



Kafrelsheikh University	 	4 th Year Mech. Power
Faculty of Engineering		Final Exam – June, 2019
Mech. Power Engineering Dept.		Time: 3 hrs.

Thermal Power Stations (2)

Question (1)

- a. What are principles of electricity generation by nuclear power plants?
- b. Describe the importance of control materials with respect to reactor safety and control.
What are the primary requirements for a control material? Give at least four examples of control materials.
- c. Give a diagram of Magnox reactor and fast breeder reactor (FBR) and explain their working and main features.
- d. A nuclear drive in a submarine delivers 25,000 shaft horse power at a cruising speed of 20 knots (1 knot =1.15 miles/h). If the power plant has an efficiency of 25%, how much (in kg) of the ^{235}U fuel is consumed on a 40,000 mile trip around the world?

Question (2)

- a. Define the multiplication factor and explain why it should be kept slightly greater than unity.
- b. Define the following terms with reference to Nuclear power plant:
 - (i) Reflector
 - (ii) Coolant
 - (iii) Biological Shielding
 - (iv) Chain reaction
 - (v) Fast Breeder Reactor
 - (vi) Fissionable material
 - (vii) Cladding
- c. If the demand on the generator increases (i.e., a greater load is placed on the turbine), explain what happens to the reactor power of (a) a PWR and (b) a BWR if no operator-caused reactivity changes are made. Which reactor follows the load?
- d. A 500 MW reactor uses natural uranium as fuel. Assuming an overall efficiency of 31% and a 100% load factor throughout the year, find the fuel consumed in one year. Natural uranium contains 0.712% U^{235} .

Please turn over

Question (3)

- a. Find the yearly savings of oil by use of uranium in a nuclear reactor, with rated power 1000 MWe, efficiency 0.33, and capacity factor 0.8. Note that the burning of one barrel of oil per day corresponds to 71 kW of heat power.
- b. What are the differences between active and passive safety systems for nuclear reactor? Explain the methods for each of them.
- c. Are nuclear plants safe? Explain in detail.
- d. Explain whether the turbine room of a BWR is habitable during normal operation.
- e. Explain the various pollutants emitted from thermal power plants and their treatment methods.

Good Luck