

**B.TECH.  
(SEM IV) THEORY EXAMINATION 2022-23  
ENERGY SCIENCE AND ENGINEERING**

Time: 3 Hours

Total Marks: 100

**Note:** 1 Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A**

**1. Attempt all questions in brief.**

2 x 10 = 20

- (a) Give the examples of Potential Energy.
- (b) What is energy quantization?
- (c) If you turn on 4 light bulbs, each rated at 40 w, how long can they be on before you reach 1kwh?
- (d) What are the two types of charge carriers in semiconductors?
- (e) How is energy generated from bio energy?
- (f) What is the anticipated life of a wind farm?
- (g) Why is ocean thermal energy conversion a renewable resource?
- (h) Write the characteristics of a green building.
- (i) What is the criteria for LEED rating ?
- (j) How do you calculate the embodied energy of material?

**SECTION B**

**2. Attempt any three of the following:**

10x3=30

- (a) Derive time independent Schrodinger wave equation.
- (b) Calculate the binding energy per nucleon of  ${}_{17}\text{Cl}^{35}$  nucleus. Given Mass of  ${}_{17}\text{Cl}^{35}$  is 34.9800U; Mass of Proton ( ${}_1\text{p}_1$ ) is 1.008665U and Mass of neutron ( ${}_0\text{n}^1$ ) is 1.007825U
- (c) Show that radioactive decay follows exponential law.
- (d) What are the devices used for measuring the solar radiations? Explain with any one of them with neat sketch.
- (e) With neat sketch explain the concept of green building .Also write the factors which can made a building green?

**SECTION C**

**3. Attempt any one part of the following:**

10x1=10

- (a) Explain the Carnot vapour power cycle with T-s diagram. Also find out the efficiency of Carnot cycle.
- (b) Explain Brayton cycle and obtained expression for efficiency in terms of pressure and temperature ration.

**4. Attempt any one part of the following:**

10x1=10

- (a) What do you mean by binding energy? What is the total binding energy per nucleon for the  ${}_{6}\text{C}^{12}$  nucleus?
- (b) With a neat sketch, explain pressurized water reactor (PWR) highlights its merits and demerits.

**5. Attempt any *one* part of the following: 10x1=10**

- (a) Discuss p-n junction in forward bias and reversed bias condition.
- (b) Derive V-I and P-V characteristics of photo volatile device.

**6. Attempt any *one* part of the following: 10x1=10**

- (a) Derive the continuity equation for 1-D fluid flow. Also derive the expression for wind power.
- (b) Write down the principle of power generation in wind mills. Derive an expression for maximum efficiency.

**7. Attempt any *one* part of the following: 10x1=10**

- (a) Describe steps for methodology for energy audit. List the key instrument for energy audit.
- (b) What is a nuclear fuel cycles? What steps are involved in Nuclear fuel cycle?

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**B. Tech.**  
**(SEM III) THEORY EXAMINATION 2022-23**  
**ENERGY SCIENCE AND ENGINEERING**

**Time: 3 Hours**

**Total Marks: 100**

**Note:** Attempt all Sections. If you require any missing data, then choose suitably.

**SECTION A**

**1. Attempt all questions in brief. 2x10 = 20**

- (a) How heat energy can be converted in to mechanical energy.
- (b) Define term entropy.
- (c) Illustrate the term nuclear fission.
- (d) Write down the advantages of nuclear energy.
- (e) Elaborate the principle of solar cell.
- (f) On what factors does the collector efficiency of a solar flat plate collector depend?
- (g) Describe various Geothermal Energy Resources
- (h) Describe various biological energy sources.
- (i) What are the alternatives to deal with energy crisis?
- (j) Discuss the terms Energy conservation and Energy audit

**SECTION B**

**2. Attempt any three of the following: 10x3 = 30**

- (a) Discuss the concept of Quantum. Also describe how quantization of energy takes place.
- (b) Illustrate the concept of nuclear fission reactor design with the help of diagram. Explain PWR type of fission reactor
- (c) Classify different types of solar thermal collector and show the constructional details of a flat plate collector. What are its main advantages?
- (d) Discuss the process of production of biogas from biomass. Describe DeenBandhu Biogas plant.
- (e) Summarize the global warming feature and focus the impacts of this phenomenon on the disturbance to the sustainability of environment.

### SECTION C

3. Attempt any *one* part of the following: 10x1 = 10
- (a) Discuss the main features of various types of renewable and non-renewable energy sources. Also explain the importance of non-conventional energy sources in the context of global warming.
  - (b) Define term radiation. Write down the difference between direct radiation and diffuse radiation.
4. Attempt any *one* part of the following: 10 x1 = 10
- (a) Illustrate the term nuclear fusion? How does it differ from nuclear fission?
  - (b) Discuss the essential features of a hydrogen-oxygen cell. Draw a suitable diagram of this cell and give the reactions took place at the electrodes.
5. Attempt any *one* part of the following: 10x1 = 10
- (a) Write short note on solar cell array.
  - (b) Describe the mechanism of photoconduction in a PV cell.
6. Attempt any *one* part of the following: 10x1 = 10
- (a) Describe the 'Single Basin' and 'Two Basin' systems of tidal power harnessing. Discuss their advantages and limitations.
  - (b) Describe the process of gasification of solid biomass. What is the general composition of the gas produced and what is its heating value? What are its applications?
7. Attempt any *one* part of the following: 10x1 = 10
- (a) Define term green energy? What are the benefits of green energy?
  - (b) Briefly explain the different types of storage systems.



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Printed Page: 1 of 2  
Subject Code: KOE033

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**BTECH**  
**(SEM III) THEORY EXAMINATION 2021-22**  
**ENERGY SCIENCE AND ENGINEERING**

**Time: 3 Hours****Total Marks: 100****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Qno.	Question	Marks	CO
a.	Comment on the statement: "The entropy of the universe tends to be maximum."	2	1
b.	What is the significance of BTU?	2	1
c.	Differentiate between Fusion & Fission nuclear reaction.	2	2
d.	Is the average binding energy of electrons in an atom independent of (Number of protons)?	2	2
e.	Describe the operation of a solar cell.	2	3
f.	Discuss the 'latitude angle' and 'Hour angle'.	2	3
g.	Explain warm spring in Geothermal Energy.	2	4
h.	State the limitations of OTEC system.	2	4
i.	Discuss the energy audit and its types.	2	5
j.	What are the alternatives to deal with energy crisis?	2	5

**SECTION B****2. Attempt any three of the following:**

Qno.	Question	Marks	CO
a.	Explain the concept of Quantum. Also describe the concept of Quantization of Energy.	10	1
b.	Illustrate the working principle of Nuclear forces & also outline the different energy scales used in Nuclear Energy.	10	2
c.	Differentiate between N type and P type of semiconductor along with energy band diagram.	10	3
d.	Outline the working principle of tidal power Plant. Discuss their advantages and limitations. Also give present status of tidal power in INDIA.	10	4
e.	Illustrate the short about the following- a) Ways of disposal of nuclear waste fuels. b) Energy crisis	10	5

**SECTION C****3. Attempt any one part of the following:**

Qno.	Question	Marks	CO
a.	Illustrate the working of Carnot heat Engines with P-V & T-S diagram.	10	1
b.	Examine the Phase change energy conversion. Describe the different operations of Rankine cycle with the help of diagram.	10	1



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**BTECH**  
**(SEM III) THEORY EXAMINATION 2021-22**  
**ENERGY SCIENCE AND ENGINEERING**

**4. Attempt any one part of the following:**

Qno.	Question	Marks	CO
a.	Draw the binding energy curve showing variation of binding energy per nucleon with mass number. With the help of this explain the phenomenon of nuclear fusion and fission & stability concept of nuclei.	10	2
b.	Illustrate the concept of Nuclear fission reactor design with the help of diagram. Explain PWR type of fission reactor.	10	2

**5. Attempt any one part of the following:**

Qno.	Question	Marks	CO
a.	Outline the concept of basic physics of semiconductors, transport, generation and recombination in semiconductors semiconductor junction.	Carrier and	3
b.	Outline the construction and working of solar P-V cell with the help of suitable diagram and also discuss performance curve and conversion efficiency in terms of fill factor of the solar P-V cell.	10	3

**6. Attempt any one part of the following:**

Qno.	Question	Marks	CO
a.	Illustrate the concept of a) Fluid dynamics in wind energy conversion. b) Betz law to receive Maximum Energy. c) Effect of number of rotor blades on performance efficiency.	10	4
b.	Analyse the construction, working and limitations of Geothermal Power Plant with the help of diagram.	10	4

**7. Attempt any one part of the following:**

Qno.	Question	Marks	CO
a.	Summarize the global warming feature and focus the impacts of this phenomenon on the disturbance to the sustainability of environment.	10	5
b.	Integrate the concept of a) Energy conservation & various principles involved in energy conservation. b) Energy Conservation in illuminating systems. c) LEED Ratings d) Concept of Green Building and Green Architecture.	10	5



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**B TECH**  
**(SEM-III) THEORY EXAMINATION 2020-21**  
**ENERGY SCIENCE & ENGINEERING**

Time: 3 Hours

Total Marks: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A**

1. Attempt all questions in brief.

2 x 10 = 20

Qno.	Question	Marks	CO
a.	What are three examples of units used for energy?	2	3
b.	What is a heat energy example?	2	3
c.	What is so bad about nuclear energy?	2	2
d.	What are the 4 fundamental forces in the universe?	2	3
e.	What are 5 advantages of solar energy?	2	3
f.	What is meant by carrier transport in semiconductor?	2	3
g.	What are 3 conventional sources of energy?	2	2
h.	Why is fluid dynamics so hard?	2	2
i.	How long does it take for nuclear radiation to kill you?	2	3
j.	What is the cause of climate change?	2	3

**SECTION B**

2. Attempt any three of the following:

Qno.	Question	Marks	CO
a.	Two engines are to operate on Otto and Diesel cycles with the following data: Maximum temperature 1400 K, exhaust temperature 700 K. State of air at the beginning of compression 0.1 MPa, 300 K. Estimate the compression ratios, the maximum pressures, efficiencies, and rate of work outputs (for 1 kg/min of air) of the respective cycles.	10	4
b.	What is the importance of quantum mechanics? What are some useful applications of nuclear physics? Explain briefly.	10	3
c.	What are the two basic ways to measure solar radiation? Explain with neat sketches.	10	4
d.	The shear stress developed in lubricating oil, of viscosity 9.81poise, filled between two parallel plates 1 cm apart and moving with relative velocity of 2 m/s is?	10	4
e.	What happens to waste of a nuclear plant system? What are the 3 levels of nuclear waste? Explain with neat sketches.	10	3

**SECTION C**

3. Attempt any one part of the following:

a.	An engine equipped with a cylinder having a bore of 15 cm and a stroke of 45 cm operates on an Otto cycle. If the clearance volume is 2000 cm <sup>3</sup> , compute the air standard efficiency.	10	4
b.	Two kg of water at 80°C are mixed adiabatically with 3 kg of water at 30°C in a constant pressure process of 1 atmosphere. Find the increase in the entropy of the total mass of water due to the mixing process (cp of water = 4.187 kJ/kg K).	10	4

4. Attempt any one part of the following:

a.	What do you mean by nuclear forces? What are the types of nuclear forces? Explain briefly.	10	2
b.	What is the safest nuclear reactor design? What are the four main components of a fission reactor? Explain briefly.	10	2

5. Attempt any one part of the following:

a.	What is difference between metal semiconductor junction and pn junction? Explain briefly.	10	3
b.	What is the principle of solar photovoltaic power generation? Explain briefly with neat sketches.	10	4

6. Attempt any one part of the following:

a.	How are wind turbines designed? Explain briefly with neat sketches.	10	3
b.	How does geothermal power work? Explain briefly with neat sketches. What are the advantages and disadvantages of geothermal energy?	10	3

7. Attempt any one part of the following:

a.	What is the concept of green building? What are the 7 components of green building?	10	3
b.	What is energy audit? How many types of energy audits are there? Explain briefly.	10	3

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**B. TECH.**  
**(SEM-III) THEORY EXAMINATION 2019-20**  
**ENERGY SCIENCE & ENGINEERING**

**Time: 3 Hours****Total Marks: 100****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

- a) What is energy?
- b) Define entropy.
- c) Define semiconductors.
- d) How holes are produced in semiconductors?
- e) Explain attenuation of solar radiation.
- f) What is the principle of solar cell?
- g) How tides are generated?
- h) Give the sources of geothermal energy.
- i) Why Stirling engines are not used?
- j) Define energy conservation.

**SECTION B****2. Attempt any three of the following:****10 x 3 = 30**

- a) How internal combustion engines work?
- b) What is nuclear fusion? How does it differ from nuclear fission?
- c) Discuss the application and economic aspect of fuel cells.
- d) Write the difference between geothermal power plant and thermal power plant?
- e) Review the energy scenario in India in brief.

**SECTION C****3. Attempt any one part of the following:****10 x 1 = 10**

- a) Explain the difference between direct radiation and diffuse radiation.
- b) Define refrigeration. State the application of refrigeration.

**4. Attempt any one part of the following:****10 x 1 = 10**

- a) Draw the binding energy curve showing variation of binding energy per nucleon with mass number. With the help of this explain the phenomenon of nuclear fusion and fission.
- b) With a neat sketch, explain pressurized water reactor (PWR), highlighting its merits and demerits.

**5. Attempt any one part of the following:****10 x 1 = 10**

- a) Explain with a neat sketch, working of a solar cell.
- b) What is the difference between intrinsic and extrinsic semiconductor?

**6. Attempt any one part of the following:****10 x 1 = 10**

- a) How tidal power plants are classified and what are the limitations of tidal power plant?
- b) What are conventional and non-conventional energy sources? Write short notes on classification of energy sources.

**7. Attempt any one part of the following:****10 x 1 = 10**

- a) What is green energy? What are the benefits of green energy?
- b) Briefly explain the different types of storage systems.



# Unit-wise Important Topics with Year-wise Question Analysis

## Operating System (KCS-401)

Unit I:

- OS Types, Monolithic vs Microkernel, Functions

2023: 1 SAQ, 2022: 1 LAQ

Unit II:

- Semaphore, Critical Section, Dining Philosopher, Producer-Consumer

2023: 2 LAQ, 2022: 2 LAQ

Unit III:

- Scheduling Algorithms, Deadlock (RAG, Banker's), PCB

2023: 2 LAQ, 2022: SAQ + LAQ

Unit IV:

- Paging, TLB, Thrashing, Page Replacement

2023: 2 LAQ, 2022: 2 LAQ

Unit V:

- File System, RAID, DMA, Disk Scheduling

2023: 2 LAQ, 2022: SAQ + LAQ

Conclusion: Units III, IV, and V are most asked.

## Theory of Automata and Formal Languages (KCS-402)

Unit I:

- DFA/NFA, Mealy/Moore, Minimization

2023: 2 LAQ, 2022: 2 LAQ

Unit II:

- Arden's Theorem, Pumping Lemma, Reg. Expressions

## Unit-wise Important Topics with Year-wise Question Analysis

2023: SAQ + LAQ, 2022: SAQ + LAQ

Unit III:

- CFGs, CNF/GNF, Ambiguity

2023: 1 LAQ, 2022: 2 LAQ

Unit IV:

- PDA Construction, CFG  $\leftrightarrow$  PDA, CFL Pumping Lemma

2023: 2 LAQ, 2022: 2 LAQ

Unit V:

- Turing Machines, Recursive, PCP, UTM

2023: SAQ + LAQ, 2022: 2 LAQ

Conclusion: All units appear regularly; focus more on Units I, II, and V.

## Object Oriented Programming with Java (KCS-403)

Based on AKTU pattern:

Unit I: OOP Principles, Overloading, Polymorphism - Frequently Asked

Unit II: Exception Handling, Multithreading - Frequently Asked

Unit III: Java 8+ Features - Occasionally Asked

Unit IV: Collections, Comparable - Frequently Asked

Unit V: Spring Boot & REST APIs - Less Frequently Asked

Conclusion: Units I, II, and IV are commonly covered.

## Python Programming (BCC-402)

Based on standard trend:

## **Unit-wise Important Topics with Year-wise Question Analysis**

Unit I: Data Types, Operators - Basic

Unit II: Loops & Conditionals - Basic

Unit III: Functions, Lists, Tuples, Dict - Frequently Asked

Unit IV: File Handling - Medium

Unit V: Libraries (pandas, Tkinter) - Occasionally

Conclusion: Focus on Units III and IV.

### **Technical Communication (BAS-301)**

2025 Question Paper:

Unit I: Communication Types, Flow - SAQ + LAQ

Unit II: Resume, SOP, Emails - SAQ + LAQ

Unit III: Presentation, Emotions - SAQ + LAQ

Unit IV: Feedback, Leadership - SAQ + LAQ

Unit V: Social Media, Personality Theories - SAQ + LAQ

Conclusion: All units are equally covered; questions are application-based.



PAPER ID-411286

Printed Page: 1 of 2  
Subject Code: BCS403

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**BTECH**  
**(SEM IV) THEORY EXAMINATION 2023-24**  
**OBJECT ORIENTED PROGRAMMING WITH JAVA**

TIME: 3 HRS

M.MARKS: 70

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A**

1. Attempt all questions in brief.

2 x 7 = 14

a	Describe JVM and byte code in Java Architecture.
b	Define the concept of classes and object in Java with a suitable example.
c	Explain Interfaces in Java with suitable example. ✓
d	Describe all the keywords used for exception handling in Java.
e	Describe various states achieved by the thread in its life cycle.
f	Write a Java program to create an ArrayList<String> with five items and display all the elements using forEach method.
g	Explain the concept of Sealed classes in Java with suitable example.

**SECTION B**

2. Attempt any three of the following:

7 x 3 = 21

a	Explain abstraction and abstract classes in Java. Describe abstract method. With a suitable example demonstrate the application of abstract classes.
b	Describe the ways to create the threads in Java with suitable code. Also explain which method is more suitable to create threads.
c	Explain the functional interfaces in Java. Describe lambda expressions with the help of functional interfaces. ✓
d	Describe Collections framework in Java with a suitable diagram displaying interfaces and classes and their hierarchy. Also explain the List, Set and Queue interfaces. ✓
e	Explain the difference between Dependency Injection (DI) and Inversion of Control (IoC) in Spring. <a href="https://www.aktuonline.com">https://www.aktuonline.com</a>

**SECTION C**

3. Attempt any one part of the following:

7 x 1 = 7

(a)	Illustrate polymorphism and its types in Java. Differentiate between run-time and compile-time polymorphism. Write super class Shape with method displayArea() and sub class Rectangle. Demonstrate method overriding with this example.
(b)	Illustrate Constructors and their applications in Java. Describe the types of constructors used in Java. Write a class with name Student with attributes roll_number, name, branch and email. Write all argument constructor for class Student and create two objects with this constructor.

4. Attempt any one part of the following:

7 x 1 = 7

(a)	Differentiate between checked and unchecked exceptions in Java. Write a Java program to demonstrate Arithmetic Exception handlings.
(b)	Differentiate between with suitable examples: 1. Character streams and Byte Streams 2. wait() and notify()

5. Attempt any one part of the following:

7 x 1 = 7

(a)	Explain Java stream API and its applications. Describe Intermediate and terminal operations with suitable example. Write a program to print sum of all even numbers form an ArrayList<Integer> containing all integers from 1 to 10.
(b)	Compare and contrast switch-case statement with switch-expression in Java. Explain with suitable example



PAPER ID-411286

Printed Page: 2 of 2  
Subject Code: BCS403

Roll No:

**BTECH**  
**(SEM IV) THEORY EXAMINATION 2023-24**  
**OBJECT ORIENTED PROGRAMMING WITH JAVA**

**TIME: 3 HRS**

**M.MARKS: 70**

6. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Describe Linked List in Java collection framework. With suitable example describe any five methods available in Linked Lists.
(b)	Describe HashMap in Java collection framework. With suitable example describe any five methods available in HashMaps.

7. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Describe following 1. Spring container 2. Spring bean life cycle
(b)	Describe following 3. Spring boot framework and its benefits 4. RESTFUL API with Spring boot

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