PANDIT DEENDAYAL PETROLEUM UNIVERSITY
SCHOOL OF TECHNOLOGY
COURSE STRUCTURE FOR B.TECH. MECHANICAL ENGINEERING

SEMESTER VII			B.TECH. MECHANICAL ENGINEERING											
Sr. No	Course Code	Course Name	Teaching Scheme					Exam Scheme						
			L	T	P	C	Hrs/wk	Theory			Practical		Total Marks
								MS	ES	IA	LW	LE/Viva	
1	ME 401T	Computer Aided Design	3	0	-	6	3	30	60	10	--	--	100
	ME-401P		--	--	4	2	4	--	--	--	25	25	50
2	ME 402T	Internal Combustion Engines	3	0	--	6	3	30	60	10	--	--	100
	ME 402P		--	--	2	1	2	--	--	--	25	25	50
3	ME 403T	Optimization Techniques	3	0	--	6	3	30	60	10	--	--	100
4	ME404P	Seminar	--	--	6	3	6	--	--	--	25	25	50
5	ME 4XXT	Department Elective-I	3	0	--	6	3	30	60	10	--	--	100
6	ME 4XXT	Department Elective-II	3	0	--	6	3	30	60	10	--	--	100
7	HS 410T	Industrial Economics	3	0	--	6	3	30	60	10	--	--	100
8	ME 409	Industrial Training	--	--	--	6	--	--	--	--	--	--	100
		Total	**18**	**0**	**12**	**48**	**30**						850

Department Elective – I: (ME 411- Experimental Stress Analysis ME 412- Science and Technology of Welding ME 413- Lubrication ME 414- Computation Fluid Dynamics and Heat Transfer ME 415- Fuels Combustion and Pollution ME 416- Advances in Measurement Techniques ME 417- Solar Photovoltaic Fundamental : Technologies & Application

Department Elective – II: (ME 418- Vibration Engineering Design ME 419-Quality Engineering ME 420- Neural Network, Fuzzy system & Application ME 421- Cryogenics ME 422- Flexible Manufacturing Systems ME 423- Industrial Design ME 424- Turbo Machinery

MS = Mid Semester, ES = End Semester; IA = Internal assessment (like quiz, assignments etc)

LW = Laboratory work; LE = Laboratory Exam

ME 401TCOMPUTER AIDED DESIGN										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	6	3	30	60	10	--	--	100

UNIT I **09**

CAD FUNDAMENTALS: Introduction, Reasons for implementing a CAD system, Computer aided process application, benefits, CAD software's, Elements of programming, CAD programming ,Need and scope of computer aided design

COMPUETR GRAPHICS: Scan conversion; Bresenham's Algorithm for line, circle and Ellipse. Standards for graphics programming, features of GKS, other graphics standards, PHIGS, IGES, PDES. Standards in CAD.

UNIT II 09

GEOMETRIC TRANSFORMATIONS: Geometric transformations- 2D and 3D translation, scaling, rotation, shear and reflection, homogeneous transformations

UNIT III 12

PLANE &SPACE CURVES: Types of mathematical representation of curves, parametric representation of line, circle, ellipse, parabola, hyperbola. Wire frame models, wire frame entities parametric representation of synthetic curves Hermit cubic splines, Bezier curves, B-splines, constructive solid geometry

FINITE ELEMENT METHOD : Introduction, FEM procedure, Types of elements, stiffness matrix, Boundary conditions, shape functions, 1-D structural problem, effect of temperature.

UNIT IV 09

Computer Programming: Use of computer programming in design of machine elements, thermal system and fluid systems, development of computer program using C, Matlab, etc. for machine components like shaft, spring, coupling, gears, bearing etc.,plotting graphs using programming language, generalized programming, optimization in design.

Approximate Total: 39Hrs

Texts and References

1. CAD/CAM: Computer Aided design and Manufacturing by MikellGroover and Zimmer, Pearson Education
2. Computer Aided Engineering & Design by Jim Browne, New Age International Publications,
3. Computer Graphics & design by P. Radhakrishnan, C.P. Kothanadaraman, New age publication
4. CAD / CAM - Chris McMohan, Jimmie Brown Addison - Wesley
5. CAD/CAM Theory & Practice by Ibrahim Zeid, Tata McGraw Hill
6. Finite Element Analysis by Chendraupatla, EEE Publication.

ME 401P COMPUTER AIDED DESIGN										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	4	2	4	--	--	--	50	50	100

Total 4hr/week is divided in two Parts

Part-1 (2 hr/week): Laboratory activity based on scan conversions and its computer programs, 2D and 3D transformations and its computer programs, computer programs of mechanical components.

Part-2 (2 hr/week): Laboratory activity based on advanced features of CAD software, assembly and mechanism analysis, programming in CAD software, finite element analysis for the simple components, practical case study

ME 402T INTERNAL COMBUSTION ENGINES										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **08**

Introduction: Engine classifications, basic engine components and terminology, working principles of engines, four-stroke (4S) and two-stroke (2S) SI and CI engines, comparison of 4S and 2S SI and CI engines, application of IC engines, engine performance parameters
Air-standard cycles: Carnot cycle, Stirling cycle, Ericsson cycle, Otto cycle, Diesel cycle, Dual cycle, Atkinson cycle, comparison of the Otto, Diesel and Dual cycles
Fuel-air cycles: Fuel-air cycles and their significance, variable specific heats, dissociation, comparison of air-standard and fuel-air cycles, effect of compression ratio & fuel-air ratio, valve-timing diagrams

UNIT II **12**

Actual cycles: comparison of air-standard and actual cycles
Fuels for IC engines: solid, liquid, gaseous fuels, rating of fuels, alternate fuels
Fuel systems for SI engines: Carburetion, principle of carburetion, types of carburettors, Solex carburettor, Carter carburettor, S.U. carburettor, petrol injection

Fuel systems for CI engines: Mechanical injection systems, electronic injection systems, ignition

Combustion and Combustion Chambers: Combustion in SI engines, abnormal combustion and knock in SI engines, combustion chambers for SI engines, Combustion in CI engines, knocking in CI engines, combustion chambers for CI engines, abnormal combustion in SI and CI engines

UNIT III **10**

Lubrication: Lubrication of engine components, lubrication systems, properties of lubricants, additives for lubricants

Heat transfer and cooling: theory of engine heat transfer, parameters affecting engine heat transfer, engine cooling systems, liquid-cooled systems, air-cooled systems

Engine emissions and control: products of combustion in IC engines, control of pollutants from IC engines, emission standards for IC engines

UNIT IV **10**

Supercharging and turbo-charging, Two-stroke engines, Alternative engines

Performance and Testing: performance parameters, speed measurements, fuel consumption, brake power, friction power, indicator diagram measurements, heat balance sheet, performance comparison of SI and CI engines

Alternative fuels for IC engines.

Approximate total hours: 40 hours

Texts and References

1. **V. Ganesan**, *Internal Combustion Engines*, 3rd edition, The Tata McGraw-Hill publications
2. **H. N. Gupta**, *Fundamentals of Internal Combustion Engines*, Printice Hall India pvt. Ltd.
3. **J. B. Heywood**, *Internal Combustion Engine Fundamentals*, The Tata McGraw-Hill publications
4. **M.L. Mathur and R.P. Sharma**, *A COURSE IN INTERNAL COMBUSTION ENGINES,* DhanparRai Publications.
5. **Colin R. Ferguson and Allan T. Kirkpatrick**, *Internal Combustion Engines Applied Thermosciences,* 2nd edition, John Wiley & Sons.

ME 402P INTERNAL COMBUSTION ENGINES LABORATORY

Teaching Scheme					Examination Scheme					
					Theory			Practical		
L	T	P	C	Hrs/Week	MS	ES	IA	LW	LE/Viva	Total Marks
--	--	2	1	2	--	--	--	25	25	50

List of practicals

1. Study of various types of carburetors.
2. Study of fuel systems for CI engines
3. Study of various types of combustion chambers for SI and CI engines.
4. Morse test on multi-cylinder IC engine.
5. Performance test on SI engine.
6. Performance test on CI engine.
7. Heat balance sheet for multi-cylinder IC engine.
8. Performance test on VCR engine

ME 403T OPTIMIZATION TECHNIQUES										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I09

Introduction: Objective function, constraints, design variables, feasible and infeasible solutions, classification of optimization problems, applications.

Graphical Method: different cases - Feasible and infeasible solutions, redundant constraints, unbound solutions, unique solution.

Classical Optimization techniques: single variable, multivariable optimization techniques

UNIT II 12

Linear Programming: Problem formulation, simplex method, transportation and assignment problems, PERT and CPM

UNIT III 09

Unconstrained Optimization Techniques: elimination methods, interpolation methods, direct and indirect search methods

UNIT IV 09

Constrained Optimization Techniques: Random Search Methods, Methods of Feasible Directions, Penalty Function Methods, Geometric Programming, Dynamic Programming

Approximate Total: 39Hrs

Texts and References

1. S S Rao, Engineering Optimization, New Age International
2. K Deb, Optimization for Engineering Design: Algorithms and Examples, Prentice-Hall of India
3. C Pearce, E Hunt **,** Optimization: Structure and Applications,Springer
4. Ravindran, G. Reklaitis, K. M. Ragsdell, Engineering Optimization: Methods And Applications, Wiley
5. F Hillier, G Lieberman, Introduction to Operation Research, McGraw Hill
6. HTaha, Operation Research –, Pearson Education.
7. A Verma, Operation Research, S.K. Kataria and Sons.
8. V Kapoor, Operation Research, Sultan Chand & Sons

ME 405P SEMINAR										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	6	3	6	--	--	--	25	25	50
Duration: During VII semester										

ME 411T EXPERIMENTAL STRESS ANALYSIS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	6	3	30	60	10	--	--	100

UNIT I 12

Strain Measurement Methods: Basic Characteristics of a Strain Gauge, Various types of strain gauges , Types of Shell Gauge, Moire Method of Strain Analysis, Grid Method of Strain Analysis.

Electrical Resistance Strain Gauge: Gauge Construction, Temperature Compensation, Semiconductor Strain Gauges. Strain gauge circuits, Potentiometer Circuits, Wheatstone Bridge.

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, experimental procedure and techniques.

UNIT II 09

Brittle Coating Method: Introduction, Coating Stresses, Failure Theories, Brittle Coating Crack Patterns Produced by Direct Loading, refrigeration Techniques, Brittle Coating Crack, Pattern Produced by Releasing the Load, Test procedures for brittle coatings analysis. Birefringent Coatings.

UNIT III 09

Introduction to Photoelasticity: Photo elasticity, Behavior of Light, Plane and circularly polarized light, Bright and dark field setups, Polariscope-Plane Polarizers, Wave Plates, Arrangement of Optical Elements in a Polariscopic, **Theory of Photoelasticity:** Stress Optic Law in Two Dimensions at Normal Incidence, Effects of a Stressed Model in a Plane Polariscope, Effects of a Plane Model in a Circular Polariscope with Dark and Light Field Arrangements.

UNITIV 09

Analysis Techniques: Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, separation Techniques.

Three Dimensional Photoelasticity: materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, applications of the Frozen-stress method, the scattered light method.

Approximate Total : 39 Hrs

Texts and References

J.W. Dally and W.F. Riley, Experimental Stress Analysis, MGH.
K. Ramesh, Published by IIT Madras, India, Experimental Stress Analysis.
A Mubin, Khanna Publications, Experimental Stress Analysis.
Sadhu Singh, Khanna Publishers, Experimental Stress Analysis.
Mark B. Moore, Prentice-Hall ,Principles of experimental stress analysis.

ME 412T Science and Technology of welding										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
4	1	0	5	5	30	60	10	--	--	100

OBJECTIVE:The course aims at imparting comprehensive knowledge on welding processes.

Unit 1: Importance of metal joining processes. Classification of welding processes. Fusion welding-joint design and edge preparation, method and selection, nature of heat source, Physic of arc, electrical characteristics of arc, machine characteristics.Metal transfer, force acting on the arc, different mode of metal transfer, heat flow in metals. **10**

Unit 2: Fusion welding processes ; SMAW- function of coating, classification of coating types, application, advantages and disadvantages ;Other fusion welding processes ; Submerge arc welding process, Gas Tungsten Arc Welding Process, Gas Metal Arc Welding, Plasma Arc Welding process ; Basics, application, advantages and disadvantages, pulsed and synergic welding **10**

Gas & Resistance Welding Processes : Gas Welding & Resistance Welding : contact resistance, spot, projection, resistance butt, and seam welding processes, Flash butt welding, Stud welding, application, Electro slag and electro gas welding, advantages and disadvantages

Unit 3 : Solid state & Beam welding processes; Fundamental principles of solid state welding processes, friction, friction stir, principles of operation, process characteristics and applications.

Beam Welding processes: Electron Beam Welding : Heat generation and regulation, equipment details in typical set up, electron beam welding in different degrees of vacuum, advantages and disadvantages, applications.Laser Beam Welding: Physics of lasers, types of lasers, operation of laser welding setup, advantages and limitations, applications. Laser cutting **10**

Unit 4: New Development in Fusion welding processes; Activated Flux TIG process, Metal Core Arc Welding, Flux Core Arc Welding.Narrow Gap Welding processes, Hybrid Welding processes;Underwater welding & repair, cladding and surfacing. Weldability of non ferrous systems. Testing of welds and welding defects and significance.Cutting Processes : Gas Cutting, Plasma cutting, Water jet cutting, Laser cutting; **welding symbols and welding positions**; **10**

Approximate Total : 40 Hrs

[1] TEXT BOOKS:

1. Schwartz M.,' Materials and Applications - Metal Joining Manual', McGraw-Hill, 1979
2. Nadkarni S.V., 'Modern Arc Welding Technology', Oxford IBH Publishers, 1996
3. Christopher Davis, 'Laser Welding - A Practical Guide', Jaico Publishing House, 1994
4. Parmar R S, Welding Engineering and Technology, Khanna Publishers, 1997
5. Nasir Ahmed 'New Development in Advance Welding' publishers, Wood head publishing Limited, England, 2007
6. John Norrish, 'Advance Welding Processes- Technologies and Process Control' Wood head publishing Limited, England, 2006
7. Leonard P. Connor, ' Welding Technology- Welding Hand Book' Eight edition, Vol. 1, American Welding Society

REFERENCES:

1. Jean Cornu, 'Advanced Welding Systems', Volume II and III, Jaico Publishing House, 1994
2. Welding Hand Book, Volume I and IV , 7th Edition , American Welding Society, 1980
3. Vill V. I., 'Friction Welding of Metals', American Welding Society, 1989
4. Schwartz M., 'Brazing - for the Engineering Technologists', Chapman and Hall, 1995
5. Manko H.H., 'Solders and Soldering', 2nd edition, McGraw Hill, 1979
6. Thwaites C.J., 'Capillary Joining - Brazing and Soldering', Research Studies Press, 1982
7. 'Brazing Hand Book', 4th Edition, American Welding Society, 1991
8. Ray Skipp, 'Soldering Hand Book', BSP Professional Books, 1988
9. Armin Rahn, 'The basics of soldering', John Wiley, 1993
10. Michael G.Pecht, 'Soldering Processes and equipment', John Wiley, 1993

ME 413T LUBRICATION										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	-	6	3	30	60	10	--	--	100

UNIT I **08**

LUBRICATION: Fundamentals, Types of Lubrication, Viscosity and its Types of Lubrication,Types of Bearings, Equations of Continuity and Motion, Hydrodynamics of Simple Configuration.

SURFACES, FRICTION AND WEAR: Topography of Surfaces, Surface features, Surface interaction, Theory of Friction, Sliding andRolling Friction, Friction properties of metallic and non -metallic materials, Friction in extremeconditions, Wear, types of wear, Mechanism of wear, wear resistance materials, Surfacetreatment, Surface modifications, Surface coatings.

UNIT II **08**

LUBRICATION THEORY: Lubricants and their physical properties lubricants standards , Lubrication Regimes inHydrodynamic lubrication, Reynolds Equation, Thermal, inertia and turbulent effects, Elastohydrodynamic (EHD) magneto hydrodynamic lubrication, Hydro static lubrication, Gaslubrication, Solid lubrication.

UNIT III **15**

DESIGN OF FLUID FILM BEARINGS: Design and performance analysis of thrust and journal bearings , Full, Partial, Fixed andpivoted journal bearings design, Lubricant flow and delivery, Power loss, Heat and temperature of steady and dynamically loaded journal bearings, Special bearings ,Hydrostatic Bearing design.

ROLLING ELEMENT BEARINGS: Geometry and kinematics, Materials and manufacturing processes, Contact stresses,Hertzian stress equation, Load divisions, Stresses and deflection, Axial loads and rotationaleffects, Bearing life capacity and variable loads , ISO standards, Oil films and their effects,Rolling Bearings Failures.

GEAR LUBRICATION: Lubrication in transmission, final drive, steering gearbox.

UNIT IV **08**

TRIBO MEASUREMENT AND INSTRUMENTATION Surface Topography measurements, Electron microscope and friction and wearmeasurements, Laser method, Instrumentation, International standards, Bearingsperformance measurements, Bearing vibration measurement. **Approximate Total: 39Hrs**

Texts and References

1. Hamrock, Schmid, Jacobson ,"Fundamentals of Fluid Film Lubrication", Marcel Dekker, New York
2. Khonsari and Booser, "Applied Tribology Bearing Design and Lubrication", Wiley Publication (I) Ltd.
3. Bhushan, B, "Principles and Applications of Tribology", Wiley and sons Publication.
4. Cameron A., "Basic Lubrication Theory", Ellis Horwood Ltd., UK,
5. Halling J. (Editor) – "Principles of Tribology ", Macmillian,
6. Williams J.A., "Engineering Tribology", Oxford Univ. Press,
7. Neale, M.J., "Tribology Hand Book", Butterworth Heinemann,
8. StolarskiT.a., "Tribology in Machine Design", Industrial Press Inc.
9. Cameron, "Principles of Lubrication", Wiley Publication(I) Ltd.

ME414T COMPUTATIONAL FLUID DYNAMICS AND HEAT TRANSFER										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **10**

Fundamentals of Fluid Mechanics and Heat Transfer: External and Internal Flow, modes of heat transfer, conservation laws, Conservation of mass, Newton's second law of motion, expanded forms of Navier -Stokes equations, Conservation of energy principle, Special forms of the Navier -Stokes equations, Classification of second order partial differential equations, Initial and boundary conditions, Governing equations in generalized coordinates.

Introduction to Finite Difference Method and Fundamentals Of CFD: Finite Difference method, Elementary finite difference quotients, Basic aspects of finite difference equations, Consistency, Explicit and Implicit methods, Errors and stability analysis, Stability of fluid flow modeling, Some nontrivial problems with discredited equations, Applications to heat conduction and convection.

UNIT II **10**

Introduction to Finite Volume Method: Integral approach, discretization & higher order schemes, Application to complex geometry.

Introduction to Finite Element Method: Stiffness matrix, Iso-parametric elements, Formulation of finite elements for flow and heat transfer problems.

UNIT III **10**

Stream Function, Vorticity Methods for Solutions Of Viscous Incompressible Flows: Two dimensional incompressible viscous flows, Incorporation of upwind scheme, Estimation of discretization error, Application to curvilinear geometries, Derivation of surface pressure and drag.

Mac-Simple Algorithms Methods to Solve Incompressible Flows and Heat Transfer: Staggered grid, Solution of the unsteady Navier -Stokes equations, Solutions of energy equation, Formulation of the flow problems, Simple algorithm.

UNIT IV **09**

Grid Generation: Structured and Unstructured Grids. Algebraic and Elliptic Methods. Examples of O-type, C- type and H-type structured grid generation.

Computational Heat Conduction in Complex Domains: Finite Volume Discretization, Implementation Details and Solution Algorithm, Example Problems.

APPROXIMATE TOTAL 39 Hours

Texts and References

1. Computational Fluid Mechanics and Heat Transfer, Anderson D.A., Tannehill J.C. and Pletcher R.H., Hemisphere Publishing Co., New York, 2004.
2. Numerical Heat Transfer and Flow ,Patankar S.V., McGraw Hill, New York, 2002.
3. Computational Methods in Fluid Dynamics,Ferziger J. H. and Peric M., Springer, New York, 2003.
4. Computational Fluid Flow and Heat Transfer,Muralidhar K. and Sunderrarajan T., Narosa Publishing House, New Delhi, 2005.
5. Computational Fluid Dynamics,Chung T. J., Cambridge University Press, London, 2005.
6. Computational Technique for Fluid Dynamics, Vol. 1 and Vol. 2 CAJ Fletcher, Springer Verlag.
7. Numerical Heat Transfer and Fluid Flow, S V Patankar, Hemisphere Publishing.
8. Computational Fluid Dynamics, John D Anderson, Jr., McGraw Hill Book Company.
9. Finite Elements in Engineering, T R Chandraputla and A D Belegundu, Prentice Hall of India.

ME 415T FUELS, COMBUSION AND POLLUTION										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **10**

Fuels, types of fuels, sources of fuels, properties of fuels, fuel analysis, heating values, proximate analysis and ultimate analysis, alternative fuels

UNIT II **10**

Combustion, Combustion stoichiometry and thermodynamics, theoretical and actual combustion process, air-fuel ratio, access air in combustion, heat of formation & heat of combustion,

Kinetics of combustion: Mechanism of combustion reactions, flame propagation, flame structure and stability, kinetics of liquid and solid fuel combustion

UNIT III **10**

Combustion appliances: furnaces, burners, fluidized bed combustion

Products of combustion: formation of NOx, SOx, COx, etc. during combustion

Introduction to pollution

UNIT IV **10**

Pollution and environment, global warming, depletion of ozone layer, health and safety issues, methods for emission and pollution control, use of alternative energy sources

Approximate total hours: 40

TEXT BOOKS and REFERENCES

1. S.P. Sharma &Chander Mohan, "Fuels & Combustion", Tata McGraw Hill Publishing Co. Ltd., 1984
2.Samir Sarkar, "Fuels & Combustion", Orient Longman, Second edition, 1990.
3. D. P. Mishra, "Fundamentals of Combustion", PHI Learning Private Limited
4. www.bee.org

ME 416T ADVANCES IN MEASUREMENT TECHNIQUES										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **10**

Introduction to industrial automation, data analysis and experimental mechanics. Characterization of mechanical systems with applications both in experimental mechanics and industrial diagnostic, advanced time-frequency analyses, digital transmission techniques in industrial automation and controls, image acquisition and analysis in mechanical measurements.

UNIT II **10**

Introduction to Advanced Measurements, definitions and concepts, classification and system components, error analysis, calibration techniques and error reduction, sensing elements, study the transformation of physical quantities to electrical signals, variable resistance sensors, strain gages, temperature sensors, induction sensors, photo sensors, etc., use of computers in measuring techniques, techniques of series and parallel transfer of information, signal conditioning, digital waves, inputs simulation, programming computers for control, study the series and parallel performance of measuring techniques, application of measuring some variables and engineering quantities, force, moment, pressure, temperature, displacement, velocity, acceleration, etc.

UNIT III **15**

Introduction to virtual instrumentation, Automatic Test Equipment (ATE) based programmable instrumentation. GPIB (General Purpose Interface Bus) based programmable instrumentation. Introduction to LabVIEW, and Agilent Visual Engineering Environment (Agilent VEE).

UNIT IV **04**

Micro-Sensor research in the development of micro-optical sensors for a wide range of aerospace and mechanical engineering applications including temperature, pressure, force, acceleration and concentration. Biomedical Instrumentation and Robotics applications

Approximate Total : 39 Hrs

Texts and References

[1] National Instruments: *Instrumentation Catalogue: Measurement and Automation*

[2] Hewlett-Packard Company, www.hp.com

[3] Caristy, J.: IEEE 488 General Purpose Instrumentation Bus Manual. Academic Press, 1989.

[4] Richard Grodzik, PIC Cookbook for Virtual Instrumentation, Elektor Electronics Publishing, 2010

[5] National Instruments: LabVIEW Manual. www.ni.com

[6] Agilent's VEE Pro 6 manual

[7] National Instruments: *PXI Specification* Rev.1.0, National Instruments, 1997.

[8] Agilent Technologies: Getting Started with VEE

[9] Gupta & John, Virtual Instrumentation Using Labview, Tata McGraw-Hill Education, 01-Jul-2005

ME 417T Solar Photovoltaic Fundamental Technologies and Applications										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	6	3	30	60	10	--	--	100

ME 415 Solar Photovoltaic Fundamental Technologies and Applications

Unit 1

Introduction: Basics of energy**,** unit convertions**,** Indian and world energy scenario, environmental concern, importance of renewable energy

Solar energy: Solar radiation, Properties of sunlight, Global and diffuse radiation

Unit 2

Semiconductor properties such as absorption, generation, recombination, etc., p-n junctions and device physics

Solar cell operation, efficiency limits, losses and measurement

Silicon solar cell technology (thin-film and wafer-based)

Unit 3

Design : Design of silicon solar cellsSolar PV Modules and arrays, simple photovoltaic systems, Concept of blocking diode and bypass diode

Unit 4

Balance of System(BoS): Calculation of balance of PV inverter systems, MPPT

Economic analysis and environmental aspects of photovoltaic systems

PV in Architecture (BIPV)

References:

1. Solar Energy by S. P. Sukhatme and J. K.Nayak
2. Solar Photovoltaics, Fundamentals, Technologies and Applications, Chetan Singh Solanki, PHI
3. Solar Engineering of Thermal Processes by Duffie and Backman
4. Solar cells: operating principles, technology and system applications by Martin A. Green

ME 418T VIBRATION ENGINEERING DESIGN										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	6	3	30	60	10	--	--	100

UNIT I09

Review of Single degree of undamped, damped and forced vibration

Two degree of freedom system: mode shapes, Eigen values and Eigen vectors, static and dynamic coupling, semi-definite system, Double pendulum, Lagrange method, vibration absorber.

UNIT II 12

Multidegree of freedom system: Influence coefficient, general equation of motion in matrix form, Eigen value problem, solution of eigen value problem, matrix method, matrix inversion method, stodola method, holzer's method

UNIT III 09

Continuous systems: equations of motion, end conditions, Longitudinal vibrations of bar, transverse vibrations of beams, torsional vibrations of shafts

UNIT IV 09

Vibration control and measurement: Vibration isolators, vibration isolation with rigid and flexible foundations, active vibration control, use of vibration absorbers, vibration pickups, vibration exciters, signal analysis, dynamic testing of machines.

Approximate Total: 39Hrs

Texts and References

G.K. Grover, Mechanical Vibrations, Nemchand& Bros.

S. Graham Kelley, Fundamental of Mechanical Vibrations, McGraw Hill

W.I. Thomson, Theory of Vibration with Application Prentice Hall

R.A. Anderson, Fundamentals of Vibration, Amerind Pub Co.

S.S. Rao, Mechanical Vibrations, Addison - Wesley Pub. Co.

ME 420T NEURAL NETWORK, FUZZY SYSTEM AND APPLICATION										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	6	3	30	60	10	--	--	100

UNIT I12

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules. Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model. Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT II 09

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements. Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis.

UNIT III 09

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT IV 09

Neural network applications: Process identification, control, fault diagnosis, Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

Approximate Total: 39Hrs

Texts and References

1. S. Rajasekharan and G. A. Vijayalakshmipai, “Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications”, PHI Publication, 2004.
2. John Yen and Reza Langan, “Fuzzy Logic: Intelligence, Control and Information”, Pearson Education, 2004.
3. Simon Haykin, “Neural Networks- A comprehensive foundation”, Pearson Education, 2001.
4. S.N.Sivanandam, S.Sumathi,S. N. Deepa “Introduction to Neural Networks using MATLAB 6.0”, TMH, 2006.
5. James A Freeman and Davis Skapura, Neural Networks Pearson Education, 2002.
4. Timothy J. Ross, “ Fuzzy Logic With Engineering Applications”, McGraw-Hill Inc. 1997

ME421T Cryogenics										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I

Introduction to properties of engineering materials at cryogenic temperatures, mechanical properties, thermal properties, electric & magnetic properties, super conducting materials, thermo electric materials, composite materials, properties of cryogenic fluids, super fluidity of He3 & He 4.

Cryogenic insulation – expanded foams, gas filled & fibrous insulation, vacuum insulation, evacuated powder & fibrous insulation, opacified powder insulation, multilayer insulation, comparison of performance of various insulations .

UNIT-II

Applications of cryogenic systems: Super conductive devices such as bearings, motors, cryotrons, magnets, D.C. transformers, tunnel diodes, space technology, space simulation, cryogenics in biology and medicine, food preservation and industrial applications, nuclear propulsions , chemical propulsions.

Cryogenic Refrigeration System: Ideal isothermal and reversible isobaric source refrigeration cycles, Joule Thomson system, cascade or pre-cooled joule–Thomson refrigeration systems, expansion engine and cold gas refrigeration systems,

UNIT III

Advanced Cryocoolers: Philips refrigerators, Importance of regenerator effectiveness for the Philips refrigerators, Gifford single volume refrigerator, Gifford double volume refrigerators analysis, COP, FOM, regenerators, pulse tube refrigerators, various types of pulse tube refrigerator.

Refrigerators using solids as working media: Magnetic cooling, magnetic refrigeration systems, thermal; valves, nuclear demagnetization.

UNIT IV

Gas liquefaction systems: Introduction, thermodynamically ideal systems, Joule Thomson effect, liquefaction systems such as Linde Hampton, precooled LindeHampson, Linde dual pressure, cascade, claude, kapitza, heyland systems using expanders, comparison of liquefaction systems.

APPROXIMATE TOTAL 42

Texts and References

1. Cryogenic process engineering, Thomas M Flynn, Informa Health Care, 2004
2. Miniature refrigerators for cryogenic sensors and cold electronics, Graham Walker,
3. Clarendon Press, 1989
4. Cryogenic technology & applications, A R Jha, Butterworth-Heinemann, 2006,
5. Cryocooler, Fundamentals Part I &II, Graham Walker, Plenum Press, New York
6. Cryogenic Regenerative Heat Exchangers, R.A. Ackermann, Springer, 1997
7. Cryogenic systems, R F Barron, Oxford University Press,
8. Cryogenic heat transfer, R F Barron, Taylor & Francis Group
9. Cryogenics: A Text Book, S. S. Thipse, Alpha Science Intl Ltd
10. Fundamentals Of Cryogenic Engineering, MamataMukhopadhyay, PHI
11. Fundamentals of Vacuum Engineering, Pipkov, Mir Publication.

ME 409 Industrial Training									
Teaching Scheme					Examination Scheme				
L	T	P	C	Hrs/Week	Report writing	Presentation and v/v	Faculty monitoring	Main Coordinator	Total
--	--		6		20	50	20	10	100

Duration: Six to eight weeks after VI semester
Examination for Industrial training will be conducted in VII semester.

OOP and Data Structures. 3-0-3-9. ME-202. Engineering Materials. 3-0-0-6. ME-201.Â ME-311. Mechanical Engineering Laboratory- III. 0-0-4-4. ME-321. Know all about B.Tech - Mechanical Engineering Course. Find out details like admission processs, eligibility, fees, placements, careers options, scope, certifications, salary and much more at Collegedekho.com.Â Mechanical engineering is one of the traditional fields of engineering which has equally played a vital role in the industrialisation of the human race. Essentially, B.Tech in Mechanical Engineering is a four-year full-time course offered at many engineering institutes of the country including the IITs, NITs etc. During the course, mechanical engineering students are trained to develop machine designs, understand their working and development process. Mechanical engineering degree is a 4 years duration course and has 8 semesters. Before you get an admission in any of the engineering colleges in Bangalore for mechanical engineering course; it is vital to know about the B. Tech mechanical enginee...Â Also mathematics is an integral part of mechanical engineering syllabus. So, before applying for this degree course, make sure you have a good understanding on all these core subjects. Source: Anurag .'s answer to What is the syllabus for a B.Tech in mechanical engineering course in India? 19 views. sGxpikInjoNOVGEnOHCFysypwvoNxroeoxdyryOW gbykyamQ GwPPnaGABfilDoDsr fhkAMlSwmidtSfqPcoQZqcx qJvNHielTeotATuGwOTYoUUFrCRkdsD.