DMMEC-401: Finite Element Analysis

Unit–I: Fundamental Concepts: Introduction, Historical background, Outline of presentation, Stresses and Equilibrium, Boundary conditions, Strain-Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potential energy and Equilibrium. The Reyleigh-Ritz method, Hamilton's principle, Galerkin's method, Saint Venant's principle.

Unit–II :One-dimensional Problems : Introduction, Finite element modeling, Coordinates and shape functions. The potential energy approach. The Galerkin approach, Assembly of the global stiffness matrix–Mass matrix and load vector,Treatment of boundary conditions, Quadratic shape functions, Temperature effects, Trusses: Introduction, Plane trusses, Three dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions.

Unit – III:Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle,in plane and Bending, Problem modeling and boundary conditions.

Unit–IV:Axisymmetric Solids Subjected to Axisymmetric Loading: Introduction, Axisymmetric formulation, Finite element modeling, Triangular element, Problem modeling and boundary conditions.

Unit–V:Two-dimensional Isoparametric Elements and Numerical Integration: Introduction. The four-node quadrilateral,Numerical integration, Higher-order elements. Beams and Frames; Introduction, Finite element formulation, Load vector, Boundary considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

Textbook :Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla, Ashok D. Belegundu (chapter 1 to 8 only).
Ref.:1. Introduction to Finite Element Method by Abel & Desai.2. Finite Element Method by O.C. Zienkiewicz.3. Concepts and Applications of finite Element Analysis by Robert D. Cook.4. Introduction to Finite Element Method by J.N. Reddy.

DMMEC : 402 - Heat and Mass Transfer

Unit – I: Conduction : Heat conduction equation in differential and in internal form – Cartesian, Cylindrical and Spherical coordinates systems, Steady state heat conduction solution for plan and composite slabs, Tubes and spheres – Critical thickness of insulation – Heat conduction through fins of uniform and variable cross section – Transient and periodic heat conduction – Lumped system analysis and use of Heisler charts and graphical methods – Biot's approximate method – Numerical methods in unsteady heat conduction analysis.

Unit – II : Convection: Continuity, momentum and energy equations–Dimensional Analysis– Boundary layer theory concepts – Free, Forced and Mixed convection– Approximate solution of the boundary layer equations–Laminar and turbulent heat transfer correlation – Momentum equation and velocity profiles in turbulent boundary layers – Application of dimensional analysis to free and forced convection problems– Empirical correlation.

Unit – III: Radiation: Black body radiation–Radiation field, Kirchoff's laws–Shape factor– Stefan Boltzman equation–Heat radiation through absorbing media – Radiant heat exchange, parallel and perpendicular surfaces–Radiation shields–Combined heat transfer due to conduction, convection and radiation.

Unit – IV :Heat Exchangers: Types of heat exchangers – Parallel flow – Counter flow – Cross flow heat exchangers – Overall heat transfer coefficient – LMTD and NTU methods – Compact heat exchangers and design considerations – Fouling in heat exchangers – Heat exchangers with phase change.

Unit – V :Mass Transfer: Conservation laws and constitutive equations – Isothermal equimass, Equimolal diffusion–Diffusion through semi permeable plane–Fick's law of diffusion – diffusion of gases, Liquids and Solids–Mass transfer coefficient. Simultaneous heat and mass transfer with phase change, Boiling: Different regimes of boiling–Nucleate. Transition and film boiling Pool boiling and flow boiling. Condensation:Laminar film consideration. Nusselt's theory– Condensation on vertical flat plat plate and horizontal tubes–Condensation in the presence of non-condensable – Drop-wise condensation.

Textbooks :1. Heat Transfer by J.P. Holman, Int. Student edition, McGraw Hill book company.
2. Analysis of Heat transfer by Eckert and Drake. In. Student edition, McGraw Hill Kogak Ltd.

DMMEC-403: Power Plant Engineering

Unit–I: Stream Power Plants: General Layout, Power plant cycles,Fuels-handling,storing, preparation and supply. Various stokers. Draft systems, chimney including calculations. Boilers: Construction and Heating surfaces. Mountings and accessories. High pressure and high duty forced circulation boilers land modern trends in Boiler design. Flue chambers and dampers. Steam piping–fittings–logging. Boiler performance, Flue gas testing and indicators (mechanical, electrical and chemical).

Unit–II: Internal Combustion Power Plants: Types of engines for power generation, Super charging, Exhaust heating fuel tanks and oil supply systems. Air supply for starting, Lubricating oils and systems of lubrication, Modern trends and design in diesel engines, Performance of engines, Care of diesel plants.Gas Turbine and other Propelled Power Plants: Introduction – Gas turbine plant–Classification and comparison of different types of gas turbine power plants – Components and different arrangements of the gas turbine plants – Indian gas turbine power plants–Governing system of gas turbine plant–Marine, Aero and Rocket Propulsion power plants.

Unit – III :Hydro Electric Plants: Hydrology, Hydrometric survey rainfall, Catchment, Reservoir, Run-off flow and fall, Storage and pondage, Losses due to percolation, Evaporation and transpiration. Mass–duration and flood discharge. Frequency studies and gauging. Different types of plants. Selection of site. Low, medium and high head plants and pumped storage plants. General layout of the plant – Head works, Spillways, Canals, Tunnels, Governing, Lubrication, Penstock, Anchorages and relief valves, different types of surge tanks, intakes, Gates and Valves.

Unit–IV: Nuclear power plants: Classification of reactors, Thermal utilisation, Fuels, Fuel moderator and coolant, Control and safety rods, Special properties of structural materials required, Induced radio-activity, Gas cooled reactors, Radiation hazards and shielding, Radio active waste disposal.

Unit–V :Direct energy Conversion: Solar Energy–Introduction, Solar radiation, Solar collectors, Energy storage. Wind Energy–Wind mills. Thermo Electric–MHD and other non conventional energy sources. Power Plant Economics: Capacity factor, Load actor, Diversity factor, Peak load consideration, Factors governing capacity of plants. Cost of power plant,Cost of erection. Operating & maintenance expenses, Cost of prodction,distribution of power & determination of rates.

Textbooks:1.Power Station Engineering and Economy by Benhaedt G.A.Skrotzki, William A. Vopat, MGH Book , Inc.2. Heat Engineering, I.T. Shvets et al, MIR Pub Moscow.3. A Course in Power Plant Engineering,S.C.Arora&S.Domdundwar.
Ref.:1.olar Power Engineering by B.S. Magal, TMGHPub Co..2. Solar Energy by S.P. Sukhatme, T MGH pub. Co.3. Modern Power Plant Engineering by Joel Weisman, Roy Eckart, PHI.4.Atextbook of Power Plant Engineering by P.C. Sharma,S.K. Kataria&Sons, ND. 5.Fundamentals of Nuclear Power Engineering by D.K. Singhai,Khanna Pub.

DMMEC: 404 - Computer Aided Design

Unit – I :Fundamentals of CAD: Introduction – The design process – Application of computers for design–Operating systems–Hardware in CAD: The design work station – I/O Devices- CAD system configuration – Creating database for manufacturing – benefits of CAD.

Unit–II : Interactive Computer Graphics – Graphic display devices – Graphics system – Graphics standards – Graphical user interface – Transformation systems- Windowing – clipping – 2D and 3D transformations – Linear transformation – Display files for 3D data – Geometric Modeling – Modeling Techniques- Wire frame Modeling – Surface Modeling -3D Solid Modeling.

Unit – III : Introduction to Finite Element Analysis – CAD techniques to finite element data preparation – Automatic mesh generation – presentation for results – 3-dimensional shape description and mesh generation – CAD applications of FEM.

Unit – IV :CAD applications and exposure to CAD packages : Simple examples of computer aided drafting, design and analysis – Introduction to simple machine elements – Analysis of cross sectional area, centroid & moment of inertia – Kinematics of crank-slider mechanism and other simple design applications. Introduction to CAD packages like ANSYS, NASTRON, NISA-II.

Unit – V :Introduction to Artificial Intelligence Introduction to Artificial Intelligence – Applications of AI in design and CAD.

Textbooks:1. CAD/CAM – Computer Aided Design & Manufacturing, by M.D.Groover & E.W. Zimmer.2. Computer Aided Design and Manufacturing by K.Lalit Narayan, K.Mallikarjuna Rao and MMM Sarcar, PHI Publications.

Ref. :1. Computer Aided Design in Mechanical Engineering by V. Rama Murthy.
2. Elements of Computer Aided Design & Manufacturing by Y.C. Pao.
3. Computer Aided Kinetics for Machine Design by D.L. Ryan.
4. Computer Aided Design and Manufacturing, by C.B.Besant & CWK Lui
5. Computer Aided Analysis & Design by S.Ghosal, Prentice Hall of India
6. CAD/CAM/CIM by Radhakrishna, New age international.

DMMEC 405: Fundamentals of Environmental Engineering

(Common with ECE and EEE)

Unit – I

Module I: Introduction- Definition- score and importance- measuring and defining environmental development: indicators.

Module II: Ecosystems-Introduction, types, characteristic features, structure and functions of Ecosystems, forest, grassland, desert, aquatic (lakes, rivers, and estuaries)

Unit – II

Module III : Environment and Natural Resources Management-Land resources - Soil erosion and desertification, effects of modern agriculture, fertilizer-pesticide problems, Forest resources : use and over-exploitation, mining and dams – their effects on forest and tribal people, Water resources : use and over-utilization of surface and ground water, floods, droughts, water logging and salinity, dams – benefits and costs, conflicts over water, Energy resources : Energy needs, renewable and non-renewable energy sources, use of alternate energy sources, impact of energy use on environment

Unit – III

Module IV : Bio-diversity and its Conservation **-** Value of bio-diversity – consumptive and productive use, social, ethical, aesthetic and option values, bio-geographical classification of India – India as a mega diversity habitat, Threats to biodiversity – Hot-sports, habitat loss, poaching of wildlife, loss of species, seeds etc., Conservation of bio-diversity – in-situ and ex-situ conservation.

Module V : Environmental Pollution – Local and Global Issues **-** Causes, effects and control measures of : air pollution, indoor air pollution, water pollution, soil pollution, marine pollution, noise pollution, solid waste management, composting, Vermiculture, urban and industrial wastes, recycling and re-use, Nature of thermal pollution and nuclear hazards, Global Warming, Acid Rain, Ozone depletion

Unit – IV

Module VI : Environmental Problems in India **-** Drinking water, sanitation and public health, Effects of activities on the quality of environment : urbanization, transportation, industrialization, green revolution, Water scarcity and ground water depletion, Controversies on major dams – resettlement and rehabilitation of people problems and concerns, Rain water harvesting, cloud seeding and watershed management.

Module VII : Economy and Environment **-** The economy and environment interaction, Economics of development, preservation and conservation, sustainability : theory and practice, Limits to growth, Equitable use of resources for sustainable lifestyles, Environmental impact assessment

Module VIII : Social Issues and the Environment**-** Population growth and environment, environmental education, Environmental movements, Environment Vs development

Unit – V

Module IX : Institutions and Governance **-** Regulation by Government, Monitoring and enforcement of environmental regulation, environmental acts : water (Prevention and control of pollution) act, air (prevention and control of pollution) act, Envt. Protection act, wild life protection act, forest conservation act, coastal zone regulations, Institutions and policies relating to India, Environmental Governance.

Module X : International Conventions - Stockholm conference 1972, Earth summit 1992, World commission for environmental development (WCED).

Module XI : Case Studies - Chipko movement, Narmada Bachao andolan, Silent valley project, Madhura Refinery and Taj Mahal, Industrialization of Pattancheru, Nuclear reactor at Nagarjuna Sagar, Tehri Dam, Ralegaon Siddhi (Anna Hazare), Kolleru lake – aquaculture, Florosis in Andhra Pradesh.

Module XII : Visit to a local area to document and mapping environmental assets – river / forest / grass land / hill / mountain, Study of local environment – common plants, insects, birds, Study of simple ecosystems – pond, river, hill, slopes etc., Visits to industries, water treatment plants, affluent treatment plants.

Textbook : Kaushik – Kaushik, Anubha

Reference : Deswal & Deswal, Raja Gopal, Dharmaraj Publishers,

Elective-II-DMMEC406-C: **AUTOMOBILE ENGINEERING**

Unit-I

Introduction: Definition of automobile, Automobile Layout, Chassis and Transmission: Introduction to Drive Train: Clutch, Gearbox, Hook's Joint, Propeller /Drive Shaft, Slip Joint, Final Drive and Differential, Front and Rear Axles, Wheels and Tires, Control systems: Introduction to Steering, and Brakes. Electrical system: Introduction to Starting System, Ignition, dynamo/alternator, cut-out and wiring. Automobile Body: Parts and Stream lining, Automobile types: Front, Rear and Four wheel drive and Automotive materials.

Unit-II

Engine (Power Plant): Multi cylinder engine parts, Classification: 'In-line' and 'V' type, Multi-Valve Engines, VCR Engines, Super Charging/Turbo charging, Air filters, Fuel Systems: Petrol Engines: Carbureted and MPFI, Ignition Systems: Conventional and Electronic, Diesel Engines: Conventional, CRDI, and Duel Fuel engines., Performance, Combustion and Exhaust Emissions, Air pollution and their control: EGR and Catalytic Converters, EURO/Bharat Stage Norms: I, II, III, IV and V., Manifolds and Mufflers, Engine Cooling and Lubrication.

Unit-III

Clutch: Necessity, Clutch Assembly: Construction and Working Principle, Types: Single and Multiple Plates, Free-Play, Fluid coupling/Torque converter, Clutch Troubles and Remedies.

Gearbox: Necessity of Transmission and Transaxle, Construction and Working Principle, Selector Mechanism, Types: Sliding mesh, Constant mesh, Synchromesh, and Epicyclical. Three, Four and Five- Speed Gearbox, Overdrive, Automatic Gearbox, Gearbox Troubles and Remedies.

Drive shaft and Final Drive: Drive Shaft: Constructional Features: Universal/Hooks Joints, Slip Joint, and Working Principle., Types of Propeller shafts, Final drive and Differential: Necessity, Constructional Features and Working Principle., Front/Rear Axles: Constructional Features and Types of Rear Axle Floating, Wheels: Disc and Drum type, Tires: Tire Construction, Tube and Tubeless Tires, Radial Tires, Tire specification, Tire rotation and Tire Maintenance.

Unit- IV

Suspension System and Vehicle Control: Coil and Leaf Springs, Shock absorbers, Wheel alignment: Kingpin angle, Caster, Camber, Toe-in, and Toe-out., Necessity of vehicle control, Steering Mechanism and its Elements: Steering gear box and its types, Steering gear ratio, Constant Velocity Joints and linkages. Power Steering, Brake system: Necessity, Parking and Power Brakes, Parts and Working Principle of Mechanical, Air and. Hydraulic Brakes: Mater and Wheel cylinder, Properties of Brake Fluids, Brake Diagnostics and Service: Brake Bleeding, Anti-lock Braking System, Automobile Accessories and Tips for Safe Driving.

Electrical and Electronic Systems: Basics of Electrical/Electronic Systems: Battery, Starting system, Charging System, Lighting and Signaling System, A/C Electrical System, Electronic Engine Management system, Automotive Embedded Systems: Vehicle Security System and Working Principle of Computer Sensors: Temperature, Flow, Cam, knock, and Oxygen, and ECU/ ECM.

Unit - V

Trouble Shooting and Maintenance: Engine and Vehicle Troubles: Diagnostic Information: Symptom descriptions and their Causes and Remedies, Periodic, Preventive and Break down Maintenance: Engine tuning, Fuel and Air filters, Lubricants, Maintenance of Battery and Electrical/Electronic System, and Tires. The Motor Vehicle Act (India).

Text Books:

1. Automotive Mechanics (10/e) - William H. Crouse and Donald L. Anglin, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-059054-0
2. Automobile Engineering – KK Jain/ RB Asthana, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-044529-X
3. Internal Combustion Engines and Air Pollution- E.F. Obert, Harper & Row International Publishers Inc., ISBN: 0-06-350561-4

Reference Books:

1. Automotive Mechanics – S. Srinivasan, Tata McGraw-Hill Publishing company Limited, ISBN: 0-07-044941-6
2. Internal Combustion Engines – Heywood, John, B. McGraw-Hill Publications Limited.
3. Automotive Engines- S Srinivasan, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-040265-5

DMMEC 407 - HEAT TRANSFER LAB

Internal Marks 50 External Marks 50 Duration of University Examinations 3 hrs

List of Experiments:

1. Study of conduction phenomena in the composite slab system
2. Determination of emmissivity, time constant, Fourier Biot module and study of variation of temperature with respect to time on s circular disc.
3. Study of heat transfer by forced convection through a horizontal test section.
4. Study of heat transfer by forced convection through a vertical test section.
5. Determination of free convective heat transfer coefficient from a horizontal cylinder in air.
6. Determination of thermal conductivity of brass employing it as a fin.
7. Tests on natural convection and pool boiling.
8. Study of forced convection with turbulence promoters.
9. Study of condensation on fin.
10. Tests on film condensation.
11. Determination of COP of vapour compression refrigeration system.
12. Study of vapour compression air conditioning system.

DMMEC 408 CAD-CAM LAB

Internal Marks 50	External Marks 50	Duration of University Examinations 3 hrs

CAD Experiments:

1. Study of MIPS rating of CPU, CISC and RISC processors SPARCand PCI architectures.Typical RAM and Hard disc sizes.
2. Study of Graphic features: 2-D vectors, 3-D vectors 3-D polygon and Gouraud –shaded polygons generation capacitiess of graphic processors, Graphic accelerators. Multiple - graphic windows hardware. Raster-op and floating point transformation hardware. Zoom, Pan and Rotation hardware.
3. Study of features of GKS, Core, CGI and PHIGS graphic standards.
4. Study of features of FEA packages like MacNeal Schwondler Corporation(MSC) NASTRAN, Engineering Mechanics Research Corporation(EMRC) NISA II, ANSYS and Autodesk Design-Expert.
5. Exercises in solid modeling, Mesh generation, Static analysis, Modal dynamic analysis and design optimization.

CAM experiments:

1. Preparation of manual part programming for CNC turning.
2. Preparation of manual part programming for CNC Milling.
3. Part programming preparation through AutoCAD.
4. APT part programming for 2D – contour.
5. APT part programming with Macros.
6. Machining of one job on CNC machine tool.
7. Robot programming through Teaching box method
8. Robot programming through computer