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VI Semester B.E. Examination
(Electronics and Communication Engineering)
Automotive Electronics (17EECC305)

Duration: 3 hours   **Max. Marks: 100**

Note: *i)* *Answer any TWO full questions from UNIT-I, any TWO full questions from UNIT-II and any ONE full question from UNIT-III.*

UNIT-I

1 a. What is stoichiometric ratio? For an engine operating in closed loop mode, how the variation in exhaust gas recirculation, air fuel ratio and ignition timing affect its performance. Show with necessary plots. (08marks)

    b. Explain different subsystems of automotive vehicles and also explain about automotive value chain. (06marks)

    c. Imagine the vehicle is running at a fixed rpm 10000 and further the driver demands for increase in speed. How the engine management system handles driver's request using ignition timing? Suggest a suitable instrumentation system with related electronics for closed loop control of ignition timing. (06marks)

2 a. What is ride and handling of an automobile? Suggest and explain the suitable control system, which provides a solution to compromise between ride and handling. (08marks)

    b. Suggest and explain hybrid vehicle power train systems, which combines low emissions of an electric vehicle and performance capabilities of IC engine powered car. (06marks)

    c. If the vehicle longitudinal acceleration is zero,

      I) Calculate wheel slip if the vehicle speed is matching with wheel speed.

      II) calculate wheel slip for front left and front right wheels for which the speed is measured as 800 rpm and 1000 rpm respectively with wheel radius is 0.2 m, when the vehicle speed is 68 kph.

      III) Calculate wheel slip when panic braking is done at 160 kph and the ABS is shutdown due to pump failure. (06marks)

3 a. The BMW 3 series car has eight cylinder engine with its displacement of 120 cubic inches, and the mass air air flow is to be calculated for every second to control the air fuel ratio at stoichiometry using η_v=0.95 and d_a=1.225 kg/m^3 with no EGR flow rate. Determine the fuel quantity and fuel injector activation duration during the intake stroke to run the warmed up and engine cranking with engine speed 5000 rpm. (08marks)

    b. Describe the control system, which provides a solution for wheel spinning and discuss the related control functions with brake circuit configuration. (06marks)

    c. Suggest and explain the suitable control mode, when the throttle angle reaches its closed position and engine rpm falls below a preset value, and also discuss the role of PI and PID controller in throttle control. (06marks)

UNIT-II

4 a. The designer needs to choose a magnetic reluctance senor or Hall effect sensor for measuring the engine speed. Justify your choice and also explain the construction and working principle for the chosen measurement technique. (08marks)

b. Calculate nominal and maximum T_{Header}, $T_{Response}$ and T_{Frame}, if LIN is operating at 10 Kbps baud rate and reserved time is set to 30% for transmitting two bytes of data. (06marks)

c. Explain the construction and working principle of solenoid value and exhaust gas recirculation actuator. (06marks)

5 a. Suggest and explain the suitable sensor and actuator used for closed loop operation of an engine control system to maintain the desired air/fuel ratio. (08marks)

b. Compare event driven and time triggered communication strategies. Discuss with a scenario, how FlexRay incorporates both of these strategies in the protocol. (06marks)

c. What are the individual channels of MOST and what kind of information is shared therein? Determine how the data 101001110010 is transmitted. (06marks)

6 a. Answer the following with respect to CAN communication.
I) Explain the data frame.
II) The CAN node receives the message as 10111101, detect whether the received information is error free or not. Assume CRC with a generator polynomial as 1011.
III) What solution CAN protocol offers for bus overloading.
IV) Explain bit stuffing and CRC. (08marks)

b. Explain the construction and working principle of MAP sensor. (06marks)

c. Why do media oriented devices need networking? Describe frame format for MOST25. (06marks)

UNIT-III

7 a. Assume that the driver has activated the cruise control switch for the desired speed of 100 kph. For the following condition determine the action of throttle controlle by the suitable control algorithm,
I) If the car is traveling on a level road.
II) If the car is to enter a long hill with steady positive slope.
III) If the car is entering to the road with steady negative slope. (08marks)

b. Propose the ADAS architecture and solution for,
I) traffic sign recognition system.
II) Parking assistance system. (06marks)

c. Describe the automotive safety standard ISO 26262 and explain ASIL levels. (06marks)

8 a. Discuss the role of on-board diagnostics in automotive vehicles. A 2003 Audi A8 was having a problem with rough running, which was causing the engine management light to illuminate, list the possible faults. (08marks)

b. Discuss the features of diagnostic protocol KWP2000. (06marks)

c. Explain the diagnostic tools for automotive vehicles. (06marks)