Answer all twenty questions.

Name: **Student Number:**

1. What are the principal load forces associated with a moving vehicle?

2. A 10 kg mass is hung from the tip of a lever. The lever is 1 m long and is at a 60° angle to the ground. Calculate the holding torque required to keep the lever from turning.

3. A motor is rigidly coupled to a load and each structure has an inertia of 0.05 kgm^2. Calculate the required electromagnetic torque if the speed is to increase linearly from rest to 600 rpm in 10 s.

4. If the moment of inertia of a solid cylinder is $\dfrac{\pi}{2}\rho l r^4$, what is the moment of inertia of a hollow cylinder of inner radius r_I and outer radius r_O?

5. What are some of the advantages of using a gearing system in an application?

6. A motor developing a torque T_{EM} is rigidly coupled to a structure of load torque T_L and each structure has an inertia J. Sketch the analogous electrical circuit.

7. If a 1 m diameter windmill generates 500 W of power, what approximate power level might a 10 m windmill develop: (a) 1.5 kW, (b) 5 kW, or (c) 50 kW?

8. Sketch the flux density profile due to the field experienced by an armature conductor in a primitive two-pole dc motor.

9. How can torque pulsations be minimized in a dc motor?

10. What are the two standard winding configurations for dc motors?

Answer all twenty questions.

11. What are the effects of armature reaction?

12. Derive the torque-speed characteristic equation for a dc machine.

13. A permanent magnet dc motor has the following parameters: Ra = $0.25\,\Omega$, $k_E = k_T = 0.5$ in MKS units. Calculate the speed at an applied voltage of 100 V and torque of 10 Nm.

14. A permanent magnet dc motor has the following parameters: Ra = $0.25\,\Omega$, $k_E = k_T = 0.5$ in MKS units, moment of inertia $J_m = 0.02$ kgm^2. The motor is accelerating a load of inertia 0.08 kgm^2 at 10 rad/s^2. Calculate the armature current and applied voltage instantaneously at 100 rad/s.

15. What additional capability can be achieved by field weakening in wound-field dc machines?

16. A wound-field dc motor is operating at rated speed, voltage, and current. If the machine is field weakened to double the speed at rated voltage, what happens to the output torque and power if the current remains at the rated value?

17. Sketch the switch-mode converter used for two-quadrant operation of the dc motor.

18. What is the structure of the trapezoidal-waveform electronically-commutated motors?

19. Sketch the switch-mode converter used for trapezoidal-waveform electronically-commutated motors.

20. Sketch the induced emfs in the trapezoidal-waveform electronically-commutated motor.

Answer all twenty questions.