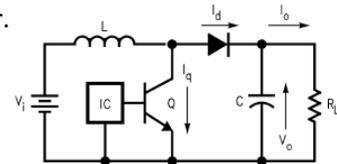


4TH YEAR MEDICAL EQUIPMENT IV TERM EXAM – PART II

I. Answer the following questions by marking the best answer among the choices given [1 point each]:

1. The circuit shown is used to ... the input voltage to the switching regulator.
- reduce
 - boost (*)
 - invert



2. For a 5V to 15V DC/DC converter based on a switching power supply with an output power of 30W, the input power will approximately be ...
- 15 W
 - 35 W (*)
 - 45 W
3. Step-down switching regulators are based on ... regulator configuration.
- Buck (*)
 - Boost
 - Inverting
4. Power density of switching regulators is usually ... than linear regulators.
- Lower
 - Higher (*)
 - More powerful
5. It is possible to use a linear regulator after a switching regulator because ...
- The output ripple is greatly reduced.
 - The efficiency of linear regulators is increased
 - Both of the above (*)
6. Given a switching regulator with input source voltage of 12V and output voltage of 100V@0.2A, it is possible to modify it to generate a 150V@0.1A by ...
- Changing the input voltage
 - Changing the feedback resistors that control the pulse width modulation (*)
 - Changing the capacitance of the boost circuit
7. Analog beamformer is better than digital beamformer from the point of view of ...
- Size
 - Cost (*)
 - Quality
8. Phase array ultrasound system must use ... beamforming.
- Digital (*)
 - Analog
 - Mixed-signal

9. The task of the receive beamformer is ...
 - a. Select the aperture elements to receive ultrasound signal from
 - b. Delay and sum of aperture signals
 - c. Both of the above

10. Analog-to-digital converters in analog beamformers have...dynamic range than those used in digital beamforming.
 - a. Higher
 - b. Lower (*)
 - c. Slower

11. Digital beamforming technology is better than analog beamforming because ...
 - a. Simplicity of digital circuitry
 - b. Accuracy of signal sampling
 - c. Accuracy of focusing delay generation (*)

12. Digital beamformer based ultrasound imaging systems usually do not contain a ... stage.
 - a. Logarithmic amplifier (*)
 - b. TGC amplifier
 - c. Pre-amplifier

13. Ultrasound transmission pulses are converted from TTL level to high voltage through ... circuits.
 - a. Boost power supply
 - b. Voltage amplifier
 - c. Switching transistor (*)

14. Single-fault condition means ...
 - a. Not more than one defect in any component in the whole system (*)
 - b. Not more than one defect in each component in the whole system
 - c. Both of the above

15. Failsafe design of biomedical equipment dictates ... of safe operation of the system.
 - a. One mode
 - b. Two modes (*)
 - c. Three modes

16. Dialysate bypass is practically implemented using ...
 - a. Valves (*)
 - b. Pumps
 - c. Opto-triacs

17. Transmembrane pressure is practically generated and modified using ...
 - a. Dialysate pumps (*)
 - b. Blood pump
 - c. Both of the above

18. Ultrafiltration volume can be practically measured from ...
 - a. The Dialysate side
 - b. The blood sides
 - c. Both of the above (*)

19. Pump control in hemodialysis is usually done using feedback from ...
 - a. Flow measurement
 - b. Tachometer (*)
 - c. Pressure measurement
 20. Design principles under single-fault tolerance include ...
 - a. Fault diagnosis and repair
 - b. Redundancy (*)
 - c. Alarm generation
 21. When power to an inherent failsafe device is interrupted ...
 - a. It automatically goes to a safe position (*)
 - b. It does not move from where it was before the power was interrupted
 - c. It works normally and safely without interruption
 22. Safety of medical devices are guaranteed by ...
 - a. Monitoring of operating parameters to be within the safe range
 - b. Redundancy of sensors and their comparison
 - c. Both of the above (*)
 23. Air bubble detection in hemodialysis is usually done using ...
 - a. Ultrasonic sensors (*)
 - b. Optical sensors
 - c. Electromagnetic sensors
 24. The following materials are safe for use in the dialysate part of hemodialysis equipment except ...
 - a. Silicone
 - b. PEEK
 - c. Titanium (*)
 25. Hematocrit value of the blood is ... the ultrafiltration rate.
 - a. Proportional to
 - b. Nonlinearly related to (*)
 - c. Independent from
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II. Mark the following statement as either True (T) or False (F) [½ point each]:

26. Load regulation is better in linear regulators than switching regulators (T)
27. Line regulation is better in linear regulators than switching regulators (T)
28. Transient recovery is better in switching regulators than linear types (F)
29. Starting from a +5V, one can design a power supply circuit that produces -15 V (T)
30. No heat sinks are necessary with switching regulators (T)
31. One can modify the output voltage from linear regulators by changing the feedback resistors (F)
32. Digital beamformers allow multiple receive lines to be acquired with a single transmission pulse (T)
33. Hematocrit value does not vary with blood volume (F)
34. The pumps in hemodialysis equipment may have different types of driving motors. (T)

35. The blood leak detection in hemodialysis is usually done with optical methods. (T)
 36. The efficiency of switching regulators is best suited for high power applications. (T)
 37. With a 5V @5A input, we can achieve a 12V @1A output from a linear regulator (F)
 38. Redundancy of sensors must be avoided in medical device to lower cost (F)
 39. Single-fault tolerance means a system that continues to operate normally even with a defective component (F)
 40. The main design component in temperature control in hemodialysis is the switching regulator of heater voltage (F)
 41. Blood line is a disposable part of the hemodialysis system (T)
 42. Special types of stainless steel can be used in hemodialysis systems (T)
 43. Valves used in hemodialysis differ from other applications in their special control mechanisms (F)
 44. Blood pump lining must be made of a special biocompatible material. (F)
 45. Conductivity sensors from different hemodialysis systems are not compatible (T)
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III. Answer the following questions

46. [3 points] In designing an ultrasound imaging system, provide the specifications that can be used to design the power supply for such system stating the voltage and current and the application inside the machine for each voltage. (Hint: it is sufficient to include only 3 voltages)
47. [3 Points] In designing a hemodialysis system, provide the specifications that can be used to design the power supply for such system stating the voltage and current and the application inside the machine for each voltage. (Hint: it is sufficient to include only 3 voltages)
48. [3 Points] In your opinion, is it easier to design and manufacture an ultrasound imaging system or a hemodialysis system in Egypt? Please give three reasons for your answer.

Best of Luck!