

- 1) Maximum Power Point Transfer (MPPT) is the process by which the maximum amount of power can be extracted from solar panels.
 - a. There are a number of strategies for achieving MPPT list them and provide a brief explanation of the application of each.
 - b. Using a comparison table, analyse the advantages and disadvantages of the strategies listed in your answer to '(a)' above.
 - c. Show graphical representation of the power output for each of the types discussed above
- 2) Analyse the differences between relays and contactors and table the advantages and disadvantages of each. Include in your answers the safety concerns that have been addressed.
- 3) The advent of solid state relays has benefits over the conventional electro-mechanical relay. Table the advantages and disadvantages of solid state relays and give reasons for your entries.
- 4) A horizontal cutter is required to cut at a rate of 0.5mm per rev for a depth of 70cms. The cutter is independently driven @ 5000rpm. The cutter is attached to a base which has a combined mass of 625kgs. A drive screw is used to drive the cutter base along a rail. The drive screw has a thread pitch of 0.85 mm and is directly connected to a drive motor (motor x).

Assume no drive or friction losses.

Perform the necessary calculations to generate a specification for a suitable induction motor (motor x) to drive the cutter base and justify your selection.
- 5) Design a small circuit that incorporates a thyristor as a component of a safety circuit.
- 6)
 - a. Explain what is meant by pole changing with regard to an induction motor, and detail the effect on the motor output.
 - b. Pole changing can be beneficial to the operation of an induction motor explain why this is true and untrue based on the circumstances of operation.
- 7) To achieve constant torque through the operational speed of an induction the voltage and frequency are varied.
 - a. When varying the speed of the motor the voltage and frequency should be varied in what relationship to maintain torque.
 - b. Explain why the torque of the motor fall off when being driven above its rated speed/frequency.