**VI Semester B.E. Examination**

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**17EECC305**

**July\_2021**

**(Electronics and Communication Engineering)**

**Automotive Electronics (17EECC305)**

**Duration: 1hr 30 min Max. Marks: 50**

**Note:** ***i) Answer any TWO full questions from Q.No. 1, 2 & 3 and ONE full question from Q. No. 4 & 5***

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| **PART-I** | | | | Marks | PI |
| 1 | a. | What is stochiometric ratio? Calculate Lambda if air fuel ratio is 12.2. Derive the expression for determining fuel injector pulse duration (base pulse width Tw) for open loop and closed loop modes using speed-density method of computing mass air flow rate. | | 8M |  |
|  | b. | Imagine the vehicle is running at a fixed rpm of 8000 and further the driver demands for increase in speed; How the engine ECU handles driver’s request using ignition timing? Suggest a suitable Instrumentation system with related electronics for closed loop control of ignition timing. | | 6M |  |
|  | c. | Explain the need for EGO Sensor. Draw the schematic of EGO Sensor and analyze the output for rich and lean mixtures. | | 6M |  |
| 2 | a. | The BMW 3 series car, eight-cylinder engine with its displacement of 121.86 cubic inches. The mass air flow is to be calculated for every second to control the air fuel ratio at stoichiometry using volumetric efficiency ηv=0.95, da=1.225 kg/m3 with no EGR rates. Determine the fuel injector activation duration during the intake stroke to run the warmed-up engine at 5000 rpm. Estimate the fuel injector pulse duration the changes to be done for the engine working in warm-up condition. | | 8M |  |
|  | b. | Why idle speed control is necessary for an engine? Explain its  configuration with a necessary block diagram. | | 6M |  |
|  | c. | For the development of an Engine ECU, apply MBD approach adhering to automotive V design model. | | 6M |  |
| 3 | a. | The designer needs to choose between a magnetic reluctance sensor and Hall Effect Sensor for measuring the engine speed. Justify your choice, and also propose a schematic for the chosen measurement technique. | | 8M |  |
|  | b. | An engine operating in closed loop mode how the  variations in,  i) Exhaust gas recirculation  ii) Air fuel ratio and  iii) Ignition timing  Affect its performance. Show with the necessary plots. | | 6M |  |
|  | c. | Discuss how secondary air injection system regulates air supply to EMS with respect to different operating conditions? | | 6M |  |
| 4 | a. | | Describe the physical reasons why a car could skid or experience wheel lock when braking. Also, discuss the best wheel lock prevention control method.  i) Calculate the wheel slip if vehicle speed is matching with  wheel speed?  ii)Calculate wheel slip for Fl(Front left) and Fr(Front right), for which the wheel rpm is measured as 2000 rpm and 2200 rpm with wheel radius as 0.3 m, when vehicle speed is 68 kph.  iii) Calculate wheel slip when panic braking is done at 150kph and ABS is shut down due to pump failure? | 8M |  |
|  | b. | | What are the individual channels of MOST and what kind of information is transported therein? What is the coding technique used in MOST Physical layer? Determine how the data 10100111001 is transmitted. | 6M |  |
|  | c. | | Assume that the driver has activated the cruise control switch set for the desired speed of (say, 60 mph). For the following conditions, determine the action of throttle controlled by the suitable control algorithm;  i) If the car is travelling on a level road  ii) If the car is then to enter a long hill with a steady positive slope (i.e. a hill going up). | 6M |  |
| 5 | a. | | Answer the following with respect to CAN communication   1. Message prioritization in case of CAN protocol. 2. Difference between Classical CAN and CAN FD 3. Physical signal transmission 4. What is the data seen by the CAN bus for the following condition?   C:\Users\giree\Desktop\New Microsoft PowerPoint Presentation21.jpg | 8M |  |
|  | b. | | Describe the control system which provides a solution for wheel spinning, and discuss the related control functions. | 6M |  |
|  | c. | | What do you mean by over steering and under steering, with the necessary break circuit configuration demonstrate how electronic stability program (ESP) counteracts the over steering and understanding condition? | 6M |  |
| 6 | a. | | For the Communication schedule shown below, draw the  i) FlexRay cluster and  ii) Respective communication cycle. | 8M |  |
|  | b. | | Compare the two communication strategies, event-driven and time-triggered. Explain to the scenario how Flexray combines these two techniques into a single protocol. | 6M |  |
|  | c. | | 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 four bytes of data. | 6M |  |
| 7 | a. | | Describe the safety standard ISO 26262. An OEM defines an item as ABS, the system for avoiding wheel lock condition and skidding during hard/panic braking. Perform Hazard analysis and risk assessment in-terms of ASIL and estimate the risk or consequence likelihood. | 10M |  |
|  | b. | | Explain SAE levels of autonomous driving and name the OEM, which has achieved SAE Level-3. | 10M |  |
| 8 | a. | | Discuss the objectives of on-board diagnostics. A 2022 Audi A8 was having a problem with rough running which in turn was causing the engine management light to illuminate. List the possible faults. | 10M |  |
|  | b. | | During cold cranking the air/fuel ratio is not able to be controlled. List the possible faults.  Discuss the features of diagnostic protocol KWP2000. | 10M |  |