



POSTAL BOOK PACKAGE 2027

MECHANICAL ENGINEERING

CONVENTIONAL PRACTICE SETS VOLUME - V

ESE SPECIFIC SUBJECTS

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RENEWABLE SOURCE OF ENERGY

CONVENTIONAL PRACTICE SETS

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Practice Questions

Q.1 What do you understand by renewable energy? How it differs from Non-renewable energy?

Solution:

Renewable Energy: Renewable energy is the term used for energy flows occurring naturally and repeatedly at a rate such that it is replenished at the same rate as they are used. The ultimate sources of renewable energy are : Sun, gravity and rotation of earth. Energy from these resource is derived in various forms such as solar, wind, tidal, biomass etc.

Difference between Renewable and Non-renewable Source of Energy

Renewable	Non-Renewable
<ol style="list-style-type: none"> 1. Energy obtained from natural and persistent flows of energy occurring in the immediate environment is renewable energy. 2. Examples: Solar, Wind, Hydro power, Biomass Tidal, Ocean thermal. 3. This type of energy is already passing through the environment as flow or current, irrespective of the fact that there is any device present to harness this energy or not. 4. Other names : Green Energy, Sustainable energy. 5. Energy Flow Diagram 	<ol style="list-style-type: none"> 1. Energy obtained from static stores of energy that remained underground unless released by human interaction is known as non-renewable energy. 2. Example: Nuclear fuels, fossil fuels of coal, oil, natural gas. 3. This type of energy is initially in the form of isolated source potential. An external (human) action is required to start the supply of energy for practical purpose. 4. Other names: Finite supplies, Brown energy. 5. Energy Flow Diagram
<p>ABC → Environmental energy flow. DEF → Harnessed energy flow.</p>	<p><u>Mined Source: Brown Energy</u></p> <p>DEF → Extracted energy from brown energy source.</p>

Q2 What is Green Power?

Solution:

The term "green power" is used to describe sources of energy which are considered environment friendly, non-polluting; and therefore may provide a remedy to the systemic effects of certain forms of pollution, and global warming. This is in fact the renewable energy sourced from the sun, the wind, water, biomass and waste, etc. Green energy is commonly thought of in the context of electricity, heating, and cogeneration, and is becoming increasingly available. Consumers, businesses, and organizations may purchase green energy in order to support further development, help reduce the environmental impacts associated with conventional electricity generation, and increase their nation's energy independence. Renewable energy certificates (green certificates, or green tags) have been one of the ways for consumers and businesses to support green energy.

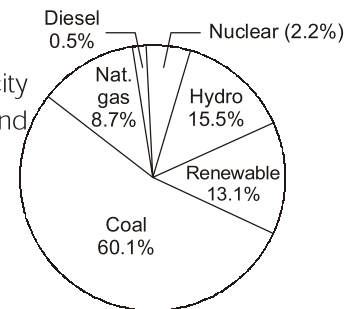
Q3 What are the main renewable energy sources in India? In which form renewable energy is used in India?

Solution:

Present Power Scenario of India

In India, total power production installed capacity is 263.66 GW (Gigawatt) and renewable energy capacity is 34.35 GW i.e. 13% of the installed capacity and 7% of the electricity produced, as on march 2015 by Ministry of New and Renewable Energy (MNRE) report.

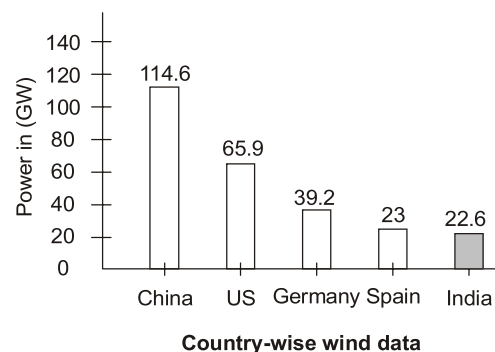
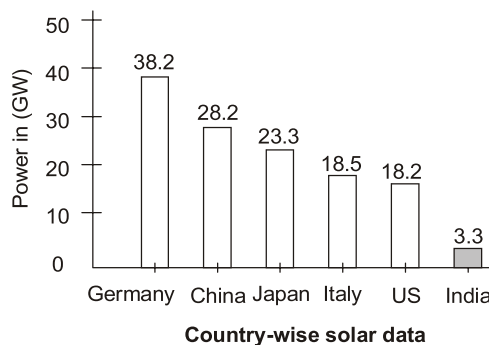
Total installed capacity is shown by given Pi-chart.



Renewable energy constitutes :

- | | |
|--------------------------|------|
| 1. Wind | 8.6% |
| 2. Solar Heating/Cooling | 1.5% |
| 3. Solar PV | 1.3% |
| 4. Biomass | 0.5% |
| 5. Biogas | 1.1% |
- India is 5th largest country producing wind energy (22.6 GW out of 370 GW) (By report : Global Wind Energy Council as on 2014)
 - India is 11th largest country in solar power production (3.3 GW out 177 GW) (As on Jan 2014, IEA report)

Country-wise Solar & Wind data are given in graphs below :



Utilities of Renewable Energy: There are numerous applications where renewable energy can be utilized. Broadly these segments can be categorized as :

1. Electricity Generation
2. Air and water heating/ cooling
3. Transport (Biodiesel, Biogas, Ethanol, Solar vehicles)
4. Rural (off grid) applications



ROBOTICS AND MECHATRONICS

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Microprocessor and Microcontroller

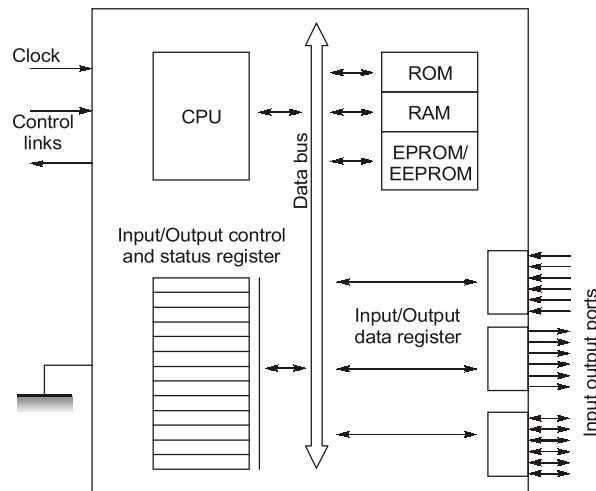
Q1 Given comparison between "Microprocessors" and "Microcontrollers".

Solution:

Microprocessor	Microcontroller
1. It contains CPU, interrupt circuit and memory-addressing circuits.	1. Besides all parts of micro-processor, they also contain, timers, parallel and serial I/O, internal RAM and ROM.
2. Access time for memory and I/O device is more.	2. Access time for memory and I/O device is less.
3. Number of operational codes (for moving data from external memory to CPU) are many.	3. Only one or two operational codes (for moving data from external memory to CPU)
4. Nature of deal with rapid movement of codes and data are from external address to chip.	4. Nature of deal with rapid movement of codes and data are within the chip.
5. Operates as a digital computer by adding external digital parts.	5. Operational as a digital computer without adding external digital parts.
6. Memory map for data and code are single.	6. Memory map for data and code are separate.
7. More flexible.	7. Less flexible.

Q2 Sketch the block diagram of a microcontroller?

Solution:

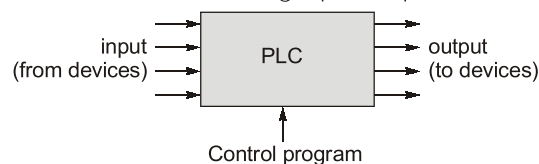


Block diagram of Microcontroller

Q3 What are programmable logic controllers (PLC)? State the special features and advantages of PLCs.

Solution:

PLCs are specialized industrial device for interfacing input/output and controlling analog and digital devices.



- (i) They are designed with a small instruction set suitable for industrial control application.
- (ii) Usually they are programmed with "ladder logic" which is graphical method of laying out the connectivity and logic between system input and output.
- (iii) They are designed with industrial control and industrial environments specifically in focus. Therefore in addition to being flexible and easy to program, they are robust and relatively immune to external interference.
- (iv) It is a 'digital electronic device' that uses a programmable memory to store instruction and to implement functions. Such as logic sequencing, timing, counting and arithmetic in order to control machines and process.

Special features of PLCs

- (i) Interfacing for input and output is inside the controller.
- (ii) Easily understood programmable language program is mainly concerned with logic and switching operation.
- (iii) Rugged and designed to withstand vibration, temperature, humidity and noise.

Advantage:

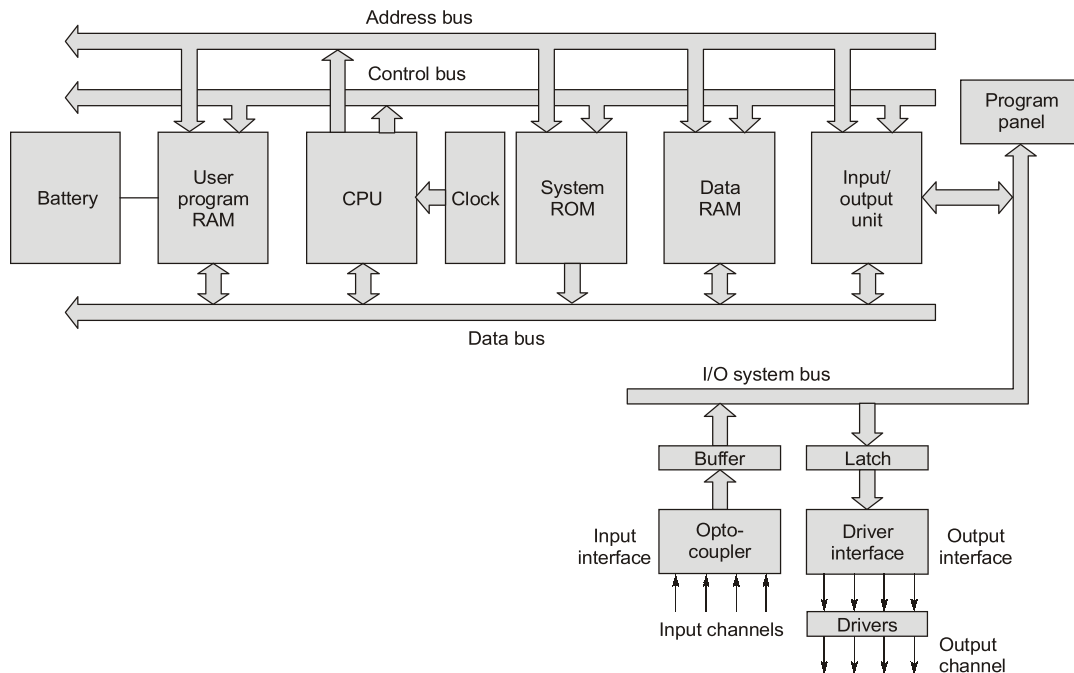
- (i) Low cost.
- (ii) Easy to install.
- (iii) Ensure increased productivity.
- (iv) Faster operational speed.
- (v) High reliability and ease maintenance.
- (vi) Can with stand harsh industrial environment.
- (vii) Provide constancy in manufacturing.
- (viii) Can input/output both analog and digital signal.
- (ix) Small size.
- (x) Easier trouble shooting.

Q4 Draw basic PLC structure/Architecture.

Solution:

PLC is a digital electronic device that uses a programmable memory to store instructions and to implement functions, such as logic, sequencing, timing, counting and arithmetic in order to control machines and processes and has been specifically designed to made programming easy.

Basic structure is



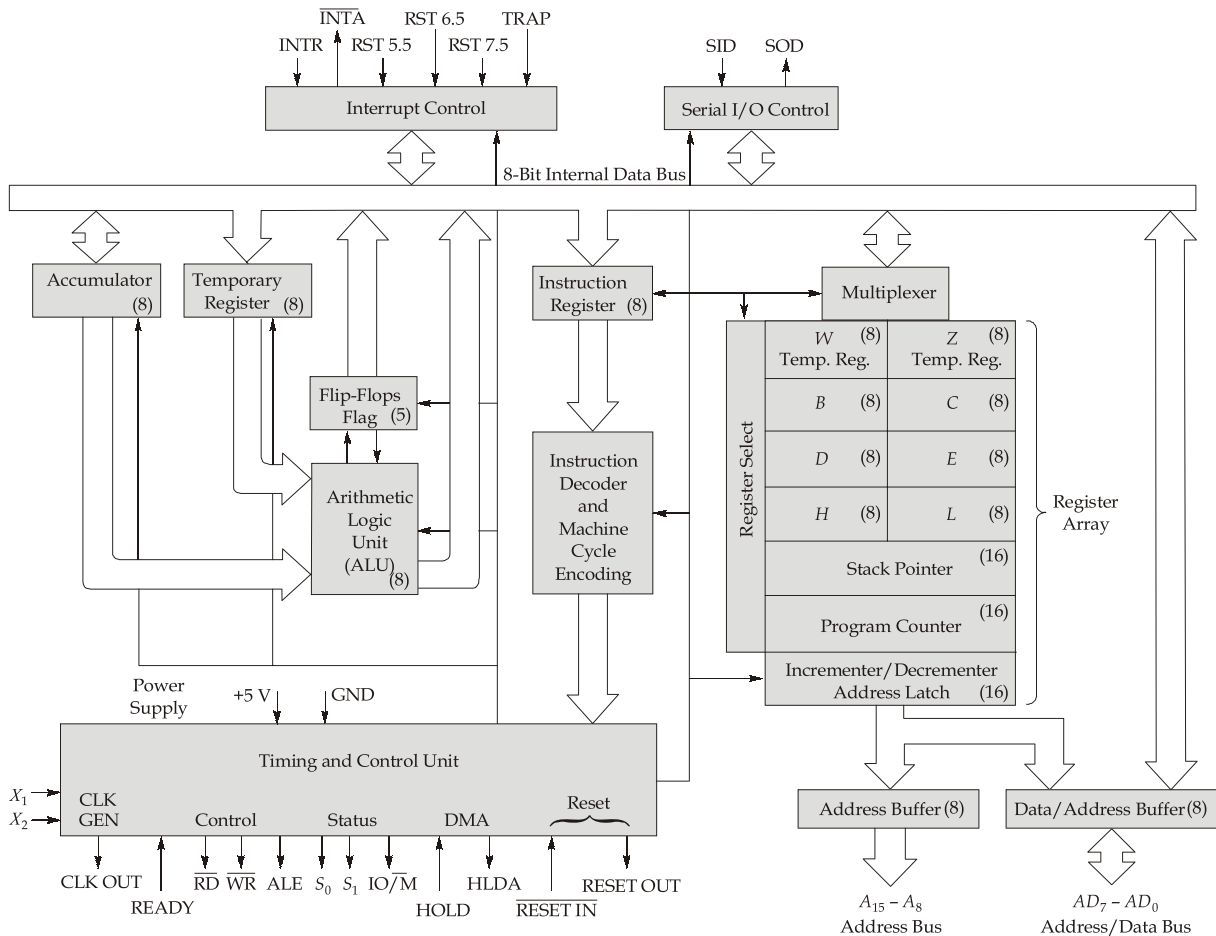
Architecture of a PLC

Q5 Explain briefly features of intel 8085 microprocessor with the help of a block diagram/architecture.

Solution:

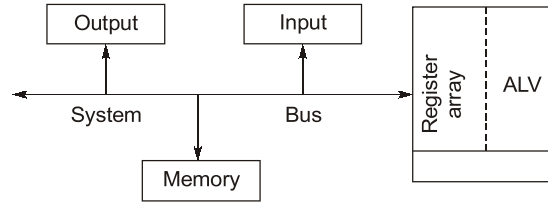
It is an 8 bit microprocessor i.e. It can accept process, or provide 8 bit data simultaneously.

- It operates on a single +5V power supply connected at V_{CC} , power supply ground is connected to V_{SS} .
- It operates on clock cycle with 50% duty cycle.
- It has a chip clock generator.
- It can operate with a 3 MHz clock frequency. The 8085 A-2 version can operate at the maximum frequency of 5 MHz.
- It has 16 address lines, hence it can access (2^{16}) 64 kbytes of memory.
- It provides 8 bit I/O addresses to access (2^8) 256 I/O ports.
- It has 8-bit accumulator, flag register, instruction, six 8 bit general purpose register (*B C D E H* and *L*) and two 16 bit registers. (*SP* and *PC*).
- It has serial I/O control which allows serial communication.
- It supports 74 instruction with the following addressing modes.
(a) Immediate (b) Register (c) Direct (d) Indirect (e) Implied
- It has a mechanism by which it is possible to increase its interrupt handling capacity.



Q6 Draw the block diagram of a microcomputer and explain briefly the three segment (ALU, Register and control unit) of a microprocessor also application of microprocessor?

Solution:



Block diagram of a microcomputer

The microprocessor consist of the following three segment.

1. **Arithmetic/Logic unit (ALU):** Computing functions are performed on data. The ALU performs arithmetic operations such as addition and subtraction and logic operation such as AND, OR and exclusive OR. Results are stored either in register or in memory or sent to output devices.
2. **Register unit:** Consist of various registers they are primarily used to store data temporarily during the execution of a program. Some of the registers are accessible to the user through instruction.
3. **Control unit:** It provides necessary timing and control signals to all the operations in the microcomputer. It controls the flow of data between the microprocessor and peripherals including memory.

Uses/Application area of microprocessor

- Instrumentation application
 - Process control
 - Instrumentation
 - Monitoring and control
 - Data acquisition
- Medical electronics
 - Patient monitoring in ICU
 - Pathological analysis
 - Measurement of parameter like blood pressure and temperature
- High level language computers
- Home entertainment and games
- Computer peripheral control etc.

Q7 What are the different parts of 8051 microcontroller?

Solution:

Different parts of the 8051 microcontroller are:

1. CPU which include program counter, ALU, working register and block circuit.
2. 8-bit CPU with registers (the accumulator).
3. 16-bit program counter (PC) and data pointer (DPTR).
4. 8-bit program status word (PSW)
5. 8-bit Stack Pointer (SP)
6. Internal ROM of 4 kB.
7. Internal RAM of 128 bytes
8. Four register banks each containing 8 registers.
 - 16 bytes, which may be addressed at bit level.
 - 8 bytes of general purpose data memory.
9. 32 input/output pins arranged as four 8-bit ports P_0 - P_3 .
10. Two 16-bit time/counters T_0 and T_1 .

11. Full duplex serial data receiver.
12. Control register-TCON, TMOD, SCON, PCON, IP and IE.
13. Two external and three internal interrupt sources.
14. Oscillator and clock circuits.

Q8 What is stack? What are its features?**Solution:**

Stack is a group of memory location in the Read/write memory for temporary storage of data during the execution of program. Stack works on the principle of LIFO (Last in First out). The starting memory location of the stack is defined in the main program and space is reserved usually at high end of memory map.

Features of stack

- The size of the stack is limited only by available memory.
- Once the stack is defined, storing of data bytes begins at the memory location less than the address in the stack pointer.
- Stack is initialized at the highest available memory location to prevent the program from being destroyed by the stack information. The size of the stack is limited only by the available memory.
- Data bytes in the register pairs can be stored on the stack by using the push instruction.
- Data bytes can be transferred from stack to respective register by using POP instruction.
- The stack pointer register (SP) tracks the storage and retrieval of the information.
- The two bytes are being stored at a time, the 16 bit memory address in the stack pointer register is decremented by two.
- When the data bytes are retrieved the address is incremented by two.

Q9 Describe in brief the following forms of memory units

ROM, PROM, EPROM, EEPROM, RAM

Solution:

ROM: ROM is Read Only Memory. It is used for store elements programs/data. Data is not lost when power is removed.

PROM: PROM is Programmable Read Only Memory. It is a type of ROM chip programmed by user for one time only.

EPROM: EPROM is Erasable and Programmable ROM. It is a type of ROM chip programmed by user and contents can be erased for repeated programming.

EEPROM: It is electrically erasable PROM. It is similar to EPROM, but erasing is done electrically by applying high voltage and it can be programmed repeatedly.

RAM: Random Access Memory. It is used to store temporary data/programs during execution. Data is lost when power is lost.

