanical Behaviour of FRP Composite Laminates, Classical Lamination Theory.

General Design Consideration and Suitable laminating Scheme.

Text Book

1. Mechanics of Composite Materials, R.M. Jones, Mc. Graw Hill Book Co.

Reference Book :

1.Fibre - Reinforced composites :- Materials, manufacturing and Design by P.K. Mallick, CRC Press.

2.Engineering Mechanics of Composite Materials, I.M.Danel, O.Issai, Oxord University Press

3. Composite materials, Broutman & Crock,

4. Principles of Composite Material Mechanics, R.F.Gibson, CRC Press

FEME6302 PROJECT MANAGEMENT

Module-I

Project Management Concepts and Needs Identification Attributes of a Project, Project Life Cycle, The Project management Process, Benefits of Project Management, Needs Identification, Project Selection, Project organization, the project as part of the functional organization. Project feasibility Analysis: Technical feasibility, commercial and financial visibility, Environment Analysis.

Module-II

Project Planning and Scheduling: Design of project management system; project work system; work breakdown structure,
project execution plan, work packaging plan, project procedure manual; project scheduling; bar charts, line of balance (LOB) and Network Techniques (PERT / CPM)/ GERT, Resource allocation, Crashing and Resource Sharing, capacity planning and expansion capacity decision.

Module III

Project Monitoring and Control and Project Performance Planning, Monitoring and Control; Design of monitoring system; Computerized PMIS (Project Management Information System). Coordination; Procedures, Meetings, Control; Scope/Progress control, Performance control, Schedule control, Cost control, Performance Indicators; Project Audit; Project Audit Life Cycle, Responsibilities of Evaluator/ Auditor, Responsibilities of the Project Manager.

Books:

1. Project Planning, Analysis, Selection, Financing, Prasana Chandra, TMH

2. Project Management, Grey, TMH.

3. Project Management, Richman, PHI

4. Project Management, Vasant Desai, HPH

5. Project Management, Bhavesh M.Patel, Vikash

6. Project Engineering & Management- Prasanna Chandra, Prentice Hall.

PEME5304   TRIBOLOGY

MODULE- I   (12 hours)

Study of various parameters: Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used. Hydrostatic lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

MODULE -II   (11 hours)

Hydrodynamic theory of lubrication: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti -friction bearing.

MODULE- III   (12 hours)

Concept of gas lubricated bearing -Concept of Elastohydrodynamic lubrication -Friction and power losses in journal bearings: Calibration of friction loss friction in concentric bearings, bearing modulus, Sommerfield number, heat balance, practical consideration of journal bearing design considerations. Air lubricated bearing: Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect. Bearing materials: General requirements of bearing materials, types of bearing materials.

TEXT BOOKS:

1. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI

2. Tribology in Industry: Sushil Kumar Srivatsava, S. Chand &Co. REFERENCE:

1. Introduction to Tribology of Bearings - B.C. Majumdar, S. Chand & Co.

2. Tribology - Hutchins, Asterix Publishers(1992)

3. Tribology - Lambert M Surhone, Miriam T Timpledon, Susan F Marseken, Betascript Publishing(2010)

BECS2212 C++ AND OBJECT ORIENTED PROGRAMMING

Module I   (08 hrs)
Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II   (16 hrs)
Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references.
Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors.
Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes.
Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators.
Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III   (08 hrs)

Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.
Template: template classes, template functions.
Namespaces: user defined namespaces, namespaces provided by library.

Text Books:
1.   Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)
2.   ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

Reference Books:

1.   Big C++ - Wiley India
2.   C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
3.   "C++ and Object Oriented Programming" - Jana, PHI Learning.
4.   "Object Oriented Programming with C++ "- Rajiv Sahay, Oxford
5.   Mastering C++ - Venugopal, McGraw-Hill Education (India)
"Object Oriented Programming with C++", David Parsons, Cengage Learning.

PCMF7302   MACHINE DESIGN SESSIONAL (0-0-3)

LIST OF EXPERIMENTS:

1. Design of coupling -Rigid & flexible type
2. Design of riveted joints (under axial & eccentric loading)
3. Design of Welded joints (under axial & eccentric loading)
4. Design of cotter & knuckle joint
5. Design & Analysis of leaf & Helical springs under various loading
6. Design of Piston
7. Design of Connected rod/crankshaft,
8. Design of Spur gear under various loading
9. Design of Helical & bevel gear under various loading
10. Design of Screw Jack under various loading
11. Practice in computer aided design of some of the above mentioned design using 3D Software

PCMF 7303   MANUFACTURING LABORATORY - III   (0-0-3)
(DYNAMIC LAB)

LIST OF EXPERIMENTS:
1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential
   20 gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker,
   Oscillating cylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axis symmetric bodies using Turn Table
   apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and   compound
   pendulum.
4. Motorized gyroscope - Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell,
   and Hartnell Governors.
6. Cams - Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System - Determination of natural
   frequency and verification of Laws of springs - Damping coefficient determination.
   b) Multi degree freedom suspension system - Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.-
   Undamped and Damped Natural frequencies.
   b) Vibration Absorber - Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system - Undamped and damped vibration.
10. Whirling of shafts - Determination of critical speeds of shafts with concentrated
    Loads.
11. a). Balancing of rotating masses.
    b). Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam - with and without concentrated masses.
    b) Forced Vibration of Cantilever beam - Mode shapes and natural frequencies.
    c) Determination of transmissibility ratio using vibrating table.

PCMF7305 METALLURGY & NON DESTRUCTIVE TESTING LAB.

1.Microstructure analysis of steel (Mild, Medium carbon, High carbon, Hardened & Spheroidised Steel), Cast iron

2. Jominy and Quench test apparatus

3. Microstructure analysis of Non ferrous alloys

4. Heat treatment of steel

5. Cooling curve experiment

6. Liquid penetrant test

7. Ultrasonic flaw detection

8. Magnetic particle testing

9. Eddy current testing.