

BACHELOR OF CHEMICAL ENGINEERING EXAMINATION, 2025

(3rd Year/4th Year, 1st Semester)

ENERGY CONSERVATION

(OPEN ELECTIVE)

Time : Three hours

Full Marks : 100

Answer any **five** questions

Answers must be **brief and to the point. Marks will be deducted for excess writing**

Answers to all parts of the same question **must be together**

1. a) What are primary and secondary energies? Give one example of each. Renewable energies are primary or secondary? $2+2+1=5$
b) What are commercial and non-commercial energies? Give one example of each. Give one example of a renewable secondary commercial energy. $2+2+1=5$
c) What is sustainable development? With a neat sketch, explain the sustainable as well as partially sustainable solutions. 10
2. a) How climate change is related to energy conservation? Which one is a more difficult challenge and why? Does sustainable development mission include both of these? If yes, how? $4+2+4=10$
b) What are the most important fossil fuels in the earth? Are these only available fossil fuels on earth? Then why are these most important? Write two advantages and two limitations of any one of these. $3+1+2+4 = 10$
3. a) Define energy security. State four actions for better energy security. $1+4=5$
b) What is electric grid? Does it contribute to energy conservation? If yes, how? $2+1+2=5$
c) State five benefits of energy conservation. 5
d) What is the central nodal agency of India for energy conservation? What is the mission of that agency? State three salient activities of that agency. $1+1+3=5$
4. a) What is cogeneration? Show the schematic of a basic heat engine and a cogeneration. $1+4=5$
b) Show the schematics of a condensing-extraction and a back pressure turbine for cogeneration with proper labelling. In a table state the suitable application areas of these two cogenerations. $3+3+4=10$
c) Write the expression of artificial thermal efficiency explaining all terms. Why it is efficiency but artificial? $2+3=5$
5. a) What is continuous condition monitoring of a device? Why it helps energy conservation? Draw a neat schematic of boiler operation with all inputs and outputs and identify which parameters are to be monitored for better energy conservation. $2+2+6=10$
b) Discuss the significance of continuous monitoring of stack temperature and oxygen concentration in exit flue gas. $5+5=10$

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6. a) How energy storage helps energy conservation? Why is it specifically important for most of the renewable energy systems? $3+2=5$
b) What is waste heat recovery (WHR)? Draw a neat schematic explaining opportunities of WHR in a process plant. $2+3=5$
c) With a neat schematic explain the process of operation of a heat pipe. Why heat pipe is more efficient in WHR than a simple heat exchanger? $8+2=10$
7. Write short notes on the following: $5 \times 4 = 20$
a) Heat Wheel, b) Payback period, c) Availability based tariff (ABT), d) Demand side management (DSM)
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