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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

MID TERM EXAMINATION

Winter Semester: 2021 - 22

Course Code: EEE 3027

Course Name: Electric Vehicle Technology (Discipline Elective)

Program & Sem: B.Tech EEE & II

Date: 14/May/2022

Time: 01:30 PM – 03:00 PM

Max Marks: 50

Weightage: 25 %

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.

(5Qx 3M= 15M)

1. The use of a multi gear or single-gear transmission depends mostly on the motor speed torque Characteristics. Define base speed of a motor and motor speed ratio.
(C.O.No.1) [Bloom's level: Knowledge]
2. Identify the statements that are true/false from the following statements.
 - A) If the vehicle speed increases, then the range of vehicle increases
 - B) Rolling resistance mainly depends on weight of the vehicle
 - C) During gradient, vehicle needs maximum torque (C.O.No.1) [Bloom's level: Knowledge]
3. The movement behavior of a vehicle along its moving direction is completely determined by all the forces acting on it in this direction. Define tractive force and shape drag.
(C.O.No.1) [Bloom's level: Knowledge]
4. A vehicle, consisting of thousands of components, is a complex system. To describe its behavior fully, sophisticated mechanical and mathematical knowledge is needed. List the parameters based on which the vehicle's driving performance is usually evaluated.
(C.O.No.2) [Bloom's level: Knowledge]
5. A hybrid drivetrain can supply its power to the load by a selective power train. State the advantages of HEV over ICE and electric vehicles. (C.O.No.2) [Bloom's level: Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries EIGHT mark.

(3Qx8M=24M)

6. Mr. Shyam 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. Shyam consulted you regarding the same because you know about the electric vehicles. Explain the way you are going to respond to Mr. Shyam with necessary discussion. (C.O.No.2) [Bloom's level: Comprehension]
7. A vehicle's driving performance is usually evaluated by its acceleration time, maximum speed, and grade ability. In EV drive train design, proper motor power rating and transmission parameters are the primary considerations to meet the performance specification. Suggest suitable motor characteristics for the above design of motor.
(C.O.No.2) [Bloom's level: Comprehension]
8. In HEV one powertrain favours steady state operation, such as an ICE or fuel cell. The other powertrain in the HEV is used to supply the dynamic power. Being put yourself as a control engineer and illustrate the possible ways of combining the power flow to meet the driving requirements of Hybrid drive train system. (C.O.No.2) [Bloom's level: Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carries ELEVEN mark.

(1Qx11M=11M)

9. Mr. Narayan is travelling from Cochin to Trissur in an Ather 450 electric vehicle at a speed of 50 kilometer per hour with the drag coefficient of 0.25, frontal area of 4 meter square, air density of 1.25 kg per meter cube and the energy available in the batteries is 4.5 kilo Watt hour. The distance needs to be covered by him is approximately 90 Km. (i) Will Mr. Narayan reach his destination with the current capacity of the battery under the above conditions? If not, with an aiding wind of 15 kilometer per hour is it possible to reach? Interpret your answer. (C.O.No.1) [Bloom's level: Application]



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**PRESIDENCY UNIVERSITY
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SCHOOL OF ENGINEERING

END TERM EXAMINATION

Winter Semester: 2021 - 22

Course Code: EEE 3027

Course Name: Electric Vehicle Technology

Program & Sem: B.Tech – II Sem

Date: 29th June 2022

Time: 01:00 PM to 04:00 PM

Max Marks: 100

Weightage: 50%

Instructions:

- (ii) Read the all questions carefully and answer accordingly.
- (iii) Question paper consists of 3 parts.
- (iv) 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.
 - i. A There are various types of pollutants and greenhouse gases which are released as emission from vehicles and they are the reasons for smoke, and air pollution.

(C.O.No.1) [Knowledge]

a. Carbon Monoxide and carbon dioxide	b. NOx gases
c. Hydrocarbons	d. All of the above
 - ii. Higher C (capacity) rates adversely impact the battery life. Higher the charging rating lower will be the life of the battery. For a 20 kWh battery if we charge or discharge at 1C it takes 1 hour time. If we charge at 0.5C rate then.....

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

a. 20 kW charge in 60 min	b. 10 kW charge in 60 min
c. 10 kW charge in 120 min	d. 20 kW charge in 120 min
 - iii. A vehicle traveling at a particular speed in air encounters a force resisting its motion. This force is known as [CO1, Knowledge]

A.Tractive force	b. Aerodynamic drag	c. Rolling force	d. Skin drag
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 - iv. The energy flow in EV is mainly via flexible electrical wires rather than bolted flanges or rigid shafts. Electric vehicles are generally powered by () (C.O.No.4) [Knowledge]

a. Aluminum batteries	b. Lead acid batteries
c. sodium batteries	d. None of the above

- v. A hybrid vehicle combines any two power (energy) sources. The combination of two power sources may support two separate propulsion systems. What purpose does a generator serve in a hybrid vehicle? (C.O.No.2) [Knowledge]
- It converts nuclear energy into more nuclear energy
 - It converts mechanical energy into electrical energy
 - It converts chemical energy into electrical energy
 - It converts electrical energy into mechanical energy
- vi. 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 (C.O.No.1) [Knowledge]
- affected less at low speeds
 - having weak relation with speed
 - no relation between speed and rolling resistance
 - no effect at all
- vii. 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.2) [Knowledge]
- Series Hybrid
 - Parallel Hybrid
 - Series-Parallel Hybrid
 - All of these
- viii. Electric propulsion systems are at the heart of EVs and HEVs. The choice of electric propulsion systems for EVs and HEVs mainly depends on several factors including (C.O.No.3)[Knowledge]
- driver's expectation
 - vehicle constraints
 - energy source
 - All of these
- ix. An electric battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. Capacity of a battery is expressed in (C.O.No.4) [Knowledge]
- Ah
 - Wh
 - Vh
 - WA
- x. 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 (C.O.No.4) [Knowledge]
- the battery is charged $1/4$ and the depth of discharge is 25%
 - the battery is discharge charged $3/4$ and the State of charge is 25%
 - the battery is charged $3/4$ and the depth of discharge is 25%
 - None of the above

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries TWELVE marks.

(4Qx12M=48M)

2. Mr. Pranav is working on a two wheeler electric vehicle. He worked out on chassis part, and designing part. Now he wanted to select a battery with good features in terms of life cycle, specific energy and at nominal cost. He 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.4) [Comprehension]
3. 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 two, three and four wheeler Electric vehicles based on the features of motors. (C.O.No.3) [Comprehension]
4. Ola Electric is recalling 1,441 units of its electric two-wheelers in the wake of incidents of vehicles catching fire, according to a company statement. The company said its investigation into the fire incident on March 26, in Pune, is ongoing. If you are the investigator engineer, list the possible causes for explosion and report the possible measures for avoiding the issues. (C.O.No.4) [Comprehension]
5. 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 the possible ways of combining the power flow to meet the driving requirements of Hybrid drive train system. (C.O.No.2) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries SIXTEEN marks.

(2Qx16M=32M)

6. An Ather 450 electric vehicle is having the following specifications: The curb weight of the vehicle is 170 kg, mass of driver is 70 kg, drag coefficient of 0.26, frontal area of 2.8 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 force is 24N and the velocity is 60 kmph. The manufacturer of Ather given a chance to you for selecting the motor power rating with the above conditions under i. No wind velocity and ii. With an opposing wind of 10 kmph. Compute the parameters that are associated with power rating of motor and report your inference with and without wind velocity. (C.O.No.1) [Application]
7. Mr. Narayan is working on go-kart project for participating in a competition. He worked out on chassis part, and designing part. Now he wanted to select a Lithium ion battery to drive a motor with power rating of 4.7kW. The battery specifications are: nominal voltage is 48V, Ah capacity is 24Ah, and cell capacity of 1.5Ah, battery efficiency is 98%.
 - i. List the parameters that are to be computed by Mr. Narayan, in order to understand the requirement of cells and usage of battery.
 - ii. Compute the listed parameters and defend the importance of each parameter. (C.O.No. 4) [Application]



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Part A [Memory Recall Questions]

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(C.O.No.1) [Bloom's level: Knowledge]
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4. A vehicle, consisting of thousands of components, is a complex system. To describe its behavior fully, sophisticated mechanical and mathematical knowledge is needed. List the parameters based on which the vehicle's driving performance is usually evaluated.
(C.O.No.2) [Bloom's level: Knowledge]
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Part C [Problem Solving Questions]

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