

GOTT SERIES (CBT) – BASIC AUTOMOTIVE TECHNOLOGY

Model Number : GOTT-AUTOMOTIVE-M10



DESCRIPTION

Auto101 course module is about the rapidly changing technology that ushers the auto industry into the new millennium which including electronically controlled systems such as fuel injection, distributorless ignitions, transmissions, transaxles, anti-lock brakes, active suspension and traction control units. A combination of theory & virtual shop “hands-on” training and experience are all vital components for today’s technician. In order to ease down the referencing resources in this course module; it is incorporated with some features like, Search, Book Mark, Note Creator and Vocabulary Pronunciation Assistant. Below is the list of the chapters covered in this course module with its associated sub-topics:-



GOTT SERIES : COMPUTER BASED TRAINING SYSTEM (CBT) – BASIC AUTOMOTIVE TECHNOLOGY



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Summary

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Below is the list of the chapters covered in this course module with its associated sub-topics:-

CHAPTERS

COMPUTER AIDED ENGINEERING

- Sub-Topics :**
- Describe techniques that can be used to perform conversions of design data between disparate systems.
 - Define downstream applications that can leverage the CAD geometry database.
 - Use CAM software to convert CAD data into tool paths for Computer Numerical Control machine tools.
 - Define and describe computer-aided prototyping techniques that can be used to enhance design quality and compress the product development cycle.
 - Describe methods that can be used to select appropriate CAD/CAM hardware and software systems based on technical and organizational constraints

ADVANCED MANUFACTURING PROCESSES & MATERIALS

- Sub-Topics :**
- Use of ferrous and non-ferrous materials in engineering applications. Analysis of the relative merits of metallic materials.
 - Application and processing of polymer materials. Use of thermo plastic and thermoset materials, Blow Moulding, Vacuum forming Techniques as well as conventional injection moulding.
 - Ceramic properties, processing and their usage in automotive engineering
 - Knowledge of all types of engineering composites from fibre reinforced polymeric systems to metal matrix composites. Their appropriate application and advantages in engineering applications will be discussed together with their manufacturing processes.
 - Metal Casting Processes , powder metallurgy and Sheet-metal forming techniques will be emphasized
 - The use and application of advanced machining technology and joining technology will be discussed.
 - Use of computer-based material selection package (e.g. Cambridge Engineering Selector) to determine optimum material and manufacturing techniques for specific applications.

POWER TRAIN

- Sub-Topics :**
- **Power Plant**
Engine types and operation; design and operating parameters; induction, in cylinder gas motion and exhaust; spark ignition and compression ignition engine characteristics; pollutant formation and control; engine heat transfer; factors affecting performance (eg valving, EGR, GDI, VVT and manifold optimisation); hybrid power plants. Engine Performance and Testing.
 - **Transmission**
Transmission rationale; effect on fuel economy; clutch sizing and actuation; gearbox design, evolution and ratio selection; mechanical, automatic and semi-automatic gearboxes and control systems; CVT; final drives and traction control.
 - **Cooling System**
Component description and characteristics; fan, water pump, heat exchanger, grill, inlet plenum, under bonnet and air outlet; cooling system design; engine heat to water, cooling pack airflow distribution, coolant heat exchanger sizing, system evaluation under standard driving conditions.

NOISE VIBRATION & HARSHNESS

- Sub-Topics :**
- **NVH context in the Automotive Industry**
 - Sources of noise and vibration, design features, Decibel scale, analytical tools
 - **NVH Theory Essentials**
 - Single DOF systems: natural frequency, modal damping, transient and frequency responses, resonance, transmissibility and isolation.
 - Multi DOF systems: eigenvalues and eigenvectors, modal participation, mode management in vehicles.
 - Acoustics: standing and traveling waves, impedance concepts, resonances, transmissibility and absorption
 - **FEA and Optimization**
 - Large mass concept, Frequency response solutions, Design drivers for NVH, Case studies of chassis and brake disk optimization
 - **Test Facilities and Instrumentation**
 - Sampling, aliasing and resolution. Statistical analysis. Frequency analysis. Campbell's plots, cascade diagrams, coherence and correlation functions.
 - **Transferable Skills**
 - Source ranking. Noise path analysis. Modal analysis. Parametric testing and Taguchi techniques. Optimisation of dynamic characteristics. Vibration absorbers and Helmholtz resonators. Active control techniques.

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VEHICLE DYNAMICS, HANDLING & SIMULATION

- Sub-Topics :**
- Typical suspension configurations, double wishbone system, McPherson strut suspension system
 - Use of analytical, graphical and rig measurements for the determination of camber angle, bump steer, caster angle, wheel rate, instantaneous centres, roll centres
 - The use of multibody systems, analysis (MBS) in vehicle dynamics, suspension modelling techniques, reference frames, inertial and mass properties, constraint elements, joint library, degree of freedom calculations, modelling springs, dampers and bushes as linear and non-linear force elements
 - The use of industry standard software (ADAMS) for suspension analysis, tyre modelling and vehicle handling simulation
 - Tyre force and moment theory, SAE tyre co-ordinate system, vertical force characteristics, stiffness and damping, lateral force and aligning moment as a function of slip and camber angle, braking and tractive force, slip ratio, rolling resistance, conicity, ply steer, calculation of tyre kinematics and geometry using vectors
 - Tyre testing, external drum, internal drum, flat belt, over the road tyre modelling techniques, interpolation methods, the 'Delft' tyre model, the Fiala tyre model
 - Computer simulation of vehicle handling manoeuvres, lane changes, control responses, steady state cornering using simplified vehicle-modelling techniques
 - Design study applications varying mass properties roll centres, road surface conditions, tyre design parameters, influence on lateral acceleration, yaw rate, roll angle and vehicle trajectory

VEHICLE AERODYNAMICS

- Sub-Topics :**
- Revision of fluid mechanics; compressible and incompressible flows, flow patterns, governing equations of fluid dynamics, boundary layers and wakes.
 - Introduction to computational fluid dynamics, Navier-Stokes equations, turbulence and turbulence modeling.
 - Aerodynamic fundamentals; aerodynamic forces and moments and their effect on vehicle stability.
 - Design features of vehicle exterior and their effect on aerodynamic performance of road vehicles.
 - Experimental methods for testing aerodynamic performance of road vehicles, dimensional analysis, and wind tunnels for vehicle aerodynamics.
 - Wind tunnel testing, instrumentation and assessment of model performance.
 - Computational methods for evaluating aerodynamic performance of road vehicles.

FINITE ELEMENT ANALYSIS

- Sub-Topics :**
- **Practical Finite Element Modelling**
Use of commercial finite element codes. Model definition within a pre-processor. Results interrogation and model validation within a post-processor. Model definition via node and element patterns. Model definition via solid modelling and meshing techniques. Mesh quality and adaptive meshing.
 - **Heat Transfer Finite Element Analysis**
Introduction to fundamental heat transfer theory. Finite element solution of steady-state and transient heat transfer problems including practical work.
 - **Dynamic Finite Element Analysis**
Introduction to fundamental vibration theory. Finite element determination of natural frequencies and mode shapes. Modal analysis. Solution of practical problems.
 - **Finite Element Theory**
Introduction to the Finite Element Method: Revision of essential topics in Mechanics of Solids. Development of stiffness matrices for simple structural elements such as tension-compression and beam elements, and for basic continuum plane-stress and plane strain elements. Discussion of further continuum elements such as plate bending, shell, axi-symmetric three-dimensional elements and isoparametric elements. Assembly of element stiffness matrices to form the global stiffness matrix, application of boundary conditions and discussion of solution procedures to solve system equations. Numerical Integration. Equivalent nodal loading

Structures Safety & Impact

- Sub-Topics :**
- Shear panel and edge member analysis of simplified vehicle structures including the Bredt-Batho torsion theory.
 - The application of finite element methods to shell and beam structures (ANSYS).
 - Theories of impact and energy absorption.
 - The legislative requirements and test procedures for occupant protection
 - The use of non-linear analysis packages (MADYMO and LS Dyna) to simulate vehicle collision, advanced restraint systems, airbags for occupant protection and pedestrian impact and related tests.
 - The development of legislation and test procedures aimed at providing improved levels of pedestrian impact protection.
 - Injury mechanisms for occupants and pedestrians
 - The use of non-linear finite element and multibody systems analysis (MADYMO) to simulate pedestrian impactor test procedures and real world pedestrian impact scenarios.
 - The development of advanced vehicle systems, such as adaptable car structures (ACS) for future pedestrian impact protection.

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MODERN AUTOMOTIVE SYSTEMS

- Sub-Topics :**
- **Introduction to Automotive Industry and Modern Automotive Systems**
Introduction to Modern Automotive Systems and need for electronics in Automobiles, Application areas of electronics in the automobiles, Possibilities and challenges in the automotive industry, Enabling technologies and Industry trends.
 - **Spark and Compression Ignition Engines**
Engine Control Functions, Fuel Control, Calculation of Injector pulse width and Injection strategies, Lambda Control, Ignition Timing Control, Engine Control Modes, Engine Control Diagnostics, Ignition Systems, Fuel Delivery Systems, Fuel Injection Systems.
 - **Transmission Control**
Introduction to Electronic Transmission Control, Shift Point Control, Lockup Control/Torque Converter Clutch, Engine Torque Control during shifting, Safety and Diagnostic Functions, Improvement of shift quality.
 - **Braking Control**
Vehicle Braking Fundamentals, Vehicle Dynamics during Braking, Brake System Components, Introduction to Antilock Braking Systems, Antilock Components, and Control Logic.
 - **Steering Control**
Fundamentals of Electronically Controlled Power Steering, Types, Electronically Controlled Hydraulic System, Hybrid Systems, Electric power steering.
 - **Automotive Electronics for passenger safety**
Air Bag and Seat Belt Pretensioner Systems: Principal Sensor Functions, Distributed Front Air Bag sensing systems, Single-Point Sensing systems, Side-Impact Sensing, and Future Occupant Protection systems.
 - **Passenger Comfort and Convenience Systems**
Introduction to Passenger Convenience Systems, Electromechanical Seat, Seat Belt Height, Steering Wheel, and Mirror Adjustments, Central Locking Systems, Tire Pressure Control Systems, Electromechanical Window Drives, etc.
 - **Overview of Fuel Cell and Hybrid Vehicles**

AUTOMOTIVE RISK & RELIABILITY ANALYSIS

- Sub-Topics :**
- Concept of safety, risk and reliability; risk analysis; As Low As Reasonably Practicable (ALARP) criteria, principles and best practice.
 - Top-down approach in risk and reliability analysis.
 - Bottom-up approach in risk and reliability analysis.
 - Probabilistic risk and reliability analysis techniques (PRA).
 - Non-probabilistic risk and reliability analysis techniques (non-PRA).
 - Application of AI and approximate logic approaches in risk and reliability analysis.
 - Workshop: work in groups to apply one of risk and reliability analysis techniques to analyse an automotive component such as engine system, braking system, electrical system, suspension system, exhaust system etc.

Manuals :

- (1) All manuals are written in English
- (2) Model Answer
- (3) Teaching Manuals

General Terms :

- (1) Accessories will be provided where applicable.
- (2) Manual & Training will be provided where applicable.
- (3) Design & specifications are subject to change without notice.
- (4) We reserve the right to discontinue the manufacturing of any product.

Warranty :

2 Years

ORDERING INFORMATION :

ITEM	MODEL NUMBER	CODE
(CBT) BASIC AUTOMOTIVE TECHNOLOGY	GOTT-AUTOMOTIVE-M10	820-209

* Proposed design only, subject to changes without any notice.