

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)

CLASS: B.TECH  
BRANCH: EEE

SEMESTER : VII  
SESSION : MO/2022

SUBJECT: EE585 HYBRID ELECTRIC VEHICLE

TIME: 3:00 Hours

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|--------|---|-----|-----|-----|
| Q.1(a) | Explain the social impacts of hybrid electric vehicles in brief.  | [2] | CO2 | BL2 |
| Q.1(b) | Highlight the main motives for the development of hybrid electric vehicle.  | [3] | CO2 | BL1 |
| Q.1(c) | Mention the advantages and challenges of hybrid electric vehicle design.  | [5] | CO1 | BL2 |
| Q.2(a) | Draw and explain the ideal traction power plant characteristic.   | [2] | CO2 | BL2 |
| Q.2(b) | Explain various types of transmission in a vehicle.   | [3] | CO1 | BL2 |
| Q.2(c) | Derive the dynamic equations of a vehicle motion along the longitudinal direction and also derive the expression of the maximum tractive effort of the vehicle. | [5] | CO2 | BL3 |
| Q.3(a) | Define specific fuel consumption and volumetric efficiency.   | [2] | CO3 | BL1 |
| Q.3(b) | Draw and explain the pressure vs. volume diagram of the 4S SI internal combustion engine.   | [3] | CO3 | BL1 |
| Q.3(c) | Explain with a neat sketch diagram the operating principle of the 4S SI internal combustion engine.   | [5] | CO3 | BL2 |
| Q.4(a) | Write the expression for battery power output for both motoring and braking in the case of an electric vehicle.   | [2] | CO2 | BL1 |
| Q.4(b) | Draw and explain briefly the six possible electric vehicle configurations.  | [3] | CO3 | BL1 |
| Q.4(c) | Derive the expression for total tractive power required for accelerating the vehicle of mass $M$ from zero to final speed $V_f$ in time $t_a$ seconds.          | [5] | CO2 | BL3 |
| Q.5(a) | Draw and explain the different architectures of a hybrid electric drive train.  | [2] | CO3 | BL1 |
| Q.5(b) | With the help of a neat diagram, describe the possible power flow for a two power train of a hybrid electric drive train.                                       | [3] | CO3 | BL1 |
| Q.5(c) | Draw and explain the configuration of the parallel hybrid electric drive train and mention its different modes of operation.                                    | [5] | CO3 | BL1 |

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