HRODC Postgraduate Training Institute

A Postgraduate-Only Institution

#210

Advanced Automotive Computerized Engine Controls, Transmissions and Vehicle Controller Area Network

Programme

Leading To:

POSTGRADUATE DIPLOMA IN

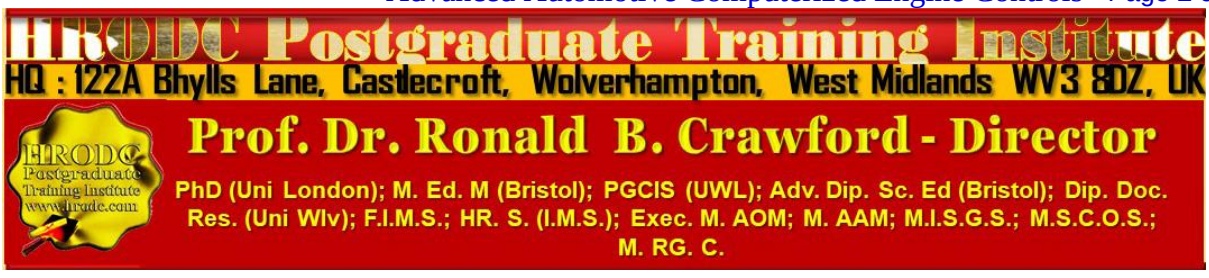
Advanced Automotive Computerized Engine Controls, Transmissions and Vehicle Controller Area Network

HRODC Postgraduate Training Institute
HQ : 122A Bhylls Lane, Castlecroft, Wolverhampton, West Midlands WV3 8DZ, UK
Prof. Dr. Ronald B. Crawford - Director
PhD (Uni London); M. Ed. M (Bristol); PGCIS (UWL); Adv. Dip. Sc. Ed (Bristol); Dip. Doc. Res. (Uni Wlv); F.I.M.S.; HR. S. (I.M.S.); Exec. M. AOM; M. AAM; M.I.S.G.S.; M.S.C.O.S.; M. RG. C.

Programme Coordinator:

Prof. Dr. R. B. Crawford is the Director of HRODC Postgraduate Training Institute, A Postgraduate-Only Institution. He has the following Qualifications and Affiliations:

- Doctor of Philosophy {(PhD) {University College London (UCL) - University of London)};
- MEd Management (University of Bath);
- Postgraduate (Advanced) Diploma Science Teacher Ed. (University of Bristol);
- Postgraduate Certificate in Information Systems (University of West London, formerly Thames Valley University);
- Diploma in Doctoral Research Supervision, (University of Wolverhampton);
- Teaching Certificate;



- Fellow of the Institute of Management Specialists;
- Human Resources Specialist, of the Institute of Management Specialists;
- Member of the Asian Academy of Management (MAAM);
- Member of the International Society of Gesture Studies (MISGS);
- Member of the Standing Council for Organisational Symbolism (MSCOS);
- Member of ResearchGate;
- Executive Member of Academy of Management (AOM). There, his contribution incorporates the judging of competitions, review of journal articles, and guiding the development of conference papers. He also contributes to the Disciplines of:
    - Human Resources;
    - Organization and Management Theory;
    - Organization Development and Change;
    - Research Methods;
    - Conflict Management;
    - Organizational Behavior;
    - Management Consulting;
    - Gender & Diversity in Organizations; and
    - Critical Management Studies.

Professor Dr. Crawford has been an Academic in the following UK Universities:

- University of London (Royal Holloway), as Research Tutor;
- University of Greenwich (Business School), as Senior Lecturer (Associate Professor), in Organisational Behaviour and Human Resource Management;
- University of Wolverhampton, (Wolverhampton Business School), as Senior Lecturer (Associate Professor), in Organisational Behaviour and Human Resource Management;
- London Southbank University (Business School), as Lecturer and Unit Leader.

His responsibilities in these roles included:

- Doctoral Research Supervisor;
- Admissions Tutor;
- Postgraduate and Undergraduate Dissertation Supervisor;
- Programme Leader;
- Personal Tutor

For Whom This Course is Designed

This Programme is Designed For:

- Automotive Electrical Engineering;
- Automotive Electrical Engineers;
- Automotive Engineers;
- Automotive Mechanics;
- Automotive Service Engineers;
- Automotive Technicians;
- Automotive Transmission Engineers;
- Automotive Transmission Technicians;
- Automotive Wiring Engineers;
- Electrical Engineers;
- Mechanical Engineers;
- Modern Motor Vehicle Importers;
- Modern Vehicle Controller Area Network (CAN) Engineers;
- Modern Vehicle Controller Area Network (CAN) Specialists;
- Modern Vehicle Controller Area Network (CAN) Technicians;
- Moto Vehicle Assemblers;
- Moto Vehicle Repairers;
- Motor Vehicle Diagnostic Engineers;
- Motor Vehicle Diagnostic Technicians;
- Motor Vehicle Distribution Managers;
- All others seeking expertise in Advanced Automotive Electrical, Electronic, Mechanical, Transmissions, Engine Control Engineering, and Modern Vehicle Controller Area Network (CAN).

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Classroom-Based Duration and Cost:	
Classroom-Based Duration:	12 Weeks (5 Days per Week)
Classroom-Based Cost:	£45,000.00 Per Student
Online (Video-Enhanced) Duration and Cost	
Online Duration:	20 Weeks – 3 Hours Per Day, 6 Days Per Week
Online Cost:	£30,150.00 Per Student

Classroom-Based Programme Cost includes:

- Free Continuous snacks throughout the Event Days;
- Free Hot Lunch on Event Days;
- Free City Tour;
- Free Stationery;
- Free On-site Internet Access;
- Postgraduate Diploma/ Diploma – Postgraduate –or
- Certificate of Attendance and Participation – if unsuccessful on resit.

Students and Delegates will be given a Selection of our Complimentary Products, which include:

- **Our Branded Leather Conference Folder**;
- **Our Branded Leather Conference Ring Binder/ Writing Pad;**
- **Our Branded Key Ring/ Chain**;
- **Our Branded Leather Conference (Computer – Phone) Bag – Black or Brown**;
- **Our Branded 8-16 GB USB Flash Memory Drive**, **with Course Material;**
- **Our Branded Metal Pen;**
- **Our Branded Polo Shirt**.;
- **Our Branded Carrier Bag**.

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Daily Schedule: 9:30 to 4:30 pm.

Delivery Locations:

1. **Central London, UK;**
2. **Dubai, UAE;**
3. **Kuala Lumpur, Malaysia;**
4. **Amsterdam, The Netherlands;**
5. **Brussels, Belgium;**
6. **Paris, France; and**
7. **Durban, South Africa;**
8. **Other International Locations, on request.**

Advanced Automotive Computerized Engine Controls, Transmissions and Vehicle Controller Area Network				
Leading to Postgraduate Diploma in Advanced Automotive Computerized Engine Controls, Transmissions and Vehicle Controller Area Network				
Module Number	**Pre-existing Course #**	**Module Title**	**Page #**	**Credit Value**
210.M1		Automotive Computerised Engine Controls	7	Quad Credit
210.M2		Advanced Automotive Transmissions	14	6-Credit
210.M3		Modern Vehicle Controller Area Network (CAN)	25	Double

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Advanced Automotive Computerized Engine Controls, Transmissions and Vehicle Controller Area Network, Programme

Leading to Postgraduate a Postgraduate Diploma in Advanced Automotive Computerized Engine Controls, Transmissions and Vehicle Controller Area Network

Programme Contents, Concepts and Issues

Module 1
Automotive Computerised Engine Controls, Leading to Diploma-Postgraduate in Automotive Computerised Engine Controls (Quad Credit)

M1. Part 1 – Understanding Electricity and Electronics

- Electrical Circuits versus Electronic Circuits;
- Electron Theory;
- Electrical Theory;
- Electrical Circuits;
- Polarity;
- Circuit Faults;
- Semiconductors;
- Integrated Circuits;
- The Digital Age.

M1. Part 2 – Computers in Cars

- Importance of Computers in Cars;
- How Computers Work;
- Engine Computer;
- Controlling Exhaust Gasses;

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- Closed-Loop and Open-Loop Operation;
- The PCM and Exhaust Emissions;
- Attributes and Characteristics of a Technician;
- System Diagnosis and Service.

M1. Part 3 – Components for Computerised Engine Control Systems

- Common Features;
- Sensing Devices;
- Actuators;
- System Diagnosis and Service.

M1. Part 4 – Operating Principles for Computerised Engine Control Systems

- Fuel Volatility and Fuel Octane;
- Electronic Fuel Injection System Operating Principles;
- Ignition System Operating Principles;
- Emission-Control Systems;
- Variable Valve Timing;
- 42-V Systems.

M1. Part 5 – Concepts of Diagnostics

- Types of Faults;
- Diagnostic Trouble Codes;
- Data Streams;
- Functional Tests;
- Technical Service Bulletins;
- Pinpoint Testing;
- Flowcharts;

- Electrical Schematics;
- Other General Diagnostic Concepts.

M1. Part 6 – Equipment Used in Diagnostic Work

- Scan Tools;
- Breakout Boxes;
- Non-Powered Test Lights;
- Logic Probes;
- Digital Volt-Ohmmeters;
- Digital Storage Oscilloscopes;
- Safety Considerations When Using a DVOM or DSO;
- Gas Analysers.

M1. Part 7 – Exhaust Gas Analysis

- Gas Analysis Theory;
- Measured Gasses;
- Gas Analysers;
- Diagnosing with the Gasses.

M1. Part 8 – Conceptualising OBD II

- CARB/EPA/SAE/OBD Background;
- Importance of OBD II;
- Functions of OBD II;
- Standardisation;
- Monitoring Conditions;
- Setting DTCs and Turning on the Mil;
- Diagnostic Management Software;
- OBD II Monitors;

- Cold Start Emissions Reduction;
- Diagnostic Equipment.

M1. Part 9 – Principles of Multiplexing

- Multiplexing Overview;
- Multiplex System Designs;
- Multiplexing Protocols;
- Communication on a J1850 VPW Data Bus;
- Communication on a CAN Data Bus;
- Multiplexing Variations;
- Other Bosch Protocols;
- Diagnosis of Multiplexed Circuits.

M1. Part 10 – General Motors' Electronic Fuel Injection

- Powertrain Control Module;
- Operating Modes;
- Inputs;
- Fuel Management Systems;
- Idle Speed Control;
- Spark Management Systems;
- Emmission Control Systems;
- Other PCM-Controlled Systems;
- Body Control Module;
- System Diagnosis and Service;
- PCM, PROM, CALPAK Service.

M1. Part 11 – General Motors and Port Fuel Injection

- Powertrain Control Module;
- Operating Modes;
- Fuel Supply System;
- Injectors;
- Throttle Body;
- Non-PCM Emission Controls;
- Inputs;
- Outputs;
- System Diagnosis and Service.

M1. Part 12 – Advanced General Motors Engine Controls

- Northstar Engine Overview;
- Northstar Inputs/Outputs;
- Cadillac LH2 Northstar Upgrades;
- Cadillac HFV6;
- GM Generation III Small-Block V8s;
- GM Generation IV Small-Block V8s;
- GM Active Fuel Management System;
- Flywheel Alternator Starter System;
- Belt Alternator Starter System;
- GM Voice-Recognition/Navigational System;

System Diagnosis and Service.

M1. Part 13 – Ford's Electronic Engine Control IV (EEC IV)

- Powertrain Control Module;
- Operating Modes;
- Inputs;
- Fuel Management Systems;
- Idle Speed Control;
- Spark Management Systems;
- Emission Control Systems;
- Other PCM-Controlled Systems;
- System Diagnosis and Service.

M1. Part 14 – Ford's Electronic Engine Control V (EEC V)

- Engine Controls;
- Inputs;
- Fuel Management Systems;
- Idle Speed Control;
- Ignition Systems;
- Emission Control Systems;
- Advanced Ford Computer System Features;
- Body Control Modules;
- Voice Recognition/Navigational Systems;
- Advanced TracTM Systems;
- Ecoboost Engine;
- CVPI Fire-Suppression System;
- System Diagnosis and Service.

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M1. Part 15 – Chrysler Corporation Fuel Injection Systems

- Powertrain Control Module;
- Inputs;
- Fuel Management Systems;
- Idle Speed Control;
- Spark Management Systems;
- Emission Control Systems;
- Other PCM-Controlled Systems;
- Chrysler Multiplexing Systems;
- Advanced Chrysler Electronic Systems;
- System Diagnosis and Service.

M1. Part 16 – European (Bosch) Engine Control Systems

- System Overview;
- Continuous Injection System;
- Pulsed Systems;
- Motronic;
- Electronic Control Unit;
- Operating Modes;
- Bosch OBD II Update;
- System Diagnosis and Service.

M1. Part 17 – Asian Computer Control Systems

- Nissan: Electronic Concentrated Control System;
- System Diagnosis and Service;
- Toyota Computer-Controlled System (TCCS);
- System Diagnosis and Service;
- Honda: Programmed Fuel Injection;

- Honda's VTEC Systems;
- System Diagnosis and Service.

M1. Part 18 – Alternative Power Sources

- Honda Insight, Civic, and Accord Hybrids;
- Toyota Hybrid System;
- Ford Escape Hybrid;
- Allison Two-Mode Hybrids;
- Fuel Cell Vehicles;
- Flexible Fuel Vehicles;
- System Diagnosis and Service.

M1. Part 19 – Approach to Diagnostics

- Narrowing Down the Area of the Problem;
- Pinpoint Testing;
- Diagnosing Intermittent Symptoms;
- Testing Catalytic Converters;
- EVAP System Tests;
- Diagnosing Air/Fuel Ratio problems;
- Diagnosing an Emission Test Failure;
- Reprogramming a Computer;
- Essential Tools of Electronic System Diagnosis;
- Other Diagnosis Resources.

Module 2
Advanced Automotive Transmissions, Leading to Diploma Postgraduate in Advanced Automotive Transmissions (6-Credit)

M2. Part 1 – Evolution of Automotive Transmissions

- Development of Automotive Transmissions:
  - Innovations;
  - Development of Vehicles and Drive Units;
  - Stages in the Development of Automotive Transmissions;
  - Development of Gear-Tooth Systems and other;
  - Transmission Components;
  - Development of Torque Converters and Clutches;
  - Investigation of Phenomena: Transmission Losses and Efficiency;
  - Historical Overview.

M2. Part 2 – Traffic – Vehicle – Transmission System

- Principles of Traffic and Vehicle Engineering:
  - The Significance of Motor Vehicles in our Mobile World;
  - Trends in Traffic Engineering;
  - Passenger and Goods Transport Systems;
  - Alternative Transport Concepts.
- The Market and Development Situation for Vehicles, Gearboxes and Components:
  - Market Situation and Production Figures;
  - Development Situation.
- Basic Elements of Vehicle and Transmission Engineering:
  - Systematic Classification of Vehicles and Vehicle Use;
  - Why do Vehicles Need Gearboxes?;
  - Main and Auxiliary Functions of Vehicle Transmissions, Requirements Profile;
  - Interrelations: Direction of Rotation, Transmission Ratio, Torque;

- Road Profiles, Load Profiles, Typical Vehicle Use and Driver Types;
- Fundamental Performance Features of Vehicle Transmissions;
- Service Life and Reliability of Transmissions;
- Centre Distance Characteristic Value;
- Gearbox Mass Characteristic Value;
- Gearbox Cost Characteristic Value;
- Gearbox Noise;
- Gearbox Losses and Efficiency;
- Trends in Transmission Design

M2. Part 3 – The Power Flow

- Power Requirement:
  - Wheel Resistance;
  - Adhesion, Dynamic Wheel Radius and Slip;
  - Air Resistance;
  - Gradient Resistance;
  - Acceleration Resistance;
  - Total Driving Resistance;
  - Efficiency Map.
- Diversity of Prime Movers:
  - Overview;
  - Electric Drive with Electric Energy Accumulator;
  - Electric Drive with Fuel Cell;
  - Hybrid Drive.
- Power Output, Combustion Engine Characteristic:
  - Torque/Engine Speed Characteristic;
  - Engine Spread, Throttle Map;
  - Consumption Map.

M2. Part 4 – Power Conversion: Selecting the Ratios

- Powertrain;
- Total Ratio and Overall Gear Ratio:
  - Overall Gear Ratio i_G,tot;
  - Selecting the Largest Powertrain Ratio $i_{A,max;}$
  - Selecting the Smallest Powertrain Ratio $i_{A,min;}$
  - Final Ratio.
- Selecting the Intermediate Gears:
  - Velocity/Engine-Speed Diagram;
  - Geometrical Gear Steps;
  - Progressive Gear Steps.
- Ratio Variation in Continuously Variable Transmissions.

M2. Part 5 – Matching Engine and Transmission

- Traction Diagram:
  - Deriving a Traction Diagram (Example);
  - Engine Braking Force;
  - Geared Transmission with Dry Clutch;
  - Geared Transmission with Torque Converter.
- Vehicle Performance:
  - Maximum Speed;
  - Climbing Performance;
  - Acceleration Performance.
- Fuel Consumption:
  - Calculating Fuel Consumption (Example);
  - Determining Fuel Consumption by Measurement;
  - Reducing Fuel Consumption;
  - Continuously Variable Transmissions.
- Emissions;
- Dynamic Behaviour of the Powertrain, Comfort.

M2. Part 6 – Vehicle Transmission Systems: Basic Design Principles

- Arrangement of the Transmission in the Vehicle:
  - Passenger Cars;
  - Commercial Vehicles;
  - All-Wheel Drive Passenger Cars;
  - Transverse and Longitudinal Dynamics with All-Wheel Drive.
- Transmission Formats and Designs:
  - Transmission Format;
  - Transmission Design.
- Basic Gearbox Concept:
  - Shifting with Power Interruption;
  - Shifting without Power Interruption;
  - Continuously Variable Transmissions without Power Interruption.
- Gear Sets with Fixed Axles, Countershaft Transmissions and Epicyclic Gears;
- Solution Principles for Part Functions, Evaluation:
  - Reverse Gear as Example.
- Passenger Car Transmissions:
  - Manual Passenger Car Transmissions (MT);
  - Automated Manual Passenger Car Transmissions (AMT);
  - Dual Clutch Passenger Car Transmissions (DCT);
  - Automatic Passenger Car Transmissions (AT);
  - Passenger Car Hybrid Drives;
  - Continuously Variable Passenger Car Transmissions (CVT).
- Commercial Vehicle Transmissions:
  - Manual Commercial Vehicle Transmissions (MT);
  - Automated Manual Commercial Vehicle Transmissions (AMT);
  - Commercial Vehicle Torque Converter Clutch Transmissions (TCCT);
  - Automatic Commercial Vehicle Transmissions (AT);
  - Commercial Vehicle Hybrid Drives;
  - Continuously Variable Commercial Vehicle Transmissions (CVT);

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- Final Drives;
- Axle Drives for Passenger Cars;
- Axle Drives for Commercial Vehicles;
- Differential Gears and Locking Differentials;
- Hub Drives for Commercial Vehicles;
- Transfer Gearboxes.

- Power Take-Offs.

M2. Part 7 – Design of Gearwheel Transmissions for Vehicles

- Gearwheel Performance Limits:
  - Causes and Types of Damage;
  - Calculating the Tooth Root Load Capacity;
  - Calculating the Pitting Load Capacity;
  - Calculating the Scuffing Load Capacity.
- Estimating Centre Distance;
- Estimating Face Widths;
- Operational Fatigue Strength and Service Life:
  - The Wohler Curve;
  - Load Profile and Counting Procedure;
  - Damage Accumulation Hypothesis;
  - Developing Low-Noise Transmissions;
  - Transmission Noise and Its Causes;
  - How Noise Reaches the Ear;
  - Assessment Criteria;
  - Countermeasures.

M2. Part 8 – Specification and Design of Shafts

- Typical Requirements in Vehicle Transmissions:
  - Configuration of Shafts in Vehicle Transmissions;
  - Designing for Stress and Strength;
  - Deflection;
  - Vibration Problems.
- General Design Guidelines;
- Transmission Drive Shaft Strength Design:
  - Loading;
  - Bearing Reactions;
  - Spatial Beam Deflection;
  - Shear Force and Bending Moment Diagrams;
  - Critical Cross-Section;
  - Stresses;
  - Preliminary Specification of the Shaft Diameter;
  - Designing for Endurance Strength;
  - Designing for Operational Fatigue Strength;
  - Common Shaft Materials.
- Calculating Deformation;
- Flow Chart for Designing Transmission Shafts.

M2. Part 9 – Gear-shifting Mechanisms

- Systematic Classification of Shifting Elements:
  - Shifting Elements for Transmissions with Power Interruption;
  - Shifting Elements for Transmissions without Power Interruption;
  - Shift-by-Wire.
- Layout and Design of Synchronizers:
  - Synchronizer Functional Requirements;
  - The Synchronizing Process;

- Design of Synchronizers;
- The Tribological System of Synchronizers;
- Engineering Designs;
- Alternative Transmission Synchronizers;
- Detail Questions.

➢ Layout and Design of Multi-Plate Clutches:

- Multi-Plate Clutch Requirements;
- The Shifting Process;
- Design of Multi-Plate Clutches;
- Tribological System of Multi-Plate Clutches;
- Engineering Designs;
- Detail Questions.

➢ Parking Locks:

- Mechanically Activated Parking Locks;
- Electrically Activated Parking Locks;
- Detail questions.

M2. Part 10 – Moving-Off Elements

➢ Dry Clutches:

- Structure of Dry Clutches;
- Design of Dry Clutches;
- Dry Multi-Plate Clutches.

➢ Wet Clutches;

➢ Dual Clutches;

➢ Hydrodynamic Clutches and Torque Converters:

- Principles;
- Hydrodynamic Clutches and their Characteristic Curves;
- Torque Converters and their Characteristic Curves;
- Engine and Torque Converter Working Together;
- Practical Design of Torque Converters;
- Engineering Designs;
- Design Principles for Increasing Efficiency.

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M2. Part 11 – Design and Configuration of Further Design Elements

- Bearings:
  - Selecting Rolling Bearings;
  - Rolling Bearing Design;
  - Design of Rolling Bearings;
  - Plain Bearings – Bearing Bushes and Thrust Washers.
- Lubrication of Gearboxes, Gearbox Lubricants:
  - Bearing Lubrication;
  - Principles of Lubricating Gearwheel Mechanisms;
  - Selecting the Lubricant;
  - Selecting Lubricant Characteristics;
  - Lifetime Lubrication in Vehicle Gearboxes;
  - Testing the Scuffing Resistance of Gearbox Lubricants.
- Oil Supply and Oil Pumps:
  - Oil Supply;
  - Oil Pumps;
  - Detail Questions.
- Gearbox Housing:
  - Gearbox Housing Design;
  - Venting Gearboxes.
- Gearbox Sealing:
  - Seals for Static Components;
  - Seals for Rotating Components;
  - Seals for Reciprocating Round Components;
  - Practical Examples;
  - Final Inspection for Detecting Leakage.
- Vehicle Continuous Service Brakes:
  - Definitions;
  - Engine Braking Systems;
  - Retarders.
- Actuation and Use.

M2. Part 12 – Typical Designs of Vehicle Transmissions

- Passenger Car Transmissions:
  - Manual Passenger Car Transmissions (MT);
  - Automated Manual Passenger Car Transmissions (AMT);
  - Dual Clutch Passenger Car Transmissions (DCT);
  - Automatic Passenger Car Transmissions (AT);
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  - Commercial Vehicle Torque Converter Clutch Transmissions (TCCT);
  - Automatic Commercial Vehicle Transmissions (AT);
  - Commercial Vehicle Hybrid Drives;
  - Continuously Variable Commercial Vehicle Transmissions (CVT).
- Final Drives:
  - Axle Drives for Passenger Cars;
  - Axle and Hub Drives for Commercial Vehicles;
  - Differential Gears and Locking Differentials;
  - All-Wheel Drives, Transfer Gearboxes.

M2. Part 13 – Electronic Transmission Control

- Networked Systems;
- Electronic Transmission Control Unit (TCU):
  - TCU Structure;
  - Operating Conditions and Constructions Technologies.
- Control Systems:
  - Transmission Actuator;
  - Clutch Actuator;

- Transmission Control Functions;
- Software;
- Examples of Transmission Control Systems.

- Transmission Calibration with Vehicle-Specific Software Data Input.

M2. Part 14 – Computer-Aided Transmission Developments

- Principles and Tools;
- Driving Simulation.

M2. Part 15 – The Automotive Transmission Development Process

- Product Life Cycle;
- Product Strategy, Product Planning;
- Release Stages in the Product Development Process;
- The Design Process and Systematic Design.

M2. Part 16 – Transmission Manufacturing Technology

- Process Chains for Steel Part Processing;
- Process Chains for Cast Part Processing;
- Process Chains for Gear Machining;
- Process Chains for Sheet Metal Machining;
- Manufacturing and Factory Management.

M2. Part 17 – Reliability and Testing of Automotive Transmissions

- Principles of Reliability Theory;
- Reliability Analysis of Vehicle Transmissions;
- Testing to Ensure Reliability.

Module 3
Modern Vehicle Controller Area Network (CAN), Leading to Diploma Postgraduate in Modern Vehicle Controller Area Network (CAN) (Double Credit)

M3. Part 1 – Automotive Communication Systems or Networks

- Automotive inter-module communication systems or networks;
- Asian, Domestics and European Vehicles;
- Fully Networked vehicles;
- THE NEED FOR IN-VEHICLE NETWORKING;
- Use of electrical and electronic components;
- Networked automotive sensors;
- Sharing of sensor information;
- Weight savings and the simpler wiring harnesses;
- Networking and modular systems.

M3. Part 2 – Protocols

- CAN or Controller Area Network communication protocol;
- CLASS A - Low speed;
- CLASS B - Medium speed;
- CLASS C - High speed;
- SAE (Society of Automotive Engineers);
- ISO (International Standards Organization);
- What is a Gateway?.

M3. Part 3 – Networking Essentials

- The 7-layer ISO/OSI reference model;
- PHYSICAL LAYER;
- DATA LINK LAYER;

- APPLICATION LAYER;
- The Node Oriented and Message Oriented (Producer-Consumer) protocols;
- Medium Access.

M3. Part 4 – Carrier Sense Multiple Access or CSMA

- Network latency;
- The Topology of a network;
- The STAR topology;
- The BUS topology;
- The TREE topology;
- The RING topology.

M3. Part 5 – Different Communication Network

- The CCD data bus (Chrysler Collision Detection);
- CCD bus ground;
- CCD bus bias voltage;
- OEM scan tool (DRB III);
- NO TERMINATION message fault;
- The PCI bus (Programmable Communications Interface);
- A CSMA/CD media access scheme;
- The Header, DATA, CRC, IFR and EOF elements;
- DCL (Data Communications Link);
- circuit 914 and 915;
- SCP (J1850) (Standard Corporate Protocol);
- Dual wire twisted pair bus topology;
- The ISO 9141 protocol;
- The NGS "DATA LINK DIAGNOSTICS" menu option;
- GM (Data Line) UART Serial Communications;
- UART data line communications;

- GM CLASS 2 data bus;
- State of health messages;
- The Tech-2 scanner has a dynamic menu configuration;
- The Tech-2's PING-ALL-MODULES;
- CAN (Controller Area Network);
- implementation of the CAN protocol;
- 11 bit and 29 bit identifier;
- EPA approved for MY 2003 and up;
- CAN A, B and C;
- MID and PID CAN Identifiers;
- Master time-keeper-node;
- Drive-by-wire systems;
- Byteflight, Flexray, and Time-triggered CAN orTTCAN;
- The CAN Data-Frame;
- Recessive (high) or dominant (low) CAN communication;
- The CAN bus-access arbitration;
- SOF (start-of-frame) bit;
- Control bit;
- Arbitration bits;
- Data bits;
- EOF or end of frame bit.

Postgraduate Diploma, Postgraduate Certificate, and Diploma – Postgraduate - Short Course Regulation

Postgraduate Certificate, Postgraduate Diploma, and Diploma – Postgraduate: Their Distinction, Credit Value and Award Title

Postgraduate Short Courses of a minimum of five days' duration, are referred to as Diploma – Postgraduate. This means that they are postgraduate credits, towards a Postgraduate Certificate and Postgraduate Diploma. Postgraduate Certificate and Postgraduate Diploma represent Programmes of Study, leading to Awards bearing their title prefixes. While we, refer to our short studies, of 5 days to five weeks, as 'Courses', those with duration of 6 weeks and more are labelled 'Programmes'. Nevertheless, in line with popular usage, we often refer to all study durations as 'Courses'. Another mark of distinction, in this regard, is that participants in a short course are referred to as 'Delegates', as opposed to the term 'Students', which is confined to those studying a Postgraduate Programme.

Courses are of varying Credit-Values; some being Single-Credit, Double-Credit, Triple-Credit, Quad-Credit, 5-Credit, etc. These short courses accumulate to Postgraduate Certificate, with a total of 180 Credit-Hours (= 6 X 5-Day Courses or 3 X 10-Day Courses), or Postgraduate Diploma, with a total of 360 Credit-Hours (= 12 X 5-Day Courses or 6 X 10-Day Courses).

Delegates studying courses of 5-7 days' duration, equivalent to 30-42 Credit-Hours (Direct Lecturer Contact), will, on successful assessment, receive the Diploma – Postgraduate Award. This represents a single credit at Postgraduate Level. While 6-day and 7-day courses also lead to a Diploma – Postgraduate, they accumulate 36 and 42 Credit Hours, respectively.

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Postgraduate Certificate, Postgraduate Diploma, and Diploma – Postgraduate Assessment Requirement

Because of the intensive nature of our courses and programmes, assessment will largely be in-course, adopting differing formats. These assessment formats include, but not limited to, in-class tests, assignments, end of course examinations. Based on these assessments, successful candidates will receive the Diploma – Postgraduate, Postgraduate Certificate, or Postgraduate Diploma, as appropriate.

In the case of Diploma – Postgraduate, a minimum of 70% overall pass is expected. In order to receive the Awards of Postgraduate Certificate and Postgraduate Diploma, candidates must have accumulated at least the required minimum 'Credit-Hours', with a pass (of 70% and above) in at least 70% of the courses taken.

Delegates and students who fail to achieve the requirement for Postgraduate Certificate, Postgraduate Diploma, or Diploma - Postgraduate - will be given support for 2 re-submissions for each course. Those delegates who fail to achieve the assessment requirement for the Postgraduate Diploma or Diploma - Postgraduate - on 2 resubmissions, or those who elect not to receive them, will be awarded the Certificate of Attendance and Participation.

Diploma – Postgraduate, Postgraduate Certificate, and Postgraduate Diploma Application Requirements

Applicants for Diploma – Postgraduate – Postgraduate Certificate, and Postgraduate Diploma are required to submit the following documents:

- Completed Postgraduate Application Form, including a passport sized picture affixed to the form;
- A copy of Issue and Photo (bio data) page of the applicant's current valid passport or copy of his or her Photo-embedded National Identity Card;
- Copies of credentials mentioned in the application form.

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Admission and Enrolment Procedure

- On receipt of all the above documents we will assess applicants' suitability for the Course or Programme for which they have applied;
- If they are accepted on their chosen Course or Programme, they will be notified accordingly and sent Admission Letters and Invoices;
- One week after the receipt of an applicant's payment or official payment notification, the relevant Course or Programme Tutor will contact him or her, by e-mail or telephone, welcoming him or her to HRODC Postgraduate Training Institute;
- Those intending to study in a foreign country, and require a Visa, will be sent the necessary immigration documentation, to support their application;
- Applicants will be notified of the dates, location and venue of enrolment and orientation, where appropriate.

Modes of Study and Duration of Postgraduate Certificate and Postgraduate Diploma Programmes

There are two delivery formats for Postgraduate Certificate and Postgraduate Diploma Programmes, as follows:

1. Intensive Full-time (Classroom-Based) Mode, lasting 3 months for Postgraduate Diploma, and 6 weeks for Postgraduate Certificate. These durations are based on six hours' lecturer-contact per day, five days (30 hours) per week, for Postgraduate Diploma;
2. Video-Enhanced On-Line Mode. This interactive online mode lasts twenty (20) weeks, for Postgraduate Diploma, and ten (10) weeks for Postgraduate Certificate. Our calculation is based on three hours per day, six days per week.

Whichever study mode is selected, the aggregate of 360 Credit Hours must be achieved.

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Introducing Our Video-Enhanced Online Study Mode

In a move away from the traditional online courses and embracing recent developments in technology-mediated distance education, HRODC Postgraduate Training Institute has introduced a Video-Enhanced Online delivery. This Online mode of delivery is revolutionary and, at the time of writing, unique to HRODC Postgraduate Training Institute.

You are taught as individuals, on a one-to-one or one-to-small-group basis. You see the tutor face to-face, for the duration of your course. You will interact with the tutor, ask and address questions; sit examinations in the presence of the tutor. It is as real as any face-to-face lecture and seminar can be. Choose from a wide range of Diploma – Postgraduate Courses and an increasing number of Specialist Postgraduate Certificate and Postgraduate Diploma Programmes. You might also accumulate Postgraduate Short Courses, via this mode of study, over a 6-year period, towards a Postgraduate Certificate or Postgraduate Diploma.

Key Features of Our Online Study: Video-Enhanced Online Mode

- The tutor meets the group and presents the course, via Video, in a similar way to its classroom-based counterpart;
- All participants are able to see, and interact with, each other, and with the tutor;
- They watch and discuss the various video cases and demonstrations that form an integral part of our delivery methodology;
- Their assessment is structured in the same way as it is done in a classroom setting;
- The Video-Enhanced Online mode of training usually starts on the 1st of each month, with the cut-off date being the 20th of each month, for inclusion the following month;
- Its duration is twice as long as its classroom-based counterpart. For example, a 5-day (30 Credit Hours) classroom-based course will last 10 days, in Video-Enhanced Online mode. This calculation is based on 3 hours tuition per day, adhering to the Institute's required 30 Credit-Hours;
- The cost of the Video-Enhanced Online mode is 67% of similar classroom-based courses;

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- For example, a 5-day classroom-based course, which costs Five Thousand Pounds, is only Three Thousand Three Hundred and Fifty Pounds (£3,350.00) in Video-Enhanced Online Mode.

10-Week Video-Enhanced Online Postgraduate Certificate and 20-Week Video-Enhanced Online Postgraduate Diploma

You might study an Online Postgraduate Certificate or Online Postgraduate Diploma, in 10 and 20 weeks, respectively, in the comfort of your office or homes, through HRODC Postgraduate Training Institute's Video-Enhanced Online Delivery. We will deliver the 180 Credit-Hours and 360 Credit-Hours, in line with our regulation, through 'Direct-Lecturer-Contact', within the stipulated timeframe. We aim to fit the tuition around your work, family commitment and leisure, thereby enhancing your maintenance of an effective 'work-study-life-style balance', at times convenient to you and your appointed tutor.

Cumulative Postgraduate Certificate and Postgraduate Diploma Courses

All short courses can accumulate to the required number of Credit-Hours, for the Postgraduate Certificate and Postgraduate Diploma, over a six-year period from first registration and applies to both general and specialist groupings. In this regard, it is important to note that short courses vary in length, the minimum being 5 days (Diploma – Postgraduate) – equivalent to 30 Credit Hours, representing one credit, as is tabulated below.

On this basis, the definitive calculation on the Award requirement is based on the number of hours studied (aggregate credit-value), rather than merely the number of credits achieved. This approach is particularly useful when a student or delegate studies a mixture of courses of different credit-values.

For those delegates choosing the accumulative route, it is advisable that at least one or two credits be attempted each year. This will ensure that the required 180 Credit-Hours and 360 Credit-Hours, for the Postgraduate Certificate and Postgraduate Diploma, respectively, are

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achieved, within the designated period. These Credit-Values, awards and their accumulation are exemplified below.

Examples of Postgraduate Course Credits: Their Value, Award Prefix & Suffix – Based on 5-Day Multiples		
Credit Value	**Credit Hours**	**Award Title Prefix (& Suffix)**
Single-Credit	30-54	Diploma - Postgraduate
Double-Credit	60-84	Diploma – Postgraduate (Double-Credit)
Triple-Credit	90-114	Diploma – Postgraduate (Triple-Credit)
Quad-Credit	120-144	Diploma – Postgraduate (Quad-Credit)
5-Credit	150-174	Diploma – Postgraduate (5-Credit)
6-Credit	180-204	Postgraduate Certificate
7-Credit	210-234	Postgraduate Certificate (+ 1 Credit)
8-Credit	240-264	Postgraduate Certificate (+2 Credits)
9-Credit	270-294	Postgraduate Certificate (+3 Credits)
10-Credit	300-324	Postgraduate Certificate (+ 4 Credits)
11-Credit	330-354	Postgraduate Certificate (+5 Credits)
12-Credit	360	Postgraduate Diploma
360 Credit-Hours = Postgraduate Diploma		
12 X 5-Day Courses = 360 Credit-Hours = Postgraduate Diploma		
10 X 6-Day Courses = 360 Credit-Hours = Postgraduate Diploma		

Exemplification of Accumulated Postgraduate Certificate and Postgraduate Diploma Award Titles

All Specialist Postgraduate Certificate and Postgraduate Diploma Programmes have their predetermined Award Titles. Where delegates do not follow a Specialism, for accumulation to a Postgraduate Diploma, they will normally be Awarded a General Award, without any Specialist Award Title. However, a Specialist Award will be given, where a delegate studies

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at least seventy percent (70%) of his or her courses in a specialist grouping. These are exemplified below:

1. **Postgraduate Diploma in Accounting and Finance;**
2. **Postgraduate Certificate in Accounting and Finance;**
3. **Postgraduate Certificate in Aviation Management;**
4. **Postgraduate Diploma in Aviation Management;**
5. **Postgraduate Certificate in Industrial Health and Safety Management, Incorporating Oil and Gas Safety;**
6. **Postgraduate Diploma in Industrial Health and Safety Management, Incorporating Oil and Gas Safety;**
7. **Postgraduate Certificate in Business Communication;**
8. **Postgraduate Diploma in Business Communication;**
9. **Postgraduate Certificate in Corporate Governance;**
10. **Postgraduate Diploma in Corporate Governance;**
11. **Postgraduate Certificate in Costing and Budgeting;**
12. **Postgraduate Diploma in Costing and Budgeting;**
13. **Postgraduate Certificate in Client or Customer Relations;**
14. **Postgraduate Diploma in Client or Customer Relations;**
15. **Postgraduate Certificate in Engineering and Technical Skills;**
16. **Postgraduate Diploma in Engineering and Technical Skills;**
17. **Postgraduate Certificate in Events Management;**
18. **Postgraduate Diploma in Events Management;**
19. **Postgraduate Certificate in Health and Safety Management;**
20. **Postgraduate Diploma in Health and Safety Management;**
21. **Postgraduate Certificate in Health Care Management;**
22. **Postgraduate Diploma in Health Care Management;**
23. **Postgraduate Certificate in Human Resource Development;**
24. **Postgraduate Diploma in Human Resource Development;**
25. **Postgraduate Certificate in Human Resource Management;**
26. **Postgraduate Diploma in Human Resource Management;**

27. **Postgraduate Certificate in Information and Communications Technology (ICT);**
28. **Postgraduate Diploma in Information and Communications Technology (ICT);**
29. **Postgraduate Certificate in Leadership Skills;**
30. **Postgraduate Diploma in Leadership Skills;**
31. **Postgraduate Certificate in Law – International and National;**
32. **Postgraduate Diploma in Law – International and National;**
33. **Postgraduate Certificate in Logistics and Supply Chain Management;**
34. **Postgraduate Diploma in Logistics and Supply Chain Management;**
35. **Postgraduate Certificate in Management Skills;**
36. **Postgraduate Diploma in Management Skills;**
37. **Postgraduate Certificate in Maritime Studies;**
38. **Postgraduate Diploma in Maritime Studies;**
39. **Postgraduate Certificate in Oil and Gas Operation;**
40. **Postgraduate Diploma in Oil and Gas Operation;**
41. **Postgraduate Certificate in Oil and Gas Accounting;**
42. **Postgraduate Diploma in Oil and Gas Accounting;**
43. **Postgraduate Certificate in Politics and Economic Development;**
44. **Postgraduate Diploma in Politics and Economic Development;**
45. **Postgraduate Certificate in Procurement Management;**
46. **Postgraduate Diploma in Procurement Management;**
47. **Postgraduate Certificate in Project Management;**
48. **Postgraduate Diploma in Project Management;**
49. **Postgraduate Certificate in Public Administration;**
50. **Postgraduate Diploma in Public Administration;**
51. **Postgraduate Certificate in Quality Management;**
52. **Postgraduate Diploma in Quality Management;**
53. **Postgraduate Certificate in Real Estate Management;**
54. **Postgraduate Diploma in Real Estate Management;**

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55. **Postgraduate Certificate n Research Methods;**
56. **Postgraduate Diploma in Research Methods;**
57. **Postgraduate Certificate in Risk Management;**
58. **Postgraduate Diploma in Risk Management;**
59. **Postgraduate Certificate in Sales and Marketing;**
60. **Postgraduate Diploma in Sales and Marketing;**
61. **Postgraduate Certificate in Travel, Tourism and International Relations;**
62. **Postgraduate Diploma in Travel, Tourism and International Relations.**

The actual courses studied will be detailed in a student or delegate's Transcript.

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