Master of Technology - Thermal Engineering

Syllabus - First Semester

ADVANCED SOLID MECHANICS

Course Code: THE4101 **CreditUnits : 04**

Course Contents :

Module-I: Three Dimensional Stress and Strain:Principal stresses and Principal strains, Mohr's circle representation of tri-axial stresses and strains.

Module-II: Unsymmetrical Bending: Shear centers for sections with one axis of symmetry. Shear center for any unsymmetrical section, stress and deflection of beams subjected to unsymmetrical bending.

Module-III: Bending of Plates: Basic definitions, Stress, Curvature and Moment relations, Basic Equation of plate deflection, Different boundary conditions, simply supported rectangular plates, axis symmetric loaded circular plates.

Module-IV: Contact Stresses:Due to Two Spherical Surfaces in Contact, Due to Two Parallel Cylindrical Rollers in Contact, Due to Two Curved Surfaces of Different Radii.

Module-V: Buckling of Columns: Beam columns with single concentrated load, number of concentrated loads, continuous lateral load, end couple, couples at both ends of the column, triangular loads and combined loads.

Module-VI: Beam on Elastic Foundations:General Theory, Infinite, Semi-infinite, and Finite beams, Classification of Beams, Beam supported by equally spaced elastic elements**.**

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books Recommended: Textbooks:

- Advanced Strength and Applied Elasticity' by Augural &Fenster, Prentice Hall.
- Advanced Mechanics of Solids' by L., Srinath, TMH
- Intermediate Mechanics of Materials' by J. R. Barber, McGraw-Hill
- Introduction to Solid Mechanics' by Shames &Pitarresi, PHI
- Advanced Topics of Strength of Materials' by U.C. Jindal, Galgotia Publication
- Arthur P. Boresi, Richard J. Schmidt and Omar M. Sidebottom: ***Advanced Mechanics of Materials***, 5th Edition, John Wiley & Sons, Inc., 1993
- W.Michale Lai, David Rubin and ErchardKrempl: ***Introduction to Continuum Mechanics***, 3rd Edition, Pergamum Press, 1993

Other References:

- Beer, P.F.and Johnston, E.R.: ***Mechanics of materials***, 2nd Edition (Metric Edition), McGraw Hill Inc, 1992.
- R.C.Hibbeler: ***Mechanics of materials***, SI 2nd Edition, Prentice-Hall Inc, 2005
- Arthur P. Boresi, and Ken P. Chong: ***Elasticity in Engineering Mechanic***, 2th Edition, John Wiley & Sons, Inc., 2000

- J.R. Barber: ***Intermediate Mechanics of Materials***, McGraw Hill International Edition, Mechanical Engineering Series, 2001

APPLIED NUMERICAL METHODS

Course Code: THE4102 **CreditUnits : 03**

Course Contents:

Module-I: Approximations and Errors in Computations: Introduction, Numbers and their Accuracy, Errors and their Computation, Error in Series Approximation

Module-II: Numerical Solution of Ordinary Differential Equations: Introduction, Solution by Taylor's Picard's Method, Euler's Method, Runge-Kutta Methods, Predictor-Corrector Methods, the Cubic Spline Method, Simultaneous and Higher Order Equations, Boundary Value Problems: Finite-Difference Method, The Shooting Method, and The Cubic Spline Method.

Module-III: Numerical Solution of Partial Differential Equations: Introduction, Finite-Difference Approximations, Laplace's Equation: Jacobi's Method, Gauss-Seidel Method, SOR Method, ADI Method, Parabolic Equations, Iterative Methods, Hyperbolic Equations.

Module-IV: Numerical Differentiation and Integration: Introduction, Numerical Differentiation, Numerical Integration, Euler-Maclaurin Formula, Adaptive Quadrature Methods, Gaussian Integration, Singular Integrals, Furies' Integrals, Numerical Double Integration

Module-V: Least- square Curve Fitting and Function Approximation: Introduction, Least-square Curve Fiting, Spline Inaterpolation,Cubic Splines, Chebyshev Minimax Approximation, Chebyshev Polynomials.

Module-VI: Numerical Solution of Nonlinear Systems: Introduction, Picard Iteration, Newton's Method, Perturbed Iterative Scheme

Module-VII: System of Linear AlgebraicEquations: Introduction, Methods for Large Linear Systems, Direct Methods, LU- Decomposition Methods, Iterative Methods, III-conditioned Systems.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books Recommended:

- Niyogi, Pradip, "Numerical Analysis and Algorithms", Tata McGraw –Hill
- Balagurusamy,E., "Numerical Methods", Tata McGraw –Hill
- Sastry, S.S., "Introduction Methods of Numerical Analysis", PHI
- Chapra, S.C. and Canal, R.P., "Numerical Methods for Engineers", Tata McGraw –Hill
- Gerald, F. Curtis, "Applied Numerical Analysis", Pearson Education

ADVANCED FLUID MECHANICS

Course Code: THE4103 **CreditUnits : 04**

Course Contents:

Module-I: Review of Kinematics: Lagrangian, Eulerian Representation, Veracity, Special Motions,Review of Governing Equations, Integral Equations for a system, Local Equations in Lagrangian Formulation, Local Equations in Eulerian Formulation, Integral Equations for a Control Volume.

Module-II: In viscid Fluids: Euler's Equation, Bernoulli's Equation, Crocco.s Equation, Vortices/Stream Function Formulation, Some Exact Solutions, Kelvin's Theorem, Helmholtz Theorem, D.Alembert.s Paradox, Fluid Mechanics Film Discussion

Module-III: Viscous flow: Review of Constitutive Equations, Linearly Viscous Compressible, and Linearly Viscous Incompressible. Exact solution, plane Poiseuille and Coquette flows; Hagen Ponselle flow through pipes.

Module-IV: Flows with large Reynolds number: Flows with very large Reynolds number, elements of two dimensional boundary layer theory; displacement thickness and momentum thickness, skin friction, Blassius solution for boundary layer on a flat plate without pressure gradient; the Karman-Polhausen integral method for obtaining approximate solutions. Drag on bodies; form drag and skin friction drag profile drag and its measurement. Taylor Vortices

Module-V: Approximations to Navies-Stokes Equations, Non-dimensionalization, Stokes Flow Uniform Flow Past a Sphere, Exact Solution, Uniform Flow Past A Circular Cylinder, Stokes Paradox, Extensions of Stokes theory, Thin Films,Lubrication Theory, Squeeze Films, Thin Films with Free Surfaces ,Hele-Shaw Flow, Boundary Layer Theory. Stability of Fluid Motions
Compressible Fluid Flow:Derivation of basic equations, Fanno flow, Rayleigh flow

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books:

- Fluid Mechanics and Its Applications Vijay Gupta & S.K. Gupta New Age International.
- Fluid Mechanics and Machinery DR Durgaiah New Age International.
- Engineering Fluid Mechanics J A Roberson and C T Crowe Jaico Publishing House.
- Fluid Mechanics: Problems and Solutions Joseph H Spark.
- Introduction to Fluid Mechanics A.F. James Prentice Hall of India.

ADVANCED MANUFACTURING SCIENCE

Course Code: THE4104 **CreditUnits : 03**

Course Contents :

Module-I: Introduction: Limitations of Conventional machining processes Need of advanced machining processes and its classification.

Module-II: Mechanical Type Metal Removal Processes: Ultrasonic machining; Elements of the process; Tool design and economic considerations; Applications and limitations, Abrasive jet and Abrasive water jet machining principles; Mechanics of metal removal; Design of nozzles; applications, Abrasive finishing process, Magnetic abrasive finishing process

Module-III: Thermal Type Advance Machining Processes: Classification, General principles and applications of Electro discharge, Plasma arc, Ion beam, Laser beam, Electron beam machining, Mechanics of metal removal in EDM, selection of EDM pulse generator dielectric, machining accuracy, surface finish and surface damage in EDM, Generation and control of electron beam for machining applications, advantages and limitations

Module-IV: Chemical and Electro-chemical Type Metal Removal Processes: Principle, working advantages, disadvantages and applications of Electrochemical, Chemical machining, Economy aspects of ECM, Electro-chemical demurring and honing

Module-V: Hybrid Unconventional Machining Processes: Introduction to ECDM, ECAM, And Abrasive EDM etc.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books:

- Advance Machining Processes V.K. Jain New Age
- Modern Machining Processes P.C. Pandey New Age
- Manufacturing Processes Degarmo -
- Manufacturing Processes Kalpakjian Tata McGraw-Hill International

COMPUTER INTEGRATED MANUFACTURING

Course Code: THE4105 **CreditUnits : 03**

Course Contents:

Module-I: Introduction: Introduction to Automation, Need and future of NC Systems and CAM, Advantages and Disadvantages, Open and Closed loop systems, Historical developments and future trends. Future of NC Machines, Difference between ordinary and NC Machine tools, Methods for improving accuracy and productivity.

Module-II: Control of NC Systems: Types of CNC Machine Tools systems devices, e.g. encoders and interpolators, Features of CNC Systems, Direct Numerical Control (DNC), Standard Controllers and General Programming features available in CNC Systems, Computer Process monitoring and Control. Adaptive control systems.

Module-III: NC Part Programming: Manual Programming for simple parts, e.g., turning, milling, drilling, etc., Computer aided NC Programming in APT language, use of canned cycles, Generation of NC Programmer through CAD/CAM systems, Design and implementation of post processors.

Module-IV: Computer Aided Process Planning: Introduction, Manual process planning vs. Computer aided process planning, Basics of variant and generative process planning methods, Examples of automated process planning systems.

Module-V: Computer Integrated Manufacturing: Introduction, features and applications of CIM, key elements, advantages and disadvantages of CIM.

Module-VI: Artificial Intelligence in Manufacturing: Introduction, Elements of Expert Systems, Introduction to Neural Networks, Expert Systems application in manufacturing, Case studies.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books:

- Computer Control of Manufacturing Systems Korean -
- CAD/CAM Grooves Prentice Hall
- NC Machine Tools S J Martin -
- CAD/CAM P N Rao Tata McGraw Hill
- CAD/CAM P Radhakrishnan, S Subramanian, V Raju
- Computer Aided Manufacturing Chang, Wysk& Wang Prentice Hall of India

ADVANCED FLUID MECHANICS LAB

Course Code: THE4106 **CreditUnits : 01**

Course Contents:

- Determination of Chezy's and Manning's constants
- Determination of co-efficient of discharge for venturiflume/standing wave
- Determination of pipe friction factor.
- Determination of minor losses.
- Study of hydraulic jump
- Impact of Jet
- Trial on turbine.
- Trial on centrifugal pump.
- Trial on reciprocating pump

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ADVANCED MANUFACTURING SCIENCE LAB

Course Code: THE4107 **CreditUnits : 01**

Course Contents:

- To study the working of EDM.
- To determine the effects of process variables of EDM on surface finish of parts.
- To determine the effects of process variables on dimensional accuracy of parts in EDM process.
- To measure the cutting forces in turning operation on lathe machine tool.
- To measure the cutting forces in drilling operation on radial drilling machine tool.
- To measure the cutting forces in grinding operation on surface grinding machine tool.
- To study the working of Ultrasonic Drilling process.
- To study the working of Advanced Manufacturing System.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

COMPUTER INTEGRATED MANUFACTURING LAB

Course Code: THE4108 **CreditUnits : 01**

Course Contents:

Features and selection of CNC turning and milling centers, Practice in part programming and Operation of CNC turning machines, subroutine techniques and use of cycles. Practice in part Programming and operating a machining center, tool Joining and selection of sequences of Operations, tool setting on machine, practice in APT based NC programming. Practice in Robot Programming and its languages, Robotic simulation using software, Robot path control, Preparation of various reports and route sheets, Simulation of manufacturing system using CAM Software, controller operating system commands

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Syllabus - Second Semester

OPTIMIZATION TECHNIQUES

Course Code: THE4201 **CreditUnits : 04**

Course Contents:

Module-I: Introduction: Need of Optimization and Historical Development, Engineering Applications, Classification and Formulation of Optimization Problem

Module-II: Classical Optimization Techniques: Single-Variable and Multi-Variable Optimization, With and Without Constraints, Kuhn-Tucker Conditions,

Module-III: Non-Linear Programming: Introduction, One-Dimensional Optimization Methods, Unconstrained and Constrained Optimization Techniques; Elimination Methods, Exhaustive Search, Interval Halving, Fibonacci, Golden Section Methods; Random Search Methods, Hooke and Jeeves Method, Powell's Method; Indirect Search Methods: Steepest Descent, Fletcher-Reeves, Newton's Method, DFP, BFGS Method; Internal and External Penalty Approach.

Module-IV: Other Optimization Techniques: Introduction and Basic Concepts of Geometric Programming, Dynamic Programming, Integer Programming, Stochastic Programming, Their Applications

Module-V: Advance Topics in Optimization: Multi-Objective Programming, Introduction to Genetic Algorithms, Simulated Annealing and ANN Based Optimization.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books Recommended:

- Engineering Optimization Theory and Practice by S.S. Rao, New Age International.
- Optimization for Engineering Design by Kalyanmoy Deb, PHI.
- Optimization Techniques by J.S. Arora, John Wiley

DESIGN OF EXPERIMENTS

Course Code: THE4202 **CreditUnits : 03**

Course Contents:

Module-I: Introduction and Experimental Methods: Introduction to Instruments and Their Representation; Static and Dynamic Performance Characteristics of Instruments; Transducer and Intermediate Elements; Advances in Instrumentation and Measurements. Experimental methods for measurements: motion, force, torque & power, pressure, temperature, stress and strain (including principal values), acoustics, signal and systems analysis; Sensors theory and applications;

Module-II: Measurement Methods and Applications: Basic statistical concepts; Normal distribution and related analysis, Gaussian distribution, Poisson distribution; Errors and error propagation in results - addition, subtraction, multiplication, division, powers, roots, general error propagation; Graphical representation; Curve fitting of experimental data – linear least-square curve fitting best straight line, equations of second degree and higher; goodness of fit, Consistent and inconsistent experiments, Chi-square test.

Module-III: Advanced Experiments and Applications: Control Systems and Engineering Applications; Application of Digital Computers in Experimental Data Analysis; Measurements of fluctuating quantities, Auto-correlations of random signal; Analysis and Measurements of space and auto correlations, Optical method and analysis for stresses in loaded members; Hot-wire/film method and analysis for turbulence quantities; Laser Doppler anemometer and application.

Module-IV: Fundamentals of Design of Experiments: Experiments Design Concepts: Introduction, Applications of experimental design, basic design principles, Basic statistical Methods, Variance, practical interpretation, Blocking factors, Factorial experiments, Two level factorial design, Regression modeling, Robust design, Random effects models.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books:

- Experimental Measurements, Precision, Error and Truth – N.C. Barford (Imperial College of Sic& Tech), Addison-Wesley Publication Company, London.
- Engineering Fundamentals in Measurements, Probability, Statistics and Dimensions – K.C. Crandall and R.W. Sea bloom (University of Washington); McGraw Hill.
- Instrumentation, Measurements and Analysis - B.C. Nakra& K.K. Chaudhry (IIT Delhi); Tata McGraw Hill.
- Experimental Methods for Engineers – J P Holman (Southern Methodist University, USA) Tata McGraw Hill
- Statics for Experimenters: Design, Innovation, and Discovery – George E.P. Box, J. Stuart Hunter and William G. Hunter; Wiley Interscience – John Wiley & Sons, New Jersey, USA.
- Experimental design and Analysis – Howard J. Seltman; 2013, *http://www.stat.cmu.edu/hseltman/ 309/Book/Book.pdf*
- Design and Analysis of Experiments – Douglas C. Montgomery; Wiley International Student Edition (8), 2014.

ADVANCED HEAT AND MASS TRANSFER

Course Code: THE4203 **CreditUnits : 04**

Course Contents :

Module-I: CONDUCTION

Introduction: Conduction Rate Equation, Thermal Properties of Matter, Heat Diffusion Equation.

1-D Steady State Conduction: The Plane Wall (Temperature Distribution, Thermal Resistance, The Composite Wall, Contact resistance), Alternative Conduction Analysis, Radial Systems, Conduction with Thermal energy Generation (Plane Wall, Radial Systems, Applications of Resistance Concepts), Heat Transfer from Extended Surfaces.

2-D and 3-D Steady State Conduction: Alternative Approaches, Method of Separation of Variables, Conduction Shape factor and Dimensionless Conuction Heat rate, Finite Difference Equations, Finite Element Method formulation for the Heat Conduction Equation, Requirements for Interpolation Functions, Plane Wall with a Heat Source – Solution by Quadratic Element, Simple Problems), Solving Finite Difference Equations – explain only (Matrix Inversion Method, Gauss-Seidel Iteration).

Module-II: CONVECTION

Introduction: Convection Boundary Layers (Velocity Boundary Layer, Thermal Boundary Layer, Concentration Boundary Layer, Significance of the Boundary Layers), Local and Average Convection Coefficients, Laminar and Turbulent Flows (Laminar and Turbulent Velocity Boundary Layer, Laminar and Turbulent Thermal and Species Concentration Boundary Layers), Boundary Layer Equations for Laminar Flow, Boundary Layer Similarity: Non-dimensional Boundary Layer Equations, Physical significance of the Dimensionless Parameters, Boundary Layer Analogies, Convection Coefficients.

External Flows: Empirical Methods, Flat Plate in Parallel Flow, Cylinder in Cross Flow, Sphere, Flow across Banks of Tubes, Impinging Jets, Packed Beds.

Internal Flows: Hydrodynamic and Thermal considerations, Energy Balance (General considerations, Constant Surface Heat Flux, Constant Surface Temperature), Laminar Flow in Circular tubes: Thermal analysis and Convection Correlations, Convection Correlations: Turbulent Flow in Circular Tubes, Convection Correlations: in Non-Circular Tubes and Concentric Tube annulus, Heat Transfer Enhancement, Micro scale Internal flow, Convection Mass Transfer, Forced Convection Heat transfer in the Near-Critical Region.

Module-III: FREE CONVECTION:

Physical consideration, Governing Equations, Similarity Considerations, Laminar Free Convection on a Vertical Surface, Effect of Turbulence, Empirical Correlations: External Free Convection Flows (Vertical Plate, Inclined and Horizontal Plate, Long Horizontal Cylinder, Sphere), Free Convection within Parallel Plate Channels, Empirical Correlations, Combined Free and Forced Convection, Free Convection to Fluids in the Near-Critical region, Convection Mass Transfer

Boiling and Condensation: Dimensionless Parameters in Boiling and Condensation, Boiling Modes, Pool Boiling and Its Correlations, Forced Convection Boiling; *Condensation*: Physical Mechanisms, Laminar and Turbulent Film Condensation, Film Condensation on Radial systems and Horizontal Tubes, Drop-wise Condensation.

Module-IV: HEAT EXCHANGERS

Heat Exchanger Types, Overall Heat Transfer Coefficient, Heat Exchanger Analysis: Parallel Flow Heat Exchanger, Counterblow Heat exchanger, Special operating conditions; Effectiveness NTU Method (Definitions, Effectiveness NTU Relations), Heat Exchanger Design and Performance Calculations using the Effectiveness NTU Method, Compact Heat Exchangers, Finite Element Method for Heat exchangers.

Module-V: RADIATION: PROCESSES AND PROPERTIES

Radiation - Processes and Properties: Fundamental Concepts, Radiation Intensity (Definitions, Radiation Intensity and Its Relation to Emission, Irradiation and Radiosity), Blackbody radiation (Planck distribution, Wien's Displacement Law, Stefan-Boltzmann Law, Band Emission), Emission from Real surfaces, Absorption, Reflection and Transmission by Real Surfaces (Absorptive, Reflectivity, Transmissivity, Special Considerations), Kirchhoff's Law, Gray surface, Environmental Radiation. **Diffusion Mass Transfer**: Physical Origins and rate equations.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books:

- Fundamentals of Heat and Mass Transfer – F P Incropera, D P Dewitt, T L Bergman and A S Lavine– Wiley India Pvt Ltd, Ansari Road, New Delhi – Reprint edition 2014
- Fundamentals of Heat and Mass Transfer – M. Thirumaleshwar; Pearson Education India
- Heat and Mass Transfer – Hans Dieter Baehr& Karl Stephan: Springer
- Heat and Mass Transfer – P.K. Nag; Tata-McGraw Hill Education Pvt Ltd.

ADVANCED INTERNAL COMBUSTION ENGINE

Course Code: THE4204 **CreditUnits : 04**

Course Contents :

Module-I: SI Engine
Introduction-carburettion-mixture requirements, fuel supply, ignition, stages of combustion, normal and abnormal combustion, factors affecting knock, combustion chambers

Module-II: CI Engine
Injection system, mechanical and electronic combustion in CI engines-stages of combustion, factors affecting combustion, direct and indirect injection system, combustion chambers, fuel spray behavior, spray structure, sparay penetration and evaporation, air motion, introduction to turbocharging and supercharging

Module-III: Basic Concept of Engine Simulation
Governing equations, simulation of various engines, engine processes for SI and CI engines, thermodynamic and fluid mechanics based models. Different types of combustion chamber,engine instrumentation

Module-IV: Types of Pollutants
Euro and Bharat norms,emission control methods in SI and CI engines, catalytic converters, EGR, modern evaporative emission control system,Lean Burn engine-Stratified charge engine, homogeneous charge compression ignition engines,plasma ignition, zero emission vehicle, engines for special applications-mining,defence, off highway tractor, bulldozer etc. Submarines race car engine systems, flexible fuel system, surface ignition.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books Recommended:

- I.C. Engine by V Ganeshan.
- Thermodynamics and Gas Dynamic of I.C. Engine, Vol. I & II by Hurlock and Winter bone.
- I.C. Engine, Vol. I & II by Benson and Whitehouse.
- Thermodynamic Analysis of Combustion Engines, by Campbell.

RENEWABLE ENERGY & ENERGY MANAGEMENT

Course Code: THE4205 **CreditUnits : 04**

Course Contents:

Module-I: Solar Energy: The sun as a perennial source of energy, direct solar energy utilization; solar thermal applications – water heating systems, space heating and cooling of buildings, solar cooking, solar ponds, solar green houses, solar thermal electric systems; solar photovoltaic power generation; solar production of hydrogen.

Module-II: Energy from Oceans: Wave energy generation – energy from waves; wave energy conversion devices; advantages and disadvantages of wave energy; Tidal energy – basic principles; tidal power generation systems; estimation of energy and power; advantages and limitations of tidal power generation; ocean thermal energy conversion (OTEC); methods of ocean thermal electric power generation.

Module-III: Wind Energy: Basic principles of wind energy conversion; design of windmills; wind data and energy estimation site selection considerations.

Module-IV: Hydro Power: Classification of small hydro power (SHP) stations; description of basic civil works design considerations turbines and generators for SHP; advantages and limitations.

Module-V: Biomass and Bio-fuels: Energy plantation: biogas generation; types of biogas plants; applications of biogas; energy from wastes.

Module-VI: Geothermal Energy: Origin and nature of geothermal energy; classification of geothermal resources: schematic of geothermal power plants; operational and environments problems.

Module-VII: Energy Conservation Management: The relevance of energy management profesion; general principles of energy management and energy management planning; application of Pareto's model for energy management; obtaining management support; establishing energy data base; conducting energy audit; identifying, evaluating and implementing feasible enrgy conservation opportunities; energy audit report; monitoring, evaluating and following up energy saving measures/projects.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

References

- 'Renewable energy resources: John W Tidwell and Anthony D Weir.
- 'Renewable energy – power for sustainable future: Edited by Godfrey Boyle Oxford University Press in association with the Open University, 1996.
- 'Renewable energy sources and their environmental impact'. S.A.Abbasi and NaseemaAbbasi. Prentice-Hall of India, 2001.
- 'Non-conventional sources of energy'. G.D. Rai. Khanna Publishers,2000.
- 'Solar energy utilization' G.D. Rai Khanna Publishers 2000.
- 'Renewable and novel energy sources' S.L.Sah. M.I. Publications, 1995.
- 'Energy Technology'. S.Rao and B.B. Parulekar. Khanna Publishers, 1999

RESEARCH METHODOLOGY AND TECHNICAL REPORT WRITING

Course Code: THE4210 **CreditUnits : 02**

Course Objectives:
The course will enhance scientific , technical and research writing skills and impart knowledge about various stages of research process, statistical analysis, statistical tests and their applications in statistical decision making.

Course Contents:

Module I: Introduction to research: Definition, motivation, need, objectives, significance and characteristics of research; types of research; steps in research process; planning a research proposal; literature review, web searching.

Module II: Population and sample, parameter and statistic, sampling and data collection, sampling design: steps, types, sample size, sampling methods, large and small samples, primary and secondary data, data processing and analysis. Sample surveys and questionnaire designing, scaling techniques.

Module III: Dependent and independent variables, univariate, bivariate and multivariate analysis, means-arithmetic, geometric and harmonic; measure of dispersion of data, standard deviation, variance, coefficient of variation and degree of freedom. Hypothesis testing: null hypothesis and alternate hypothesis, errors in hypothesis testing, significance and confidence levels, parametric tests and non-parametric tests, one-tailed and two-tailed tests, analysis of variance. Regression analysis and curve fitting, method of least-squares, explained and unexplained variations, coefficient of correlation, coefficient of determination**.**

Module IV: Technical/scientific/research report writing: structure and components of scientific reports, formats of dissertations, research report, report writing skills, report preparation, referencing , bibliography and footnotes. Making presentation-use of visual aids and PPTs. Publication of research papers, citations,. Intellectual property rights and copy rights, plagiarism, patents and patent laws, commercialization and ethical issues.

Examination Scheme:

Attendance	Assignment/Library consultation /Thesis writing	Class test	Final Exam	Total
5	15	10	70	100

Text Books:

- Blake, G. and Bly, R.W. 1993, The Elements of Technical Writing. MacMillan, New York
- Booth, V. 1981. Writing a Scientific Paper and Speaking at Scientific Meetings. The Biochemical Society, London
- Chawla,D and Sondhi, N. 2016, Research Methodology- Concepts and Cases. Vikas Publishing House Pvt Ltd. New Delhi
- Kothari, C.R.2008. Research Methodology- Methods and Techniques, 2nd.ed. New Age International Publishers, New Delhi.

Reference Books:

- Geode, Millian J.& Paul K. Hatl, Methods in Research, McGraw Hills, New Delhi.
- Montomery, Douglas C.(2007), 5th Ed. Design and Analysis of Experiments, Wiley India.
- Panneerselvam, R.2009. Research Methodology, PHI Learning Pvt.Ltd., New Delhi-110001
- Ranjit Kumar 2009. Research Methodology- A step –by- step Guide for beginners; 2nd ed. Dorling Kindersley (India) Pvt. Ltd. Patpargang, Delhi- 110092

ADVANCED HEAT AND MASS TRANSFER LAB

Course Code: THE4206 **CreditUnits : 01**

List of Experiments

- Study of variation of emissivity of test plate with absolute temperature.
- To demonstrate the super thermal conductivity of heat pipe.
- To plot the temp. v/s time response of the three pipes(test pipe, copper pipe, stainless pipe).
- To plot the temperature distribution along the length of test pipe ,copper pipe, stainless pipe).
- Solar radiation.
- To study and evaluate- performance of solar cell.
- Study of pyranometre.

To determine natural convective heat transfer coefficient and to calculate and to plot variation of natural convective heat transfer coefficient along the vertical tube

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

DESIGN OF EXPERIMENTS LAB

Course Code: THE4207 **CreditUnits : 01**

Experiments related with the subjects theory.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

OPTIMIZATION TECHNIQUES LAB

Course Code: THE4208 **CreditUnits : 01**

Experiments related with the subjects theory.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Syllabus - Third Semester

TOTAL QUALITY MANAGEMENT & QUALITY ASSURANCE

Course Code: THE4301 **CreditUnits : 03**

Course Contents:

Module-I: The Foundations of Total Quality Management: Components of quality, The total quality management approach, Innovation, design and improvement, Product quality characteristics and service quality characteristics, Quality parameters and specific dimensions of quality

Module-II: Key Aspects of the Quality System: Planning for quality**,** Flowcharting, Detailed flow process charts and flow diagrams**,** planning for just-in-time (JIT) management**,** System design and contents**,** System documentation, implementation and assessment

Module-III: TQM Tools and the Improvement Cycle: Measurement of quality, Costs of quality, Tools and techniques for quality improvement, Statistical process control, Quality improvement techniques in service industries, Specific techniques for design, reliability, maintenance and process improvement

Module-IV: The Quality Organization within an Organization: People and the organizational structure**,** Responsibilities and performance management**,** the relationship between the quality organization and top management**,** Culture change through teamwork for quality improvement**,** Implementing teamwork for quality improvement: the DRIVE model

Module-V: Internal Quality Audits: Scope of requirements and audit procedures**,** the audit programme and planning of quality audits**,** Verifying compliance with planned arrangements, determining the effectiveness of the system**,** reporting the results of quality audits**,** Follow-up audits

Module-VI: Quality and Business Process Re-engineering: Beyond tools to total quality management**,** Stages in the development of quality and related activities: inspection, quality assurance**,** company-wide quality control**,** total quality management, Quality circles

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books

- Total Quality Management – the route to improving performance**, OAKLAND, J.S.,** Butterworth/Heinemann (1993)
- ISO 9000 Quality Systems Handbook 2nd Edition, HOYLE**, D., Butterworth**/Heinemann1997

COMPUTATIONAL FLUID DYNAMICS

Course Code: THE4302 **CreditUnits : 04**

Course Contents:

Module-I: Introduction: Introduction to C.F.D. , models of the flow, governing differential equations – continuity equation, momentum equation, energy equation, Navier- stokes equation, physical boundary conditions.

Module-II: Mathematical Behavior of Governing Equation: Classification of quasi linear partial differential equation, General method of determining the Classification of partial differential equation, hyperbolic, parabolic, elliptic equations.

Module-III: DiscritizationMethods: Finite difference methods difference equations, explicit & implicit approach, errors & analysis of stability. Basics of finite control volume method, errors & analysis of stability,

Module-IV: Heat Conduction Problem : Solution of One dimensional heat conduction through a pin fin by F.D.M solution of two dimensional heat conductional in a plate by F.D.M. Control volume formulation of the heat conduction problem and its solution.

Module-V: Heat Conduction with Convection &Diffusion: Steady state one dimensional convection and diffusion, unwinding, exact solution, exponential scheme, hybrid scheme, power law scheme, Discrimination equation for two dimensions & three dimensions, false diffusion.

Module-VI: Fluid Flow Problem: Viscous incompressible flow, solution of the coquette flow problem by F.D.M., calculation of the flow field using stream function –vortices method numerical algorithms for solving complete navier stokes equation – MAC method; SIMPLE method.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books Recommended;

- Numerical heat transfer and fluid flow by suhas. V. patankar
- Computational fluid dynamics by John.d.Anderson, Jr
- Introduction to Computational fluid dynamics by Anil .W. Date

REFRIGERATION ENGINEERING

Course Code: THE4303 **CreditUnits : 04**

Course Contents:

Module-I: Introduction: Simple vapor compression cycle, pressure-Enthalpy diagram, Ewing's construction maximum COP condition for simple vapor compression cycle Effect of operating conditions (Evaporator pressure, condenser pressure, suction vapor super heat, liquid sub cooling) Deviation of actual vapor compression cycle with that of theoretical

Module-II: Air Refrigeration System: Reverse Carnot cycle, Bell-Coleman cycle, advantages and disadvantages of air refrigeration system, necessity of cooling the aero planes, simple cooling and simple evaporative type, Bootstrap and Bootstrap evaporative type, regenerative type, reduced ambient type air cooling systems. Limitations, merits and comparison

Module-III: Multi Temperature: Method of improving the COP, optimum interstate pressure for two stages refrigeration system, Multi stage or compound compression with flash inter cooler, single expansion valve and multi expansion valve. Multi evaporator system with single compressor, individual compressor with compound compression, single expansion valve and multi-expansion valve.

Module-IV: Production of Low Temperature: Limitations of simple vapour compression system, multistage system, cascade system, production of solid carbon dioxide, Joule-Thomson effect, liquification of gases, hydrogen, helium, application of low temperature, Cryogenic insulation.

Module-V: Steam Jet Refrigeration: Steam Jet Refrigerator, component of steam Jet refrigeration plant, advantages and limitations of steam jet refrigeration system, performance of the system. Determination of equilibrium concentration.

Module-VI : Vapour Absorption System : Simple vapors absorption system, Maximum co-efficient of performance, modification of simple vapour absorption system, actual vapours absorption cycle and its graphical representation. Absorption system calculation Rich and poor solution concentration Lithium – Bromide water system.

Module-VII: Application: Manufacturing and treatment of metal, Medical, civil engineering, solar refrigeration and ice manufacturing.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books Recommended:

- Mechanical Refrigeration by Sporks and Diffio.
- ASHARE Handbook (Fundamentals) by ASHARE.
- Thermal Environment Engineering by Threlkeld.
- Refrigeration and Air-conditioning by C.P. Arora.
- Refrigeration and Air –conditioning by Stocker.
  - o Cascade system Ejector compression system.
  - o Method, use of Pre-cooling, Liquification.
- Refrigeration and Air conditioning by Stocker, Mc-Graw Hill.
- Air Conditioning Design Hand Book by Carrier Corfon (Ed), Mc-Graw Hill.

CRYOGENICS

Course Code: THE4304 **CreditUnits : 03**

Course Contents :

Module-I: Gas liquefaction systems, thermodynamically ideal systems, Joule Thomson effect, adiabatic expansion; liquefaction system for air, Neon, hydrogen and helium, effect of component efficiencies on system performance.

Module-II: Gas separation and purification – principles, plant calculation, air, hydrogen, and helium separation systems.

Module-III: Cryogenic refrigeration systems, ideal and practical systems, cryogenic temperature measurement; cryogenic fluid storage and transfer systems, storage vessels and insulation, two-phase flow in cryogenics transfer systems, cool down process.

Module-IV: Introduction to vacuum technology, low temperature properties of materials, pump down time, application of cryogenic systems, super-conductive devices, rocket and space simulation, cryogenics in biology and medicine, cry pumping.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

References:

- Barron, R., Cryogenic Systems, McGraw-Hill, 1966.
- Timmerhaus, K. D. and Flynn, T. M., Cryogenic Process Engineering, Plenum Press, 1989.
- Scott, R. B., Cryogenic Engineering, D'Van-Nostrand, 1962.
- Vance, R. W. and Duke, W. M., Applied Cryogenic Engineering, John Wiley, 1962.
- Sitting, M. Cryogenic, D' Van-No strand, 1963.

AIR-CONDITIONING

Course Code: THE4305 **CreditUnits : 03**

Course Contents :

Module-I: Introduction and Human Comfort: Psychometric and psychometric properties, psychometric relations and processes, adiabatic temperature, psychometric chart, summer and winter air-conditioning system, year-round air-conditioning, factors influencing-human comfort, effective temperature, factors governing optimum effective temperature.

Module-II: Cooling Load Calculations: Types of loads, building heat transmission, solar-radiation infiltration, occupants, electric lights, products load, other internal heat sources, fresh-air miscellaneous steams, design of air-conditioning systems.

Module-III: Air Conditioning Systems: Central station, unitary, distinct, self-contained direct expansion, all water, all air, air-water system, arrangement of components, air-cleaning and air filters, humidifiers, dehumidifiers air-washers, fan and blowers, grills and registers.

Module-IV: Air Conditioning Control System: Heating and cooling coils, basic principles of control system, temperature humidity, pre-heating and humidification, cooling and dehumidification, reheat and all-year conditioning control systems. Elements of control, Deflective element (bimetallic, bulbs and below, electrical resistance, electromagnetic sensitive and pressure sensitive, controlling room conditions at partial load (ON-OFF control), by pass control, reheat control and volume control).

Module-V: Miscellaneous: Evaporative cooling, heating system, ventilation and ventilation standards, thermal insulation duct design and air-distribution system, noise and noise control, solar air-conditioning. Transport air conditioning, air conditioning of special type of buildings, air conditioning of textile industry, photographic industry, theatre auditorium, hospitals etc.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books Recommended:

- Refrigeration and air conditioning by C.P. Arora.
- Refrigeration and air conditioning by Jordan and Priester
- Refrigeration and air conditioning by William
- ASHARAE Hand Book (Fundamentals) ASHARAE
- Elementary Refrigeration and air conditioning Stoecjer McGraw Hill
- Air Conditioning Engineering Jones Arnold.

GAS TURBINE AND JET PROPULSION

Course Code: THE4306 **CreditUnits : 03**

Course Contents :

Module-I: Introduction: Introduction to simple gas turbine; open cycles considering heat exchanger; reheater; multispool arrangement; combined cycles and cogeneration scheme; closed cycle; industrial applications of gas turbine.

Module-II: Power Cycles: Efficiencies & specific work output of heat exchanger cycles; reheat cycles; cycles with intercooled compression; various component loses.

Module-III: Combustion Systems: Combustion process, types of combustion systems, operational requirements, combustion chamber performance.

Module-IV: Turbine: Axial Flow Turbine- Elementary theory of axial flow turbine; swirl angle; total to total stage efficiency; flow coefficient; floe coefficient; loss coefficient for the nozzle blades; methods of blade cooling.Radial flow turbine- specific work output; various efficiencies

Module-V: Jet Propulsion & Turbojet Engine: Introduction; net thrust; propulsion efficiency; intake & propelling nozzle efficiency; turbojet engine -actual cycle analysis ; typical engine performance; corrected engine performances; thrust augmentation.

Module-VI: Turboprop & Ramjet Engine: Turboprop Engine process & cycle analysis; engine performances; Ramjet engine; jet expansion; overall process and performance

Module-VII: Rocket Engine: Solid and liquid propellant rocket motor cooling;, propellant section; performance and design

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books Recommended:

- Gas turbine theory by H. Cohen & GFC Rogers
- Jet propulsion and gas turbine theory gyZucrow, John Wiley
- Jet propulsion by Hesse, Pitman
- Theory and design of gas turbine & jet engine by Vincent, Mcgraw Hill

COMPUTATIONAL FLUID DYNAMICS LAB

Course Code: THE4307 **CreditUnits : 01**

List of Experiments

- To make and validate a computer programme for the one dimensional pin fin steady state heat conduction.
- To make and validate a computer programme for the one dimensional transient heat conduction.
- To make and validate a computer programme for the plate in two dimensions in steady state conduction.
- To make and validate a computer programme for the plate in two dimensions in transient state.
- To make and validate a computer programme for the comparison of explicit, implicit, semi-implicit method of computation of heat transfer equation.
- To make and validate a computer programme for the fully developed laminar flow in circular pipe.
- To make and validate a computer programme for the coutte flow.
- To make and validate a computer programme to solve the navier stokes equation.
- To make and validate a computer programme to solve a model problem by stream function vortices method.
- To make a project by using MAC /SIMPLER method

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

REFRIGERATION ENGINEERING LAB

Course Code: THE4308 **CreditUnits : 01**

List of Experiments

- To Study The Performance Of Refrigeration Cycle Using Different Expansion Devices.
- To Prepare Heat Balance Sheet Of Refrigeration Cycle.
- To Study Humidification with Heating & Dehumidification with Cooling.
- To Compare C.O.P. Of The Refrigeration Test Rig When Working As Heat Pump And As Refrigerator.
- To Study The Constructional Details Of Hermetically Sealed Reciprocating Compressor.
- To Study Constructional Details Of Rotary Compressor.
- To Study Constructional Detail Of Thermostatic Expansion Valve.
- To Study Constructional Detail Of Automatic Expansion Valve.
- To Study Constructional Details Of Thermostatic Switch.
- To Study High Pressure (Hp) and Low Pressure (Lp) Control Devices.
- To Find The Ice Making Capacity Of Ice Plant.
- To Study Performance Of Cooling Tower.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

SUMMER INTERNSHIP EVALUATION

Course Code: THE4335 **Credit Units: 06**

Guidelines:
There are certain phases of every Intern's professional development that cannot be effectively taught in the academic environment. These facets can only be learned through direct, on-the-job experience working with successful professionals and experts in the field. The internship program can best be described as an attempt to institutionalize efforts to bridge the gap between the professional world and the academic institutions. Entire effort in internship is in terms of extending the program of education and evaluation beyond the classroom of a university or institution. The educational process in the internship course seeks out and focuses attention on many latent attributes, which do not surface in the normal classroom situations. These attributes are intellectual ability, professional judgment and decision-making ability, inter-disciplinary approach, skills for data handling, ability in written and oral presentation, sense of responsibility etc.

In order to achieve these objectives:

- **Each student will be allotted a supervisor** for proper guidance.
- **Student will first submit synopsis in the format given by coordinator/supervisor.**
- Student will maintain a file (**Internship File/Project Report**). **Further, coordinator will provide NTCC project guidelines and sample to help in preparation of file.** The Internship File aims to encourage students to keep a personal record of their learning and achievement throughout the Programme. It can be used as the basis for lifelong learning and for job applications. Items can be drawn from activities completed in the course modules and from the workplace to demonstrate learning and personal development. The File will assess the student's analytical skills and ability to present supportive evidence, whilst demonstrating understanding of their organization, its needs and their own personal contribution to the organization.

The **layout guidelines** for the Project Report

1. File should be in the following specification

- A4 size paper
- **Font**

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

- **Margins**

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

- **Line Spacing**

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

- **Tables and Figures**

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures

experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

- **Drawings**

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

- **Equations**

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

2. Report Size: The maximum number of pages of the Report should be preferably between 50-80 pages.

3. Report Layout: The report should contain the following components
Front Page
Table of Content
Acknowledgement
Student Certificate
Company Profile (optional)
Introduction
Main Body
References / Bibliography

The File will include ***five sections*** in the order described below. The content and comprehensiveness of the main body and appendices of the report should include the following:

1. **The Title Page**--Title - An Internship Experience Report For (Your Name), name of internship organization, name of the Supervisor/Guide and his/her designation, date started and completed, and number of credits for which the report is submitted.
2. **Declaration by the Students-**This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.
3. Certificate-This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).
4. Acknowledgements-This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.
5. Abstract and **Keywords-**This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.
7. Contents-This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

8. **Introduction**--short, but should include how and why you obtained the internship experience position and the relationship it has to your professional and career goals.

9. **Main Body**--should include but not be limited to daily tasks performed. Major projects contributed to, dates, hours on task, observations and feelings, meetings attended and their purposes, listing of tools and materials and their suppliers, and photographs if possible of projects, buildings and co-workers.

10. **References / Bibliography** --This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE INTERNSHIP FILE

Continuous Internal Assessment	**Final Assessment**
40 Marks	60 Marks

Continuous Internal Assessment consists of topic relevance, progress report and synopsis marks. Final Assessment includes viva, presentation and report marks.

Examination Scheme:

Components	**V**	**S**	**R**	**PR**	**FP**
Weightage (%)	20	20	20	20	20

V – Viva, S – Synopsis, FP – Final Presentation, R – Report, PR-Progress Report

PROJECT-DISSERTATION-I

Course Code: THE4337 **CreditUnits: 05**

GUIDELINES FOR DISSERTATION

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

A short account of the activities that were undertaken as part of the project;

A statement about the extent to which the project has achieved its stated goals.

A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;

Any activities planned but not yet completed as part of the DISSERTION, or as a future initiative directly resulting from the project;

Any problems that have arisen that may be useful to document for future reference.

- Report Layout

The report should contain the following components:

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Future prospects**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic*Escherichia coli* O157: H7. *ClinMicrobiol Infect*, **8** (suppl 1): 116–117.

For book

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

ASSESSMENT OF THE DISSERTATION FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation	50
Viva Voce	50
Total	**100**

ata, leading to production of a structured report.

Selecting the Dissertation Topic
It is usual to give you some discretion in the choice of topic for the dissertation and the approach to be adopted. You will need to ensure that your dissertation is related to your field of specialization.

Deciding this is often the most difficult part of the dissertation process, and perhaps, you have been thinking of a topic for some time.

It is important to distinguish here between 'dissertation topic' and 'dissertation title'. The topic is the specific area that you wish to investigate. The title may not be decided until the dissertation has been written so as to reflect its content properly.

Few restrictions are placed on the choice of the topic. Normally we would expect it to be:
- relevant to business, defined broadly;
- related to one or more of the subjects or areas of study within the core program and specialisation stream;
- clearly focused so as to facilitate an in-depth approach, subject to the availability of adequate sources of information and to your own knowledge;
- of value and interest to you and your personal and professional development.

Planning the Dissertation
This will entail following:
- Selecting a topic for investigation.
- Establishing the precise focus of your study by deciding on the aims and objectives of the dissertation, or formulating questions to be investigated. Consider very carefully what is worth investigating and its feasibility.
- Drawing up initial dissertation outlines considering the aims and objectives of the dissertation. Workout various stages of dissertation
- Devising a timetable to ensure that all stages of dissertation are completed in time. The timetable should include writing of the dissertation and regular meetings with your dissertation guide.

The Dissertation plan or outline
It is recommended that you should have a dissertation plan to guide you right from the outset. Essentially, the dissertation plan is an outline of what you intend to do, chapter wise and therefore should reflect the aims and objectives of your dissertation.

There are several reasons for having a dissertation plan
- It provides a focus to your thoughts.
- It provides your faculty-guide with an opportunity, at an early stage of your work, to make constructive comments and help guide the direction of your research.
- The writing of a plan is the first formal stage of the writing process, and therefore helps build up your confidence.
- In many ways, the plan encourages you to come to terms with the reading, thinking and writing in a systematic and integrated way, with plenty of time left for changes.

- Finally, the dissertation plan generally provides a revision point in the development of your dissertation report in order to allow appropriate changes in the scope and even direction of your work as it progresses.

Keeping records
This includes the following:

- Making a note of everything you read; including those discarded.
- Ensuring that when recording sources, author's name and initials, date of publication, title, place of publication and publisher are included. (You may consider starting a card index or database from the outset). Making an accurate note of all quotations at the time you read them.
- Make clear what is a direct a direct quotation and what is your paraphrase.

Dissertation format
All students must follow the following rules in submitting their dissertation.

- Front page should provide title, author, Name of degree/diploma and the date of submission.
- Second page should be the table of contents giving page references for each chapter and section.
- The next page should be the table of appendices, graphs and tables giving titles and page references.
- Next to follow should be a synopsis or abstract of the dissertation (approximately 500 words)
- Next is the 'acknowledgements'.
- Chapter I should be a general introduction, giving the background to the dissertation, the objectives of the dissertation, the rationale for the dissertation, the plan, methodological issues and problems. The limitations of the dissertation should also be hinted in this chapter.
- Other chapters will constitute the body of the dissertation. The number of chapters and their sequence will usually vary depending on, among others, on a critical review of the previous relevant work relating to your major findings, a discussion of their implications, and conclusions, possibly with a suggestion of the direction of future research on the area.
- After this concluding chapter, you should give a list of all the references you have used. These should be cross - references with your text. For articles from journals, the following details are required e.g.

  Draper P and Pandyal K. 1991, The Investment Trust Discount Revisited, Journal of Business Finance and Accounting, Vol18, No6, Nov, pp 791-832.

  For books, the following details are required:
  Levi, M. 1996, International Financial Management, Prentice Hall, New York, 3rd Ed, 1996

- Finally, you should give any appendices. These should only include relevant statistical data or material that cannot be fitted into the above categories.

The Layout Guidelines for the Dissertation

- A4 size Paper
  - Font: Arial (10 points) or Times New Roman (12 points)
  - Line spacing: 1.5
  - Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

Guidelines for the assessment of the Dissertation
While evaluating the dissertation, faculty guide will consider the following aspects:

1. Has the student made a clear statement of the objective or objective(s).
2. If there is more than one objective, do these constitute parts of a whole?
3. Has the student developed an appropriate analytical framework for addressing the problem at hand.
4. Is this based on up-to-date developments in the topic area?
5. Has the student collected information / data suitable to the frameworks?

6. Are the techniques employed by the student to analyse the data / information appropriate and relevant?
7. Has the student succeeded in drawing conclusion form the analysis?
8. Do the conclusions relate well to the objectives of the project?
9. Has the student been regular in his work?
10. Layout of the written report.

Assessment Scheme:

Continuous Evaluation:		40%
(Based on Abstract, Regularity, Adherence to initial plan, Records etc.)		
Final Evaluation: Based on,		60%
Contents & Layout of the Report,	20	
Conceptual Framework,	05	
Objectives & Methodology and	05	
Implications & Conclusions	10	
Viva & Presentation	20	

Syllabus - Fourth Semester

PROJECT-DISSERTATION-II

Course Code: THE4437 **CreditUnits: 15**

GUIDELINES FOR DISSERTATION

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

A short account of the activities that were undertaken as part of the project;

A statement about the extent to which the project has achieved its stated goals.

A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;

Any activities planned but not yet completed as part of the DISSERTION, or as a future initiative directly resulting from the project;

Any problems that have arisen that may be useful to document for future reference.

- Report Layout

The report should contain the following components:

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Future prospects**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic*Escherichia coli* O157: H7. *ClinMicrobiol Infect*, **8** (suppl 1): 116–117.

For book

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

ASSESSMENT OF THE DISSERTATION FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation	50
Viva Voce	50
Total	**100**

ata, leading to production of a structured report.

Selecting the Dissertation Topic
It is usual to give you some discretion in the choice of topic for the dissertation and the approach to be adopted. You will need to ensure that your dissertation is related to your field of specialization.

Deciding this is often the most difficult part of the dissertation process, and perhaps, you have been thinking of a topic for some time.

It is important to distinguish here between 'dissertation topic' and 'dissertation title'. The topic is the specific area that you wish to investigate. The title may not be decided until the dissertation has been written so as to reflect its content properly.

Few restrictions are placed on the choice of the topic. Normally we would expect it to be:
- relevant to business, defined broadly;
- related to one or more of the subjects or areas of study within the core program and specialisation stream;
- clearly focused so as to facilitate an in-depth approach, subject to the availability of adequate sources of information and to your own knowledge;
- of value and interest to you and your personal and professional development.

Planning the Dissertation
This will entail following:
- Selecting a topic for investigation.
- Establishing the precise focus of your study by deciding on the aims and objectives of the dissertation, or formulating questions to be investigated. Consider very carefully what is worth investigating and its feasibility.
- Drawing up initial dissertation outlines considering the aims and objectives of the dissertation. Workout various stages of dissertation
- Devising a timetable to ensure that all stages of dissertation are completed in time. The timetable should include writing of the dissertation and regular meetings with your dissertation guide.

The Dissertation plan or outline
It is recommended that you should have a dissertation plan to guide you right from the outset. Essentially, the dissertation plan is an outline of what you intend to do, chapter wise and therefore should reflect the aims and objectives of your dissertation.

There are several reasons for having a dissertation plan
- It provides a focus to your thoughts.
- It provides your faculty-guide with an opportunity, at an early stage of your work, to make constructive comments and help guide the direction of your research.
- The writing of a plan is the first formal stage of the writing process, and therefore helps build up your confidence.

- In many ways, the plan encourages you to come to terms with the reading, thinking and writing in a systematic and integrated way, with plenty of time left for changes.
- Finally, the dissertation plan generally provides a revision point in the development of your dissertation report in order to allow appropriate changes in the scope and even direction of your work as it progresses.

Keeping records
This includes the following:

- Making a note of everything you read; including those discarded.
- Ensuring that when recording sources, author's name and initials, date of publication, title, place of publication and publisher are included. (You may consider starting a card index or database from the outset). Making an accurate note of all quotations at the time you read them.
- Make clear what is a direct a direct quotation and what is your paraphrase.

Dissertation format
All students must follow the following rules in submitting their dissertation.

- Front page should provide title, author, Name of degree/diploma and the date of submission.
- Second page should be the table of contents giving page references for each chapter and section.
- The next page should be the table of appendices, graphs and tables giving titles and page references.
- Next to follow should be a synopsis or abstract of the dissertation (approximately 500 words)
- Next is the 'acknowledgements'.
- Chapter I should be a general introduction, giving the background to the dissertation, the objectives of the dissertation, the rationale for the dissertation, the plan, methodological issues and problems. The limitations of the dissertation should also be hinted in this chapter.
- Other chapters will constitute the body of the dissertation. The number of chapters and their sequence will usually vary depending on, among others, on a critical review of the previous relevant work relating to your major findings, a discussion of their implications, and conclusions, possibly with a suggestion of the direction of future research on the area.
- After this concluding chapter, you should give a list of all the references you have used. These should be cross - references with your text. For articles from journals, the following details are required e.g.

  Draper P and Pandyal K. 1991, The Investment Trust Discount Revisited, Journal of Business Finance and Accounting, Vol18, No6, Nov, pp 791-832.

  For books, the following details are required:
  Levi, M. 1996, International Financial Management, Prentice Hall, New York, 3rd Ed, 1996

- Finally, you should give any appendices. These should only include relevant statistical data or material that cannot be fitted into the above categories.

The Layout Guidelines for the Dissertation

- A4 size Paper
  - Font: Arial (10 points) or Times New Roman (12 points)
  - Line spacing: 1.5
  - Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

Guidelines for the assessment of the Dissertation
While evaluating the dissertation, faculty guide will consider the following aspects:

11. Has the student made a clear statement of the objective or objective(s).
12. If there is more than one objective, do these constitute parts of a whole?
13. Has the student developed an appropriate analytical framework for addressing the problem at hand.

14. Is this based on up-to-date developments in the topic area?
15. Has the student collected information / data suitable to the frameworks?
16. Are the techniques employed by the student to analyse the data / information appropriate and relevant?
17. Has the student succeeded in drawing conclusion form the analysis?
18. Do the conclusions relate well to the objectives of the project?
19. Has the student been regular in his work?
20. Layout of the written report.

Assessment Scheme:

Continuous Evaluation:		40%
(Based on Abstract, Regularity, Adherence to initial plan, Records etc.)		
Final Evaluation: Based on,		60%
Contents & Layout of the Report,	20	
Conceptual Framework,	05	
Objectives & Methodology and	05	
Implications & Conclusions	10	
Viva & Presentation	20	