

Enrollment No.....



Faculty of Engineering
End Sem Examination Dec-2023
AU3CO32 Hybrid Vehicles

Programme: B.Tech.

Branch/Specialisation: AU

Duration: 3 Hrs.**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- Q.1 i. Maximum vehicle speed of EV is determined by- 1
- (a) $V_{max} = \frac{\pi N_m \max r_d}{30 i_{g \min} i_0} \left(\frac{m}{s} \right)$ (b) $V_{max} = \frac{\pi N_m \min r_d}{30 i_{g \min} i_0} \left(\frac{m}{s} \right)$
- (c) $V_{max} = \frac{\pi N_m \max r_d}{30 i_{g \max} i_0} \left(\frac{m}{s} \right)$ (d) $V_{max} = \frac{\pi N_m \min r_d}{30 i_{g \max} i_0} \left(\frac{m}{s} \right)$
- ii. Vehicle performance factor is the ratio of- 1
- (a) $d = (F_t - F_w) / M_v g$ (b) $d = (F_t + F_w) / M_v g$
- (c) $d = M_v g / (F_t - F_w)$ (d) $d = M_v g / (F_t + F_w)$
- iii. The leakage current is the ratio of- 1
- (a) Electric potential to the dielectric leakage resistance
- (b) Dielectric leakage resistance to the electric potential
- (c) Electric resistance to the electric potential
- (d) Electric potential to the electric resistance
- iv. Capacitors rated voltage with a non-aqueous electrolyte has been about- 1
- (a) 2.3 to 3.3 V (b) 0.9 to 1.1 V
- (c) 2.0 to 2.5 V (d) None of these
- v. In a single-phase half-wave thyristor circuit with R load & $V_s = V_m \sin \omega t$, the maximum value of the load current can be given by- 1
- (a) $2V_m/R$ (b) V_s/R (c) $V_m/2$ (d) $V_s/2$
- vi. The charger current should be set so that the average current- 1
- (a) $I_{battery} = I_{charger} - I_{system}$ (b) $I_{battery} = I_{charger} + I_{system}$
- (c) $I_{battery} = I_{system} - I_{charger}$ (d) $I_{battery} = I_{charger} / I_{system}$

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- vii. In an induction motor, rotor slots are usually not quite parallel to the shaft but are given a slight skew- **1**
 (a) To reduce the magnetic hum
 (b) To reduce the locking tendency of the rotor
 (c) To increase the speed of the motor
 (d) To reduce the magnetic hum and locking tendency of rotor
- viii. What will happen, with the increase in speed of a DC motor? **1**
 (a) Back emf increase but line current falls
 (b) Back emf falls and line current increase
 (c) Both back emf as well as line current increase
 (d) Both back emf as well as line current fall
- ix. What do mean by run-down? **1**
 (a) Stop functioning (b) Fall down
 (c) Go down (d) Start functioning
- x. What happens in coasting mode of an electric traction? **1**
 (a) Continuous power is provided by the electric drive to maintain the locomotive speed
 (b) The power supply is cut-off the train is allowed to run with its own inertia
 (c) Electric drive accelerates the motor from stand still condition to the rated speed
 (d) Regenerative braking is provided to recover the energy from locomotive
- Q.2 i. What is the need and importance of EV and HEV vehicle? **3**
 ii. Describe the current state of the art of EV / HEV technology along with technology challenges associated it. **7**
- OR iii. Explain performance parameters of vehicle. **7**
- Q.3 i. What is Peukert capacity of a battery? What is its significance in EV applications? **4**
 ii. Elaborate on batteries and super-capacitors as energy source elements in electric and hybrid electric vehicles. **6**
- OR iii. Explain the basic principle of fuel cell and its constructional working with its neat diagram. **6**
- Q.4 Attempt any two:
 i. Describe the battery charging methods used in EV / HEV in details. **5**
 ii. Explain the design of Z-converter for battery charging. **5**

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- iii. Explain bi-directional DC-DC converter working. **5**
- Q.5 i. Explain the working principal of BLDC motor. **4**
 ii. Explain configuration and control of reluctance motor drive. **6**
- OR iii. Explain the propulsion system for EV and HEV with neat sketch. **6**
- Q.6 Attempt any two:
 i. Explain the drive train arrangement of series hybrid electric system used in hybrid vehicle. **5**
 ii. What are the advantages of hybrid electric vehicle over electric vehicle? **5**
 iii. What is “Power Rating” for electric vehicle? Explain type of power rating used in electric motor. **5**
