PVP 23

Code: 23ES1101

I B.Tech - I Semester – Regular Examinations - JANUARY 2024

BASIC CIVIL & MECHANICAL ENGINEERING

(Common for EEE, ECE, CSE)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts: Part-A and Part-B.
2. Each Part contains:
- 5 short answer questions. Each Question carries 1 Mark and
- 3 essay questions with an internal choice from each unit. Each question carries 10 marks.

3. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	What is the scope of transportation engineering?	L1	CO1
1.b)	List out advantages of prefabricated structures.	L1	CO5
1.c)	What is surveying?	L1	CO2
1.d)	Basic differences between flexible and rigid pavements.	L1	CO3
1.e)	What are the functions of DAMS?	L1	CO4

			BL	CO	Max. Marks
		UNIT-I			
2	a)	Explain the necessity of civil engineering for society building.	L2	CO1	5 M
	b)	Discuss pre-fabricated construction techniques in detail.	L2	CO5	5 M
		OR			
3		Elaborate the scope of any three civil engineering disciplines.	L2	CO1	10 M

		UNIT-II			
4	a)	Define contour and discuss the characteristics of contours and give suitable sketches.	L2	CO2	5 M
	b)	Discuss briefly about prismatic compass.	L2	CO2	5 M
		OR			
5	a)	The following staff readings were observed successively with a level. The instrument has been moved after 5^{th} and 11^{th} readings. 0.485, 1.210, 1.635, 3.395, 3.775, 0.650, 1.400, 1.795, 2.575, 3.375, 3.895, 1.735, 0.635, 1.605 m. Determine the R.L. of various points, if the first reading was taken with a leveling staff held on a bench mark of R.L of 100m using Raise and Fall method.	L2	CO2	6 M
	b)	Explain any two methods of leveling.	L2	CO2	4 M
		UNIT-III			
6	a)	Explain the necessity of transportation for any country.	L2	CO3	5 M
	b)	What is mean by hydrology and state its importance?	L2	CO4	5 M
		OR			
7	a)	Explain Tunnel and Airport engineering.	L2	CO3	5 M
	b)	Discuss quality and specifications of water.	L2	CO4	5 M

PART – B

		BL	CO
1.f)	Write any four different applications of Ferrous materials.	L1	CO1
1.g)	What is shape memory alloy?	L1	CO1
1.h)	What is hot working and cold working process?	L1	CO2
1.i)	What is the principle of boiler?	L1	CO2
1.j)	What is Fission Process?	L1	CO3

			BL	CO	Max. Marks
		UNIT-I			
8	a)	Write down the role of mechanical engineering in energy and manufacturing sector.	L2	CO1	5 M
	b)	Explain the applications of composite materials.	L2	CO1	5 M
		OR			
9	a)	Discuss the different types of ceramic materials.	L2	CO1	5 M
	b)	Explain the applications of smart materials.	L2	CO1	5 M
		UNIT-II			
10	a)	Discuss the different types of forming processes with diagrams.	L2	CO2	5 M
	b)	Draw and show the following parts of the sand mold and mention their functions. i) Riser, ii) Vent Hole, iii) Chaplet, iv) Mold cavity, v) Runner.	L2	CO2	5 M
		OR			
11	a)	Differentiate between welding and	L2	CO2	5 M

		brazing processes.			
	b)	Explain the working principle of Vapor Compression Refrigeration system with a neat sketch.	L2	CO2	5 M
		UNIT-III			
12	a)	Discuss about the Hydro power plant with few advantages.	L2	CO3	5 M
	b)	Explain different types of Gear Drives and Chain Drives.	L2	CO3	5 M
		OR			
13	a)	Explain different configurations of robot.	L2	CO3	5 M
	b)	Differentiate between Flat belt and V belt drives based on the applications.	L2	CO3	5 M

23ES1101

Basic civil & Mechanical Engineering

Scheme of Evaluation

I B.Tech I Sem Regular Exam feb 2024

Part-B

1,

f) $\frac{1}{4}$ mark for each Application $= \frac{1}{4} \times 4 = 1$ m

g) 1 mark for definition $= 1$ m

h) $\frac{1}{2}$ mark for hot working $\frac{1}{2}$ mark for cold working $= 1$ m

i) 1 mark for boiler principle $= 1$ m

j) 1 mark for explanation of Fission Process $= 1$ m

Unit-I

8 a) $\frac{1}{2}$ mark for each role of mechanical engineer in energy sector $\frac{1}{2} \times 5 = 2.5$ m

$\frac{1}{2}$ mark for each role in manufacturing sector $\frac{1}{2} \times 5 = 2.5$ m

5 m

b) 1 mark for each application of composite material $= 1 \times 5 = 5$ m

9 a) 1 mark for each type of composite material Specification & explanation $= 1 \times 5 = 5$ m

b) 1 mark for each application of smart materials $= 1 \times 5 = 5$ m

Unit II

10 (a) 1 mark for each type of forming process explanation
& 1 mark for diagram of each forming process (for any two) $1+3=3$ marks $+2$ marks $= 5$ M

(b) 1 mark for each part mentioning & welding application $1 \times 5 = 5$ M

11 (a) 1 mark for each difference point b/w Welding & brazing $1 \times 5 = 5$ M

(b) 3 marks for sketch of Vapor compression Refrigeration system $3+2 = 5$ M
2 marks for explanation

Unit – III

12 (a) 2 marks for sketch of hydro power plant
1 mark for Explanation about plant
2 marks for advantages $2+1+2 = 5$ M

(b) $2\frac{1}{2}$ m for different Gear drives $2\frac{1}{2}+2\frac{1}{2} = 5$ m
$2\frac{1}{2}$ m for different chain drives

(or)

13 (a) 1 mark for each type of configuration & Point Explanation & diagrams $1 \times 5 = 5$ M

(b) 1 mark for each difference point b/w Flat belt & V belt $1 \times 5 = 5$ M

Part –B

1.

f) 4 different applications of Ferrous materials

1. Cast iron is used in applications like engine blocks, pipes
2. Cast iron is used in applications like cookware and structural elements
3. Wrought Iron is used in applications like railings and furniture
4. wrought iron is used in ornamental and decorative applications

g) Shape memory alloy can "remember" a specific shape and return to it's original shape when subjected to temperature changes. Eg: Nickel-titanium (NiTi) is a well-known shape memory alloy.

h) Hot working is a metal-forming process that occurs at the red hot condition of the material i.e above the recrystallization temperature of the material being shaped and cold working is is a metal-forming process that occurs at the below recrystallization temperature of the material being shaped.

i)A boiler generates steam or vapour or combination of both by heating a liquid usually water under pressure by combustion of Fossil fuels.

j) Nuclear fission is the process of breaking the nucleus of an atom into two lighter nuclei. The process may take place spontaneously in some cases or may be induced by the excitation of the nucleus with a variety of particles.

Unit – 1

8. a) Role of Mechanical Engineering in Energy and Manufacturing sector

The energy sector is a category that relate to producing or supplying energy. Role of Mechanical engineering in gaining the technology in the energy sector was as follows

- Renewable Energy: Technologies like solar panels, wind turbines and hydroelectric systems have gained prominence for clean and sustainable energy generation.
- Energy Storage: Advances in battery technology, such as lithium-ion batteries and solid-state batteries, enable efficient energy storage for grid stabilization and electric vehicles.
- Smart Grids: Smart grid technologies enhance the efficiency and reliability of energy distribution, with features like real-time monitoring and demand response systems.
- Nuclear Fusion: Ongoing research in nuclear fusion aims to harness the power of the sun for a virtually limitless and clean energy source.

Role of Mechanical engineering in gaining the technology in the **Manufacturing sector** was as follows

- Additive Manufacturing (3D Printing): 3D printing technologies allow for rapid prototyping and customized production, reducing waste and lead times.
- Industry 4.0: The integration of automation, IoT, and data analytics into manufacturing processes for smart factories, leading to improved efficiency and predictive maintenance. Industry 4.0 can be defined as the integration of intelligent digital technologies into manufacturing and industrial processes

- Robotics and Automation: The use of robots for repetitive and complex tasks, including collaborative robots (cobots) working alongside humans.
- Augmented Reality (AR) and Virtual Reality (VR): These technologies assist in training, maintenance, and design tasks by providing immersive and interactive experiences.

b) **Applications of composite materials can be found in the following areas**

- In Aerospace: space shuttle tiles, thermal barriers, high-temperature glass windows, fuel cells.
- Can used as a cutting tool.
- In the military - ceramic armour, structural components for ground, air and naval vehicles, missiles and sensors.
- In Automotive: catalytic converters, ceramic filters, airbag sensors, spark plugs, pressure sensors, vibration sensors, oxygen sensors, safety glass windshields, piston rings.
- In Computers: insulators, resistors, superconductors, capacitors, ferroelectric components, microelectronic packaging.
- Consumer Uses: glassware, windows, pottery, magnets, dinnerware, ceramic tiles, Tenses, home electronics, microwave transducers.

9 (a) Different types of ceramic materials

Oxide Ceramics: Oxide ceramics are a category of ceramic materials that are primarily composed of oxygen and one or more metallic elements.
Examples: Alumina (aluminum oxide), Zirconia (zirconium oxide)
Applications: Cutting tools, ball bearings, spark plug insulators and dental implants.
Nitride Ceramics: Nitride Ceramics are of class of ceramic materials primarily composed of nitrogen and one or more metallic elements.
Examples: Silicon Nitride (Si3N4), Aluminum Nitride (AlN)
Applications: Bearings, turbine blades and heat sinks in electronics.
Carbide Ceramics: Carbide ceramics are a category of ceramic materials primarily composed of carbon and one or more metallic elements
Examples: Silicon Carbide (SiC), Tungsten Carbide (WC)
Applications: Cutting tools, abrasive materials and armor.
Refractory Ceramics: Refractory ceramics, also known as refractories, are a category of ceramic materials that are specifically designed to withstand extreme temperatures, often in excess of 1,000 degrees Celsius (1,800 degrees Fahrenheit).
These materials are highly heat-resistant and have excellent thermal and chemical stability
Examples: Alumina, Silicon Carbide, Magnesia (magnesium oxide)
Glass Ceramics: Glass ceramics are a special class of materials that combine the properties of both glass and ceramics.
Applications: Cookware, glass-ceramic cooktops, dental restorations.

b) Applications of smart materials:

1.In Accelerometers (e.g., stabilizing quadrotors)
2. In Strain Sensors
3. In Emitters and Receivers of Stress Waves
4. In Active Vibration Control in Stationary and Moving Structures (e.g., helicopter blades)
5. In Smart Skins for Submarines

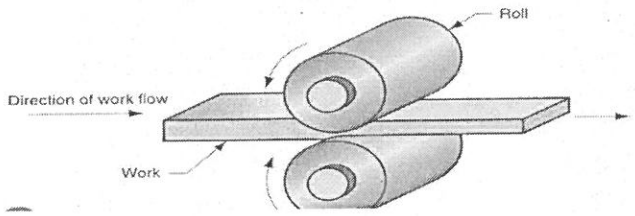
6.In Piezoelectric Materials with Skin-like Properties for Sensing Temperature and Pressure
7. Utilization in Thermochromic Technologies, including liquid crystals, thermochromic paper, polymers and inks.
8. Implementation in Photochromic Lens Technology.

Unit – II

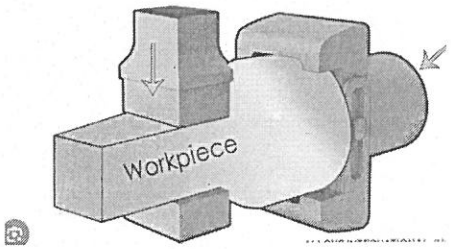
10 a) Different types of forming process

1. Rolling
2. Extrusion
3. Forging

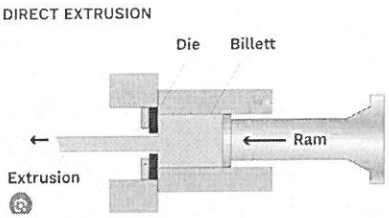
Rolling : One kind of a forming operation is *rolling, which is the process of* reducing the thickness of a flat sheet of material by compressing it between rollers. Sheet metal that is produced in this manner is used to make aircraft wings and fuselages, beverage containers, and the body panels of automobiles.



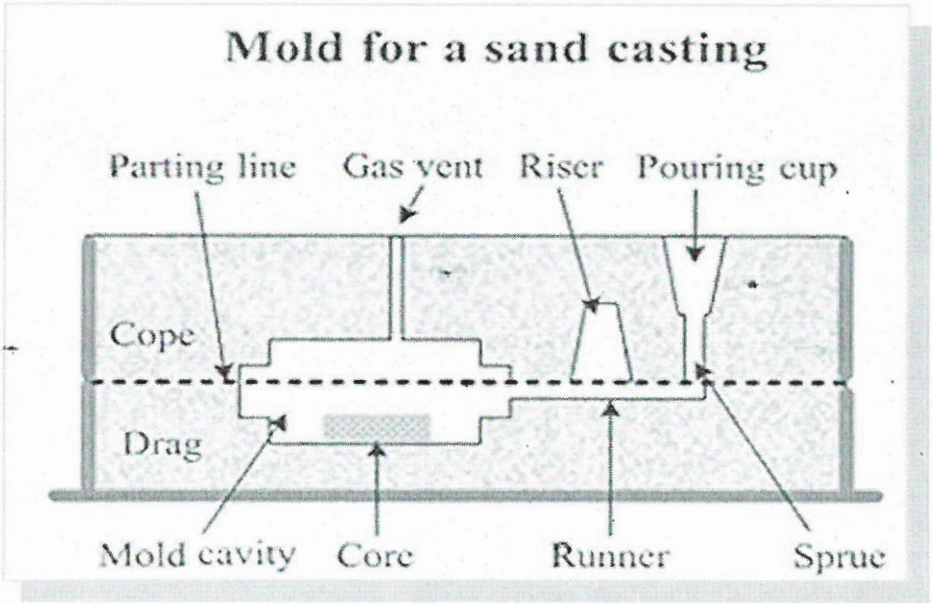
Forging: Forging is another forming process, and it is based on the principle of heating, impacting, and plastically deforming metal into a final shape. Industrial-scale forging is the modern version of the blacksmith's art of working metal by hitting it with a hammer against an anvil. Components that are produced by forging include some crankshafts and connecting rods in internal combustion engines.



Extrusion : Another forming process known as *extrusion is used to create long straight* metal parts whose cross sections may be round, rectangular. In extrusion, a mechanical or hydraulic press is used to force heated metal through a tool (called a die) that has a tapered hole ending in the shape of the finished part's cross section. The die is used to shape the raw material, and it is made from a metal that is much harder than what is being formed.



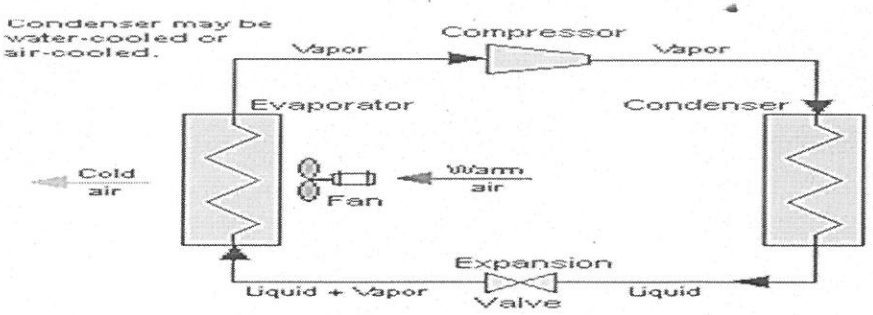
10 b)



11 a) Differences between Welding and Brazing process

Welding	Brazing
Work piece to be joined need to be heated till their melting point.	Work pieces are heated but below their melting point.
Mechanical properties of base metal may change at the joint due to heating and cooling.	May change in mechanical properties of joint but it is almost negligible.
Heat cost is involved and high skill level is required.	Cost involved and sill required are in between others two.
Heat treatment is generally required to eliminate undesirable effects of welding.	No heat treatment is required after brazing.
No preheating of workpiece is required before welding as it is carried out at high temperature.	Preheating is desirable to make strong joint as brazing is carried out at relatively low temperature.

11 b)



The vapor compression refrigeration cycle consists of four main components: 1. Compressor, 2. Condenser, 3. Expansion valve, 4. Evaporator. Each component plays a crucial role in the overall functioning of the cycle.

Compressor: Low pressure and low temperature vapour refrigerant was sucked in to the compressor from evaporator. The compressor is the heart of the refrigeration system and is responsible for compressing the refrigerant gas and raises its pressure and temperature. This process increases the energy of the refrigerant, allowing it to absorb heat from the surroundings.

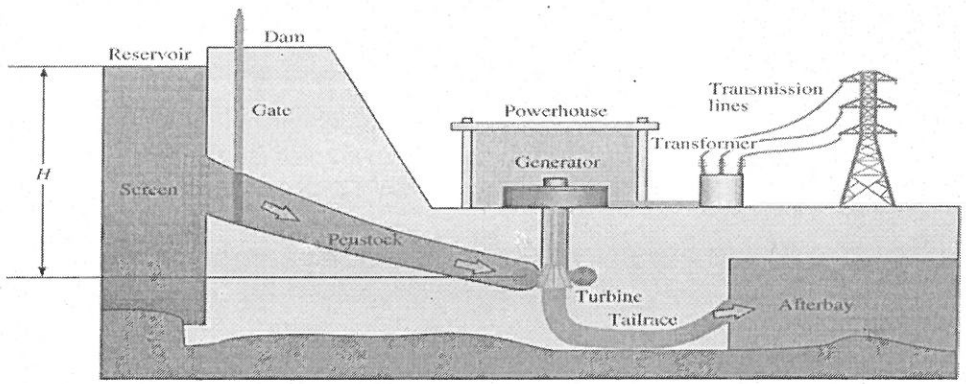
Condenser: The condenser is where the high-pressure, high-temperature refrigerant gas is cooled and condensed into a liquid state. This is achieved by transferring heat from the refrigerant to the surrounding environment, usually through the use of a fan or water-cooling system. As the refrigerant cools down, it releases heat and changes its state from a gas to a liquid.

Expansion Valve: The expansion valve is a small device that controls the flow of the refrigerant from the high-pressure side of the system to the low-pressure side. It creates a pressure drop, which causes the refrigerant to expand rapidly. This expansion leads to a decrease in temperature and pressure, preparing the refrigerant for the next stage of the cycle.

Evaporator: The evaporator is where the refrigerant absorbs heat from the space that needs to be cooled. As the low-pressure, low-temperature liquid refrigerant enters the evaporator, it evaporates into a gas by absorbing heat from the surroundings. This heat transfer process cools down the space, making it suitable for various applications, such as air conditioning or food preservation.

Unit – III

12 a) Hydro power plant : Produces electrical energy from the flow of water



- The dam serves as a barrier, raising the water level in the reservoir to increase its potential energy. The height difference between the reservoir and the penstock is the key factor behind the pressure that drives the turbine, generating power.
- When the control gates are opened, water flows through the penstock toward the turbine. Along the penstock's length, surge tanks and trash racks are strategically placed. The surge tank is vital for preventing water hammering, compensating for sudden changes in load on the turbine and ensuring a consistent flow of water to the turbine, preventing power output fluctuations.
- Trash racks remove impurities from the water before it reaches the turbine, reducing wear and tear on the turbine and extending its lifespan.
- As water strikes the turbine blades, it converts the pressure energy into mechanical energy, which is then transformed into electrical energy by the generator. The resulting high-voltage electricity is transmitted to the power grid via transmission lines.

Advantages:

- Abundant and reliable renewable energy source in India.
- Provides consistent power without fluctuations, even during increased load conditions.
- Allows controlled water supply for downstream agriculture.
- Modest maintenance and operational costs.
- Can mitigate downstream flooding.
- Offers tourism opportunities

b) Gear drives: Gear drives are mechanisms that transmit power and motion between rotating shafts using interlocking gears. They function based on the principles of meshing teeth to transfer torque and rotation. The primary components of a gear drive include:

Types of Gear Drives

- Spur Gears: These have straight teeth and are the most common type. They transmit motion between parallel shafts.
- Helical Gears: With angled teeth, helical gears offer smoother and quieter operation compared to spur gears. They also transmit motion between parallel shafts.
- Bevel Gears: These gears have cone-shaped teeth and are used to transmit motion between intersecting shafts.

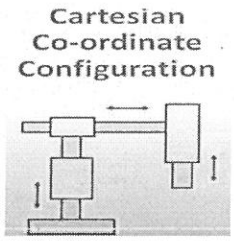
Chain drives: Chain drives are a mechanical power transmission system that transfers rotary motion between two or more shafts using a metal chain. They consist of interconnected links that mesh with teeth on sprockets to transmit power.

Types of Chain Drives:

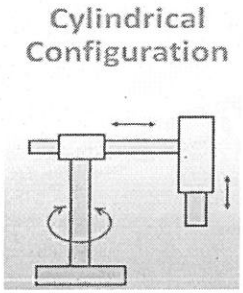
- Roller Chain: Commonly used in various applications due to its ability to handle high loads and transmit power efficiently.
- Silent Chain: Employed in applications requiring smooth and noiseless operation, such as in some automotive timing systems.
- Inverted Tooth Chain: Known for its ability to handle high speeds and high loads, used in precision machinery and certain industrial applications

13 a)

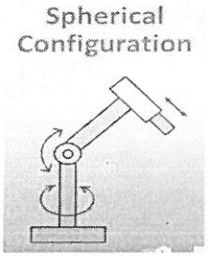
1. Cartesian Coordinate System(P-P-P) : The Cartesian coordinate is also called rectangular coordinate system. In this system, the 3 sliding corresponding to moving the wrist up and down in and out and back , forth takes place. This configuration is represented by (Prismatic-Prismatic- Prismatic).



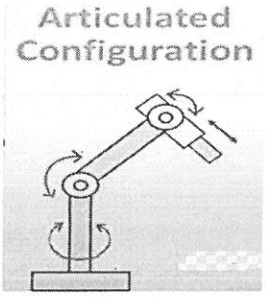
2. Cylindrical Coordinate System(R-P-P) : The cylindrical robot has a rotary joint for rotation and a prismatic joint for angular motion around the joint axis. The rotary joint moves in a rotational movement around the common axis. In contrast, the prismatic joint will move in a linear motion.



3. Spherical or Polar Coordinate system(R-R-P) :Polar robots are robot configurations with a combined linear joint and two rotary joints, with an arm connected to a robotic base and a twisting joint. Also known as spherical robots, the axes create a spherical work envelope and a polar coordinate system.



4. Articulated Arm (R-R-R) : configurations with three rotary joints. The best example for this type of configuration has been observed in some of the type of robots specially known as SCARA.



b) Differences between Flat belt and V belts

Flat Belt Drive	V-Belt Drive
Flat belt has rectangular cross-section where width is substantially larger than thickness.	V-belt has trapezoidal cross-section where larger side width is almost same with thickness.
Flat belt is jointed (hinged). So it produces vibration and noise.	V-belt is made endless. Thus its operation is smooth and quite.
In flat belt drive, only one surface of the belt remains in contact with the pulleys.	In V-belt drive, two side surfaces of the belt remain in contact with the pulleys.
Power transmission capacity of flat belt is comparatively lower due to higher chance of slip.	V-belt can transmit more power without slip due to increased friction.
It is recommended for long distance power and motion transmission.	It is preferred for short to medium distance power and motion transmission.
Slip also limits the achievable speed reduction. Up to 1:4 reduction is attainable.	Higher speed reduction, up to 1:7, is attainable.