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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22

Course Code: EEE 319

Course Name: Electric Vehicles (Discipline Elective-II)

Program & Sem: B.Tech EEE & VI

Date: 26th April 2022

Time: 1:30 PM to 2:30 pm

Max Marks: 30

Weightage: 15%

Instructions:

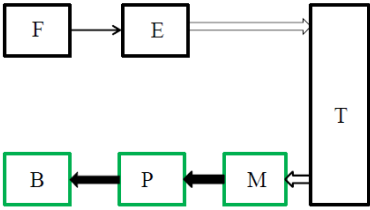
- (i) Read the all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries THREE marks. (3Qx 3M= 9M)

Q.NO.1. Most commonly, the propulsion force in HEV is provided by a combination of electric motor and an ICE. State a simple HEV drive train system which is used in passenger cars and buses. List at least 2 reasons for the same. (C.O.No.1) [Bloom’s level: Knowledge]

Q.NO. 2. Due to the variations in HEV configurations, different power control strategies are necessary to regulate the power flow to or from different components. Identify the operating mode of the following parallel hybrid system. (C.O.No.1) [Bloom’s level: Knowledge]



Q.NO. 3. A case study provides a general approach for assessing the combined technical–economical–environmental benefits of transportation options. This analysis showed that the hybrid and electric cars have advantages over the others. The economics and environmental impact associated with use of an electric car depends significantly on the source of the electricity: Which of the following conditions are true i. If electricity is generated from renewable energy sources, the electric car is advantageous to the hybrid vehicle. ii. If the electricity is generated from fossil fuels, the electric car remains competitive only if the electricity is generated onboard. iii. If the electricity is generated with an efficiency of 50–60% by a gas turbine engine connected to a high-capacity battery and electric motor, the electric car is superior in many respects. (C.O.No.1) [Bloom’s level: Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries SIX marks.

(2Qx6M=12M)

Q.NO.4. A hybrid drivetrain can supply its power to the load by a selective power train. There are many available patterns of operating two power trains to meet the load requirement. Being Put yourself as a control engineer and illustrate of possible ways of combining the power flow to meet the driving requirements of Hybrid drive train system.

(C.O.No.1) [Bloom's level: Comprehension]

Q.NO.5. Mr. Ruther wants to convert his existing internal combustion engine vehicle (ICEV) into an electric vehicle (EV) by replacing the internal combustion engine and fuel tank with an electric motor drive and battery pack while retaining all the other components. Mr. Ruther asked you because you know about the electric vehicles. Explain the way you are going to respond to Mr. Ruther with necessary discussion.

(C.O.No.1) [Bloom's level: Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carries NINE marks.

(1Qx9M=9M)

Q.NO. 6. Mr. Suman is travelling from Chennai to Bangalore in a Hyundai Kona electric car at speed of 90 kilometer per hour with the drag coefficient of 0.23, frontal area of 5 meter square, air density of 1.25 kg per meter cube and the energy available in the batteries is 30 kilo Watt hour. The distance needs to be covered by him is approximately 340 Km. Estimate whether Mr. Suman will reach his destination or not with the above conditions. If not, with an aiding wind of 15 kilometer per hour is it possible to reach? Defend your answer. [9M]
(C.O.No. 2) [Bloom's level: Comprehension]



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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 2

Winter Semester: 2021 - 22

Course Code: EEE 319

Course Name: Electric Vehicles (Discipline Elective-II)

Program & Sem: B.Tech EEE & VI

Date: 1st June 2022

Time: 1:30 PM to 2:30 PM

Max Marks: 30

Weightage: 15%

Instructions:

- (i) *Read the all questions carefully and answer accordingly.*
- (ii) *Question paper consists of 3 parts.*
- (iii) *Scientific and Non-programmable calculators are permitted*

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries two marks.

(5Qx 2M= 10M)

1. When a vehicle goes up or down a slope, its weight produces a component of force that is always directed downwards. This force component ----- the forward motion, i.e. the grade climbing. When the vehicle goes down the grade, this force component ----- the vehicle motion. (C.O.No.2) [Bloom's level: Knowledge]
- a. opposes, aids b. aids, opposes c. opposes, opposes d. aids, aids
2. The rolling resistance coefficient, f_r , is a function of the tire material, tire structure, tire temperature, tire inflation pressure, tread geometry, road roughness, road material, and presence or absence of liquids on the road. The rolling resistance is [2M] (C.O.No.2) [Bloom's level: Knowledge]
- a. affected less at low speeds b. having week relation with speed
- c. no relation between speed and rolling resistance d. no effect at all
3. The depth of discharge (DOD) is the fraction of battery capacity that can be used from the battery and will be specified by the manufacturer. If the SoC is 75%, it means [2M] (C.O.No.3) [Bloom's level: Knowledge]
- a. the battery is charged 1/4 and the depth of discharge is 25%
- b. the battery is discharge charged 3/4 and the State of charge is 25%
- c. the battery is charged 3/4 and the depth of discharge is 25%
- d. None of the above

4. The torque T_w required to drive the wheel is obtained by directly mounting a motor on the differential or by using a gear box or by using a chain drive to magnify the lesser torque to the torque that is needed to drive the wheel. The wheel torque T_w is

(C.O.No.2) [Bloom's level: Knowledge]

- a. Wheel force * wheel radius b. Wheel Force*velocity
c. Velocity*Wheel radius d. wheel force*square of wheel radius
5. "Energy storages" are defined as devices that store energy, deliver energy outside (discharge), and accept energy from outside (charge). For a 25kWh battery 0.1 C rate implies push in / pull out of powerin ----- minutes

[C.O.No.3] [Bloom's level: Knowledge]

- a. 2.5kW,600 / 25kW, 60 b. 2.5kW/2.5 kW, 600 min
c. 2.5kW/2.5 kW, 60 min d. 25 kW, 60 min/ 2.5 kW,600 min

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries five marks.

(2Qx5M=10M)

6. Mr. Antony is working on go-kart project at Presidency University. He worked out on chassis part, and designing part. Now he wanted to select a battery for his vehicle and he is not having any idea about batteries which he wanted to purchase. Mr. Antony approached you regarding the selection of battery. Explain the way you are going to guide him, so that he will be able to choose a battery from variety of batteries.

(C.O.No.3) [Bloom's level: Comprehension]

7. Mr. Kiser got a project from his faculty in which he is supposed to find out the number of cells which are present in a Lithium ion battery with a terminal voltage of 48V, 3 Ah capacity, motor power of 6kW, an efficiency of 0.98. Being put yourself in place of Mr. Kiser, estimate the presence of cells used in that battery.

(C.O.No.3) [Bloom's level: Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carries ten marks.

(1Qx10M=10M)

8. An Ather 450 electric vehicle is having the following specifications: The curb weight of the vehicle is 200 kg, mass of driver is 80 kg, drag coefficient of 0.28, frontal area of 2.3 meter square, air density of 1.25 kg per meter cube, rolling coefficient is 0.015, gear ratio is 5.6:1, transmission efficiency of 80%, wheel radius is 0.23m, acceleration time is 0-50 kmph in 6 sec. The manufacturer of Ather given a chance to you for selecting the motor power rating with the above conditions. Compute the parameters that are associated with power rating of motor.

(C.O.No.2) [Bloom's level: Application]



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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

END TERM EXAMINATION

Winter Semester: 2021 - 22

Course Code: EEE 319

Course Name: Discipline Elective: Electric Vehicles

Program & Sem: B.Tech – VI Sem

Date: 30th June 2022

Time: 9:30 AM to 12:30 PM

Max Marks: 100

Weightage: 50%

Instructions:

- (iv) Read the all questions carefully and answer accordingly.
- (v) Question paper consists of 3 parts.
- (vi) Scientific and Non-programmable calculators are permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO marks.

(10Qx 2M= 20M)

1. Higher the charging rating lower will be the life of the battery. For a 10 kWh battery if we charge or discharge at 1C it takes 1 hour time. If we charge at 2C rate then..... (C.O.No.4) [Knowledge]
 - a. 10kW charge in 40 min
 - b. 10 kW charge in 30 min
 - c. 10 kW charge in 60 min
 - d. 10kW charge in 20 min
2. For selecting the appropriate electric vehicle motors, one has to first list down the requirements of the performance that the vehicle has to meet, the operating conditions and the cost associated with it. Go-kart vehicle and two-wheeler applications which requires less performance (mostly less than 3 kW) at a low cost, it is good to go with [CO3, Knowledge]
 - a. BLDC motor
 - b. PMSM motor
 - c. Induction motor
 - d. SRM motor
3. If we have a vehicle which is normally driving at 100 kilometers per hour and if we increase the speed to 110 kilometer per hour, what will be its effect on the power rating of the machine?
 - a. the rating of the electric motor should be 72 % more
 - b. the rating of the electric motor should be 33 % more
 - c. the rating of the electric motor should be 21 % more
 - d. Information is not sufficient(C.O.No.1) [Knowledge]
4. Which of the following factors adversely affects the capacity of the lead-acid battery?
 - a. Temperature of surroundings
 - b. Specific gravity of electrolyte
 - c. Rate of discharge
 - d. All of these.(C.O.No.3) [Knowledge]
5. What is meant by the term regeneration?
 - a. It's when electricity is generated during deceleration and braking
 - b. It's when the battery is charged during engine idling
 - c. It's when the battery is recharged from the mains supply(C.O.No.4) [Knowledge]

- d. None of these
6. Most commonly, the propulsion force in HEV is provided by a combination of electric motor and an ICE. Which of the following has simple drive train system? (C.O.No.1) [Knowledge]
- a. Series Hybrid
 - b. Parallel Hybrid
 - c. Series-Parallel Hybrid
 - d. All of these
7. The translation of fuel energy into work at the wheels ----- vehicle in urban and highway driving. (C.O.No.1) [Knowledge]
- a. high for ICE
 - b. high for HEV
 - c. high for EV
 - d. high for fuel cell vehicle
8. Gasoline cars of 1900 were noisy, dirty, smelly, cantankerous, and unreliable. In comparison, electric cars were comfortable, quiet, clean, and fashionable. Golden age of Electrical vehicle marked from ----- to ----- with peak production of electric vehicles in 1912. (C.O.No.1)[Knowledge]
- a. 1881-1924
 - b. 1890-1924
 - c. 1900-1924
 - d. 1912-1960
9. Consider a battery of 72 V with a capacity of 10kWh, battery capacity can be defined by its ampere hour is (C.O.No.3)[Knowledge]
- a. Capacity / voltage
 - b. Voltage * capacity
 - c. voltage / capacity
 - d. can't be determined
10. Vehicle propulsion has specific requirements that distinguish stationary and onboard motors. Every kilogram onboard the vehicle represents an increase in structural load. This increase structural load results (C.O.No.2)[Knowledge]
- a. higher efficiency
 - b. higher friction losses
 - c. high velocity
 - d. No effect

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries TWELVE marks. (4Qx12M=48M)

11. The load power of a vehicle varies randomly in actual operation due to frequent acceleration, deceleration and climbing up and down the grades. Different power control strategies are necessary to regulate the power flow to or from different components. All the control strategies aim satisfy the goals like maximize the efficiency, minimize the pollution, system cost and good driving performance. Describe the different architectures through which it is possible to achieve the listed goals. (C.O.No.1) [Comprehension]
12. There are many requirements for energy storages applied in an automotive application. Several types of energy storages are used for EV and HEV applications. Distinguish different types of energy sources used in electric vehicles. (C.O.No.3) [Comprehension]
13. Electric propulsion systems are at the heart of EVs and HEVs. They consist of electric motors, power converters, and electronic controllers. The core element of the EV, apart from Electric Vehicle Batteries, which replaces the Internal Combustion engines is an Electric motor. EVs use traction motors that are capable of delivering torque to the wheels. Classify the motors and select the motors which are used in 2, 3 and 4 wheeler Electric vehicles based on the features of motors. (C.O.No.3) [Comprehension]
14. Charging an electric car battery is a simple process: you simply plug your car into a charger that is connected to the electric grid. However, not all EV charging stations (also known as electric vehicle supply equipment, or EVSE) are created equal. Distinguish the configurations of different charging mechanisms that are available as public and private charging systems. (C.O.No.4) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries SIXTEEN marks.

(2Qx16M=32M)

15. The appropriate design parameters will help us in understanding the economy of energy utilization and balancing between mileage and fuel efficiency by doing a mathematical framework analysis of vehicle mechanics based on Newton's second law of motion. A Nissan Leaf electric vehicle is having the following specifications: The curb weight of the vehicle is 1400 kg, mass of driver is 80 kg, drag coefficient of 0.28, frontal area of 2.8 meter square, air density of 1.25 kg per meter cube, rolling coefficient is 0.015, gear ratio is 7.7:1, transmission efficiency of 85%, wheel radius is 0.29 m, acceleration time is 0-60 kmph in 10 sec. The manufacturer given a chance to you for selecting the motor power rating and battery capacity and cells which are present in that battery with the above conditions. A. list the design parameters and B. Compute the listed design parameters. Also write your inference about the calculations.

(C.O.No. 2) [Comprehension]

16. a. In every electric vehicle, there is a presence of drivetrain arrangement which consists of battery, power converters used for charging as well as for driving the motor, controller etc. If you have got an opportunity to choose a converter which will be best suited for the above said operations with minimal cost, weight, size, presence of power factor correction, then which one will you choose?. Sketch the chosen converter and justify your answer with necessary information.

b. The input voltage and current of a DC-DC power converter are 230V and 15A, respectively. The output voltage is 400V. Compute the output current and output power if the converter has an efficiency of 92%?

(C.O.No. 4) [Application]