Reg. No.															

B.Tech. DEGREE EXAMINATION, DECEMBER 2023

Sixth Semester

18AUO101T - HYBRID AND ELECTRIC VEHICLES

(For the candidates admitted from the academic year 2020-2021 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours | Max. Marks: 100

	Marks	BL	CO	PO

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

1. A machine member used to connect engine shaft to gear box is called — 1 | 1 | 1 | 1
   (A) Differential (B) Clutch
   (C) Flywheel (D) Propeller shaft

2. What are the two main types of hybrid vehicle? — 1 | 1 | 1 | 1
   (A) The series hybrid vehicle and the mild hybrid vehicle (B) The parallel hybrid vehicle and the full hybrid vehicle
   (C) The series hybrid vehicle and the parallel hybrid vehicle (D) The full hybrid vehicle and the empty hybrid vehicle

3. The electric motor in a hybrid car can also act as — 1 | 1 | 1 | 1
   (A) Generator (B) Fuel pump
   (C) Cooling pump (D) Brake actuator

4. What will happen if the vehicle is made 50% heavier, but all other parameters remain the same? — 1 | 1 | 1 | 1,2
   (A) The running resistance will decrease (B) The running resistance will increase
   (C) The running resistance will remain the same (D) The aerodynamic resistance will increase by a factor of 1.5 squared

5. In _____vehicle the motor can be used as generator and in _____ vehicle it needs only propulsion component. — 1 | 2 | 2 | 1
   (A) Parallel hybrid, parallel hybrid (B) Parallel hybrid, series hybrid
   (C) Series hybrid, parallel hybrid (D) Series hybrid, series hybrid

6. Cells are connected in series in order to increase the — 1 | 2 | 2 | 1,2
   (A) Current capacity (B) Life of the cells
   (C) Voltage rating (D) Terminal voltage

7. Unit of specific energy is — 1 | 2 | 2 | 1
   (A) Wh/kg (B) W/hkg
   (C) Whkg (D) Kg/Wh

8.	Clutch can be eliminated in _____vehicle because the _____can start from zero speed and operate all the way to max speed. (A) Electric, engine (B) Hybrid, motor (C) Electric, motor (D) Hybrid, engine	1	2	2	1
9.	_____is the system that accommodate the unequal speed of the inside and outside of the wheel, when the vehicle tums around a corner. (A) Differential (B) Propeller shaft (C) Antilock braking system (D) Electronic stability control	1	1	3	1
10.	The planetary gear has the advantage of _____density and _____gear reduction in a small volume. (A) High power, low (B) High power, high (C) Low power, high (D) Low power, low	1	1	3	1
11.	_____is the medium which is the only one energy converter can provide propulsion power. (A) Series hybrid (B) Parallel hybrid (C) Series – parallel hybrid (D) Multi hybrid	1	1	3	1,3
12.	_____gear ratio is used for higher vehicle speed, but peak traction force that drive train can deliver _____ (A) Smaller, larger (B) Smaller, smaller (C) Larger, smaller (D) Larger, larger	1	1	3	1,3
13.	_____measure of overall efficiency of vehicle starting from extraction of fuel to final drive including all energy conversions. (A) Wheel to well ratio (B) Transmission efficiency (C) Well to wheel ratio (D) Tractive effort	1	1	4	1
14.	Which part of DC motor can sustain maximum temperature rise? (A) Commutator (B) Armature winding (C) Field winding (D) Slip ring	1	1	4	1
15.	Which of the following will happen, if the traction resistance is equal to the total running resistance? (A) The vehicle will accelerate (B) The vehicle will decelerate (C) The vehicle will run at a constant velocity (D) The vehicle will come to rest	1	1	4	1
16.	The difference between the rotor speed and the stator synchronous speed is (A) Percentage slip (B) Slip speed (C) Synchronous rotor speed (D) Synchronous stator speed	1	1	4	1
17.	Un-sprung weight is (A) Weight of vehicle (B) Weight of chassis frame (C) Weight of wheels (D) Weight of wheels and axles	1	1	5	1
18.	By looking at which particular part of the motor we can identify a "DC motor"? (A) Shaft (B) Field winding (C) Armature winding (D) Commutator	1	1	5	1

19.	The size of an electric motor depends on _____required from the machine. (A) Maximum speed (B) Maximum torque (C) Constant speed (D) Constant torque	1	2	5	1
20.	The vehicle should be operated off its engine of battery or both, until the battery is at a _____acceptable _____ (A) Minimum, SOC (B) Maximum, SOC (C) Minimum, endurance (D) Maximum, endurance	1	2	5	1

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

		Marks	BL	CO	PO
21.	Explain the role of battery management system in EV.	4	1	1	1
22.	What is gradability and state the assumptions for maximum gradability?	4	1	2	1
23.	Compare alkaline battery with lead acid battery.	4	2	2	1,2
24.	List the various HEV configurations.	4	3	3	1
25.	Brief the working of SRM (switched reluctance machines).	4	2	4	1
26.	Explain typical front wheel and rear wheel drive in EV.	4	2	5	1
27.	Write short notes on H bridge motor drive controller.	4	1	5	1

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
28. a.	Explain in detail the construction and working principle of Li-ion based batteries.	12	1	1	1
	(OR)				
b.	What is the need for battery management system? Briefly explain the operation of BMS with layout diagram?	12	2	1	1
29. a.	Explain in detail about the construction and working principle of permanent magnet motor.	12	2	2	1
	(OR)				
b.	What is the need of buck boost converter? Explain its working with circuit diagram.	12	2	2	1
30. a.	Describe the operational difference between series and parallel hybrid with layout.	12	3	3	1,2
	(OR)				
b.	Briefly explain the control of DC motor drives.	12	3	3	1,2
31. a.	Describe parameter optimization of electric motor.	12	2	4	1,3
	(OR)				

b.	Briefly explain energy management strategies in electric vehicle.	12	2	4	1,3
32. a.	Compare in detail the Toyota Prius and Honda insight hybrid vehicles.	12	2	5	1,3
	(OR)				
b.	Explain 42V system for traction applications.	12	2	5	1

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