SYLLABUS FOR LECTURER MECHANICAL ENGINEERING AT CCCT

Subject 1. CNC Technology & Programming

Introduction to NC Technology

- Evolution of NC, Advantages of NC, hardwired System, Soft Wired System, Introduction of mechatronics, CNC –Advantages.

CNC machine – Machine Features

- Machine features, principal parts of CNC machine compared to conventional machines like Bed / Column / Structure, Guide Ways, re-circulating Rolling Elements – LM Guideways, aero static & hydrostatic guide ways re-circulating ball Screws, Tool changes and ATC, Pallet changers, Coolant Systems, lubricating systems, chip conveyor etc.

Definition of Datum – Machine Datum, Reference Point, Work Zero, Tool Point

- Understanding of machine datum, reference point, work zero, tool point for writing part program.

Introduction to Part Programming

- Coordinate system
- CNC codes and part programming

Subject 2. Mechanical Measurement & Metrology

INTRODUCTION OF THE MEASUREMENT

- Definition
- Aim of measurements
- Factors in the selection of measuring instruments
- Measurement system
- Scale and pointer type indicator instrument
- Calibration procedure
- Errors in measuring instrument
- Standards of measurements- different standards
- Definition and meaning of inspection
- Precision and accuracy
- Accuracy and cost
- Sources of error
- Sensitivity and reliability
- Geometry of form or shape
- Classification of measurements.

LIMITS, FITS AND GUAGES

- Introduction
- Indian standards
- Limits, fits and tolerance.
- Limits – maximum limit, minimum limit basic and actual sizes.
- Tolerance deviation zero line, tolerance zero
- Fits – clearance fit interface fit, transits fit
- System of fit – hole basic and shaft basis
- Computation of maximum limit, minimum limit for clearance fit, interface fit
- Standard grades of tolerances.

STANDARDS MEASUREMENTS

- Introduction
- Standards – line standard, end standards, wave length standard.
- Classification of standards, gauge control structure

TYPES AND CLASSIFICATION OF

- Linear measurements
- Comparators
- Sensing elements
- Transducers
- Strain gauges
- Speed measurement
- Acceleration measurement
- Temperature measurements
- Pressure measurement
- Flow measurement
- Level measurement

Subject 3. Thermal Engineering

BASIC THERMO DYNAMICS

- Definition of thermodynamics system.
- Definition of terms such as system, boundary, surrounding.
- Classifications of thermo dynamic systems and thermal equilibrium – closed system, open system isolated system.
- Review of the terms-pressure (absolute and gauge), volume, temperature, heat, density, force, work, power, energy, STP, NTP, vacuum, specific volume, internal energy, enthalphy, entropy.
- Review of Zeroth, first and second laws of thermo-dynamics T-diagram.
- Review of the laws of perfect gasses-Boyle's law. Charle's law, characteristics gas of equation, gas constant, universal gas constant, specific heats.
- Internal energy.
- Properties and classification of system-extensive and intensive properties.
- Concept of perfect.
- Thermodynamics processes – explanation of P.V. Diagram, derivation of work done and formulae for heat added and internal energy, constant volume pressure process, isothermal process, adiabatic isentropic process, polytropic process, throttling process, solving simple problems on above.

AIR CYCLES

- Heat engine and its types.
- Thermal efficiency of a heat engine cycle.
- Air standard efficiency of a neat engine cycle.
- Air standard efficiency of a cycle.
- Thermo dynamic reversibility.
- Carnot cycle.
- Otto cycle.
- Diesel cycle.
- Dual combustion cycle
- Applications of above cycles.
- Solving problems on above.
- Fuel air cycles or real cycles as applied to I.C. engines.

PROPERTIES OF STEAM

- Introduction to basic thermal units
- Formation of steam-definition of dryness fraction
- Properties of steam
- Internal latent heat and internal energy
- External work done and enthalpy

ELEMENTS OF HEAT TRANSFER

- Introduction methods of heat transfer
  Conduction, Convection, Radiation, Newton's law of cooling

Fourier's law of heat conduction and thermal conductivity

- Heat transfer by conduction through a thick homogeneous wall (slab) and simple problems.
- Heat transfer by conduction through a flat composite wall and simple problems.
- Radial heat transfer by conduction through a hollow cylinder and simple problems
- Heat exchangers i. Parallel flow ii. Counter flow

I. Planck's law ofemission
II. Stefan Boltsman law of total radiation
III. Kirchoff's law

- Concept of black body and grey body
- Emissivity and absorptivity and their relationship

Subject 4. Pneumatics & Hydraulics - Fundamentals and circuit design

BASICS OF PNEUMATICS

Properties of Air, Economy application, Physical foundation unit of pressure.

BASIC OF HYDRAULICS

Comparison between Pneumatic & Hydraulics, Hydraulic oil – its characteristics – viscosity, viscosity index etc., application of Pascal's evolution and Bernoulli's theorem, laminar and turbulent flow, Reynolds number, losses in pipes, valves and fittings.

PNEUMATIC COMPONENTS

Generation of Air pressure, Compressors, types – Pneumatic actuators : Motors, Cylinders, Oscillator, Types of construction – Filter, Regulator, Lubricator Unit – Air control valves, construction details – Direct Control valves : types, construction details, specification depending on number of parts and position – Check valves, flow control valves, its logics construction – Introduction to Electro Pneumatics.

HYDRAULIC POWER ACTUATORS

Source of Hydraulic Power : Pump, Pumping Theory, types of positive displacement pumps; Gear Pump, vane Pump[, Axial piston pump, Rotary piston pump; Construction, working of Pump, Pump performances (adjustment of radial and axial clearances) – Reservoirs, Fluid Filters : Types, pressure gauge; Construction, gauge connection, snubber, fluid conditioner, flow gauges – power actuators – hydraulic Cylinders; Types SA, DA, tandem, Rod less, Telescopic, Rotary actuators, gear Vane and Piston motors – Pressure Control valves, pressure regulating valves, Sequence valves – Counter pressure & Counter Balancing Application, Constructional Details Types – Directional Control valves : Types, construction, 3 Position DC valves, Different types of Zero configuration – Flow Control Valve

– Construction and types like Plain, pressure compensated, temperature compensated, Remote control etc., Check valves - Hydraulic Pipes and Hoses : Flexible hoses; Selection, screwed fittings (Ermeto Fittings), quick coupling, etc. – Seals and Packings – Introduction to electro hydraulics – Safety aspects when dealing with hydraulic circuits.