JUNIOR ENGINEER MECHANICAL ENGINEERING EXAMINATION 2024 MEMORY BASED QUESTIONS (PAPER-I)

EXAM DATE	**05/06/2024**
EXAM TIME	**1:00 PM – 3:00 PM**
SUBJECT	**Junior Engineer 2024 Mechanical Engineering (Paper-I)**

SECTION A & B: MECHANICAL ENGINEERING (NON-TECH)

Q.1. Name of Aravali mountain range
Sol. Folded mountain range

Q.2. Bhakra Nangal dam is brief in which river
Sol. Bhakra Nangal dam is built on Sutlej river which is situated in Bilaspur district of Himachal Pradesh.

Q.3. 103rd CAA is related to
Sol. 103rd CAA is related to 10% reservation for economic weaker section(EWS).

Q.4. Who was awarded with noble prize for singing?
Sol. When it was announced on October 13th, 2016 that Bob Dylan would be awarded the Nobel Prize in Literature that year, many were outraged by the Swedish Academy's decision to privilege a singer-songwriter and musician over a more conventional literary writer.

Q.5. When Swami Vivekanand was born?
Sol. Swami Vivekanand is born on 12 January, 1863 and this day is celebrated as National Youth Day.

Q.6. PM Vishwakarma scheme was launched on?
Sol. PM Vishwakarma scheme was launched on 17th September, 2023.

Q.7. Article-32 of the constitution is related to writ petition?
Sol.

- Herbis Corpus
- Mandamus
- Prohibition
- Certiorari
- Quo-warranto

Q.8. What was the Khilji dynasty time period?
Sol.

- 1290-1320
- Founded by Jalal-ud-din Khilji

Q.9. Article-151 is related to?
Sol. Article-151 is related to Controller Auditor General (CAG) reports of Centre and State.

Q.10. Section-151A of representation of People's Act, 1951 is related to

Sol. Section-151A of representation of People's Act, 1951 is related to filling casual vacancies in parliament and state legislature within the period of six months.

Q.11. Who was first finance minister of India?

Sol. RK Shanmukham Chetty was the first finance minister of India. R.K. Shanmukham Chetty was born in Coimbatore on 17th October 1892. Independent India's first Budget was presented by the country's first finance minister, RK Shanmukham Chetty, on November 26, 1947, which was an interim Budget.

Q.12. Who was the first Chief Justice of Supreme Court who also became acting Prime Minister of India?

Sol. Mohammad Hidayatullah was the 11th Chief Justice of India. He had also served as the Acting President of India from 20 July 1969 to 24 August 1969 and from 6 October 1982 to 31 October 1982.

Q.13. Which vitamin deficiency leads to tuberculosis?

Sol. Deficiency of vitamin D (25-hydroxycholecalciferol) has long been implicated in activation of tuberculosis (TB) (1).

Q.14. Article-42 of directive principle of state policy(DPSP) is related to?

Sol. Article-42 of directive principle of state policy(DPSP) is related to the State shall make provision for securing just and humane conditions of work and for maternity relief.

Q.15. Algae belongs to which kingdom?

Sol. Algae belongs to kindom protista.

Q.16. Arrange the planets according to size?

Sol. The eight planets in our solar system can be arranged as follows based on their size: Mercury < Mars < Venus < Earth < Neptune < Uranus < Saturn < Jupiter.

Q.17. Which minister is responsible for Narmada river protection?

Sol. Narmada Control Authority, Ministry of Jal Shakti.

Q.18. What is the sequence of fundamental duties?

Sol.

S.No	11 Fundamental Duties
1.	Abide by the Indian Constitution and respect its ideals and institutions, the National Flag and the National Anthem
2.	Cherish and follow the noble ideals that inspired the national struggle for freedom
3.	Uphold and protect the sovereignty, unity and integrity of India
4.	Defend the country and render national service when called upon to do so
5.	Promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities and to renounce practices derogatory to the dignity of women
6.	Value and preserve the rich heritage of the country's composite culture
7.	Protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures
8.	Develop scientific temper, humanism and the spirit of inquiry and reform
9.	Safeguard public property and to abjure violence
10.	Strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement
11.	Provide opportunities for education to his child or ward between the age of six and fourteen years. (This duty was added by the 86th Constitutional Amendment Act, 2002)

Q.19. Which minister introduced GST bill?
Sol. Arun Jaitely

Q.20. 16th Speaker of Himachal Pradesh?
Sol. Kuldeep Singh Pathania, INC since 5 January 2023.

Q.21. Which device is used to measure earthquake?
Sol. Seismograph

Q.22. Montreal protocol is related to?
Sol. The Montreal Protocol, finalized in 1987, is a global agreement to protect the stratospheric ozone layer by phasing out the production and consumption of ozone-depleting substances (ODS). ODS are substances that were commonly used in products such as refrigerators, air conditioners, fire extinguishers, and aerosols.

Q.23. Which organelle is called suicide bag?
Sol. Lysosomes

Q.24. Tectonic plate movement relates to?
Sol. The movement of these tectonic plates is likely caused by convection currents in the molten rock in Earth's mantle below the crust. Earthquakes and volcanoes are the short-term results of this tectonic movement. The long-term result of plate tectonics is the movement of entire continents over millions of years (Fig.

Q.25. What is the meaning of fraternity?
Sol. 1. : a social, honorary, or professional organization. especially : a social club of male college students.

SECTION C: MECHANICAL ENGINEERING

Q.1. **What is Chemical formula of ammonia?**

Sol. NH_3

Where,

N→Nitrogen

H → Hydrogen

Q.2. **PMM–II to dis-obeys which of the following law?**

(a) First law of thermodynamics

(b) Second law of thermodynamics

(c) Third law of thermodynamics

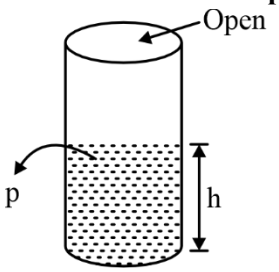
(d) None of these

Sol. Second law of thermodynamics.

Q.3. **Which of the following method of casting is a permanent moulding method?**

Sol. Die casting

Q.4. **What is the absolute pressure for the given figure as shown below?**



(a) ρgh

(b) $p_{atm} + \rho gh$

(c) p_{atm}

(d) p_g

Sol.

Absolute pressure = Guage pressure + atmospheric pressure

$p_{ab} = p_g + p_{atm}$

$p_{ab} = \rho gh + p_{atm}$

Q.5. **What is name of CCl_3F**

Sol. R – 011

Q.6. **Why superheater is used in Power Plant?**

Sol. A power plant uses a superheater to increase thermal efficiency by raising the temperature of steam above its saturation point.

Q.7. **Air preheater is used for?**

Sol. An air preheater is used to increase the thermal efficiency of a power plant by heating the air before it enters the furnace, which improves the combustion efficiency and reduces fuel consumption.

Q.8. **Center of pressure does not depend upon**

(a) C.G.
(b) Area
(c) MOI
(d) density of liquid

Sol. The center of pressure is the point where the total sum of the pressure field acts on a submerged surface and can be calculated using the principles of fluid mechanics. It primarily depends on the shape and orientation of the surface, the location of the center of gravity (C.G.), the area of the surface, and the moment of inertia (MOI) of the surface. However, it does not depend on the density of the liquid.

$$h^* = \frac{I_G \times \sin^2\theta}{A\bar{h}} + \bar{h}$$

Q.9. **In the spring control governor if the stiffness is increased then what will be impact on sensitivity of an governor?**

Sol. In a spring-controlled governor, if the stiffness of the spring is increased, the sensitivity of the governor will decrease.

Increasing the stiffness of the spring means that a greater force is required to produce the same amount of displacement. This means that for the same change in speed, the governor will move less, making it less responsive to small changes in speed.

Q.10. **In the irreversible process entropy increases or decreases**

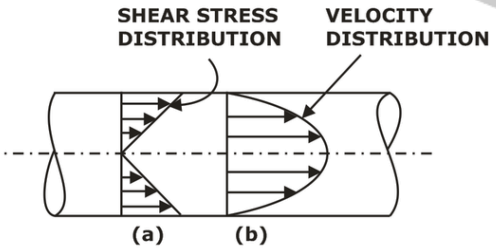
Sol. In an irreversible process, entropy always increases.

According to the second law of thermodynamics, the entropy of an isolated system never decreases; it either increases or remains constant. For irreversible processes, entropy increases because they are accompanied by irreversibilities that generate entropy within the system.

Thus, in an irreversible process, the entropy of the system (and the universe) increases.

Q.11. Distribution of shear stress in circular pipe for laminar flow condition?

Sol. In a circular pipe under laminar flow conditions, the distribution of shear stress is linear with respect to the radius. The shear stress is highest at the wall of the pipe and decreases linearly to zero at the center of the pipe.



Q.12. **In, h = u + pv, 'pv' represents**

Sol. In the thermodynamic equation h = u + pv, the term pv represents the **flow work** or **flow energy**.

Q.13. **Overall efficiency of a turbine in the form of mechanical and hydraulic efficiency**

Sol. The overall efficiency of the turbine combines both hydraulic and mechanical efficiencies. It represents the ratio of the useful mechanical work output to the hydraulic power input.

It can be calculated as the product of hydraulic efficiency and mechanical efficiency.

$\eta_{overall} = \eta_h \times \eta_{mech}$

Q.14. Which term remains constant in the throttling process?

Sol. Enthalpy remains constant in the throttling process. This is a key characteristic of the throttling process, where the enthalpy of the fluid does not change despite significant changes in temperature and pressure.

Q.15. What is unit of force

Sol. The unit of force is Newton (N) in the SI system and Pound-force (lbf) in the Imperial system.

Q.16. If carbon content in steel is less than 0.21% then it is which type of steel?

(a) HSS
(b) High Carbon Steel
(c) Alloy Steel
(d) Mild Steel

Sol. The carbon content of mild steel typically ranges from 0.05% to 0.25% by weight. This low carbon content contributes to its relatively low tensile strength and good formability, making it suitable for various applications such as construction, automotive, and general engineering.

Q.17. Kaplan turbine belongs to which of the following

(a) Axial flow
(b) Radial flow
(c) Tangential flow
(d) Mixed flow

Sol. The Kaplan turbine is an axial flow turbine. It has a propeller-like design where the flow enters the turbine axially (parallel to the axis of rotation) and exits the turbine axially.

Q.18. Porter Governor

Sol. The Porter governor is a type of centrifugal governor used to control the speed of steam engines and other rotating machinery. It is a gravity-controlled governor.

Q.19. Find Polar moment of inertia when G, L and D of circular cross-section is given

Sol.

The polar moment of inertia (also known as the torsional constant) J of a circular cross section can be calculated using the diameter D or radius $R = \frac{D}{2}$.

The formula for the polar moment of inertia J of a circular cross section is

$$J = \frac{\pi}{32} D^4$$

Q.20. What is the spring stiffness formula?

Sol. $$\boxed{K = \frac{Gd^4}{64R^3 n}}$$

Q.21. Type of casting in which the die is permanent.

Sol. The type of casting in which the die (mold) is permanent and can be reused to create multiple castings is called **permanent mold casting** or **gravity die casting**.

Q.22. Which device is used to heat steam above saturation level

Sol. The device used to heat steam above its saturation level is called a superheater.

Q.23. Hermetically sealed compressor refer to?

Sol. A hermetically sealed compressor is a compressor in which the compressor and the motor driving it are enclosed within the same housing, so the entire system is sealed and operates without a shaft seal.

Q.24. Formula of Heat rejection ratio (HRR)?

Sol. $$\boxed{\text{HRR} = 1 + \frac{1}{\text{COP}}}$$

Q.25. Zeroth law of thermodynamics gives the concept of?

Sol. The Zeroth Law of Thermodynamics introduces the concept of temperature and thermal equilibrium.

Q.26. Hygrometer measures?

Sol. A hygrometer is an instrument used to measure the amount of moisture or humidity in the atmosphere.

Q.27. Volumetric efficiency of reciprocating compressor is given by

Sol. $$\eta_{vol} = \frac{V_{act}}{V_{th}}$$

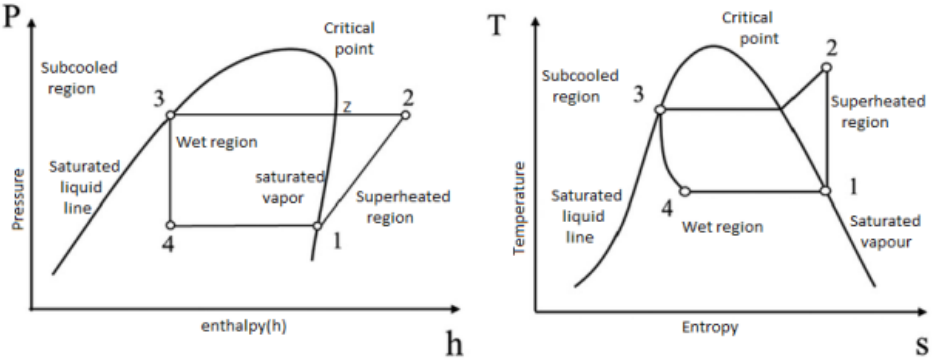
$$\eta_{vol} = 1 + C - C\left(\frac{P_H}{P_L}\right)^{\frac{1}{n}}$$

Q.28. In which casting wax is used?

Sol. Wax is used in the **investment casting** process. Investment casting, also known as lost wax casting, is a manufacturing process used to create complex metal parts from wax patterns.

Q.29. P-h diagram of vapour compression refrigeration system(VCRS)?

Sol.



Q.30. Which of the following friction is considered when the body on the rough surface just about to move?

(a) Static friction
(b) Dynamic friction
(c) Limiting friction
(d) None of these

Sol. Limiting friction

MECHANICAL ENGINEERING

Q.35. Kelvin plank's statement?

Sol. According to Kelvin plank "It is impossible to construct a device which operates on a cycle and produces no other effect than the transfer of heat from a single body to produce work.

Q.36. Hot working done

(a) below recrystallization temperature
(b) above recrystallization temperature
(c) At room temperature
(d) None of the above

Sol. above recrystallization temperature

Q.37. What are the assumptions of the air-standard cycle?

(a) below recrystallization temperature
(b) above recrystallization temperature
(c) At room temperature
(d) None of the above

Sol. Air standard assumptions

1. The working medium is a perfect gas with constant specific heats and molecular weight corresponding to values at room temperature.
2. No chemical reactions occur during the cycle. The heat addition and heat rejection processes are merely heat transfer processes.
3. The processes are reversible.
4. Losses by heat transfer from the apparatus to the atmosphere are assumed to be zero in this analysis.
5. The working medium at the end of the process (cycle) is unchanged and is at the same condition as at the beginning of the process (cycle).

Q.38. Mist lubrication system used in

Sol. Mist lubrication is commonly used in 2-stroke engines, particularly in certain types of 2-stroke engines where the lubrication system is designed to mix oil with the fuel to provide lubrication to the engine's moving parts.

Q.39. Which welding uses capillary action to fill the filler material in joining process?

(a) Gravity due casting
(b) Braze welding
(c) Brazing
(d) None of these

Sol. Brazing uses capillary action to fill the filler material in joining process.

Q.40. In a drilling operation, given the tool diameter (D) in meters and cutting speed (V) in meters per second, determine the rotational speed of the tool in revolutions per minute (rpm).

Sol. $V = \frac{\pi DN}{60}$

$$\therefore N = \frac{60 \times V}{\pi D}$$