# mIEt MEERUT INSTITUTE OF ENGINEERING AND TECHNOLOGY

NH-58, Delhi-Roorkee Highway, Baghpat Road, Meerut – 250005 U.P.

## Make-Up Test – I : Odd Semester 2022-23

| Course/Branch | : B Tech | Semester | : I |
| Subject Name | : FME | Max. Marks | : 60 |
| Subject Code | : BME101 | Time | : 90 min |

**CO-4** : *Understand fluid properties, conservation laws and hydraulic machinery used in real life.*

**CO-5** : *Understand the working principle of different measuring instrument and mechatronics with their advantages, scope and Industrial application.*

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### Section – A (CO - 4) # Attempt Both The Questions # 30 Marks

Q.1 : Attempt all **THREE** questions (Short Answer Type). Each question is of 4 marks. (3 x 4 = 12 Marks)

a) Define the following fluid properties (i) Dynamic Viscosity (ii) Kinematic Viscosity (iii) Specific gravity.

b) Define hydraulic turbines. How they are classified?

c) State the Newton's law of viscosity. What are Newtonian and non-Newtonian fluids?

Q.2 : Attempt all **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a) The Diameter of a pipe at section '1' and section '2' are 10 cm and 15 cm respectively. Find the discharge through the pipe if velocity of water flowing through the pipe at section '1' is 5 m/s. Also determine the velocity at section '2'.

b) Explain the construction and working of Reaction turbine with neat sketches.

c) Explain the construction and working of centrifugal pump with neat sketch.

### Section – B (CO - 5) # Attempt Both The Questions # 30 Marks

Q.3 : Attempt all **THREE** questions (Short Answer Type). Each question is of 4 marks. (3 x 4 = 12 Marks)

a) Define Mechatronics. What are its advantages and disadvantages?

b) Define following : (i) Calibration (ii) Accuracy (iii) Precision and (iv) Resolution.

c) Define Autotronics, Bionics and Avionics with examples.

Q.4 : Attempt all **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a) What are various measuring instruments used for pressure? Explain Bourdon tube pressure gauge in brief.

b) Define Mechanical actuators. Explain any three in details.

c) Write short notes on (i) Pressure Control Valves (ii) Direction Control Valves

# MEERUT INSTITUTE OF ENGINEERING AND TECHNOLOGY

### NH-58, Delhi-Roorkee Highway, Baghpat Road, Meerut – 250 005 U.P.

**Sessional Examination / Class Test – I : Odd Semester 2022-23**          (300)

9/12/2

| | | | |
|---|---|---|---|
| **Course/Branch** | : B Tech – Ist Year (0C2, 0C4, 0C6, 0C8, 0C-10, | **Semester** | : I |
| **Subject Name** | : Fundamental of Mechanical Engineering Group ) | **Max. Marks** | : 60 |
| **Subject Code** | : BME101 | **Time** | : 120 min |

**CO-1** : *Apply the concept of force resolution and stress and strain to solve basic problems*

**CO-2** : *Understand the construction details and working of internal combustion engines, electric vehicle and hybrid vehicles.*

## Section – A  (CO - 1 ) # Attempt both the questions # 30 Marks

Q.1 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks.     (2 x 6 = 12 Marks)

   a)  Define strain. Also explain normal and shear strain with neat sketches.

   b)  Define (i) Factor of safety, (ii) Poisson's Ratio.          ◯

   c)  What do you mean by moment and couple of a force?

   d)  State the Lami's theorem.

   e)  State Parallelogram law of forces.

   f)  Define the following (i) Resultant of a force (ii) Free body diagram(FBD)

   g)  State Principle of transmissibility.
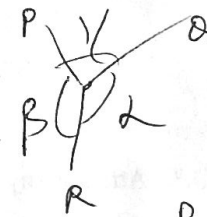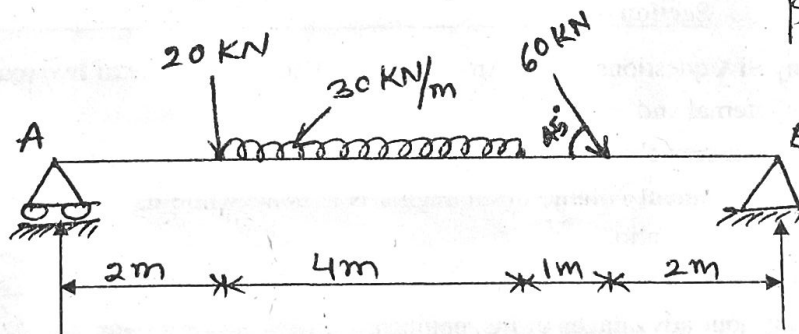
Q.2 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. *(3 x 6 = 18 Marks)*

   a)  Explain **force system** in details.

   The resultant of two forces P and 30N is 40N inclined at 60° to the 30N force. Find the magnitude and direction of force P.

   b)  Explain various types of load and supports.

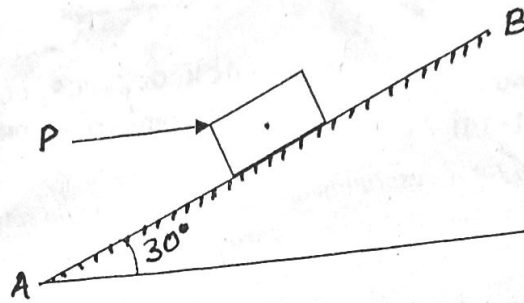   Find the reactions at point A and B in the given fig.



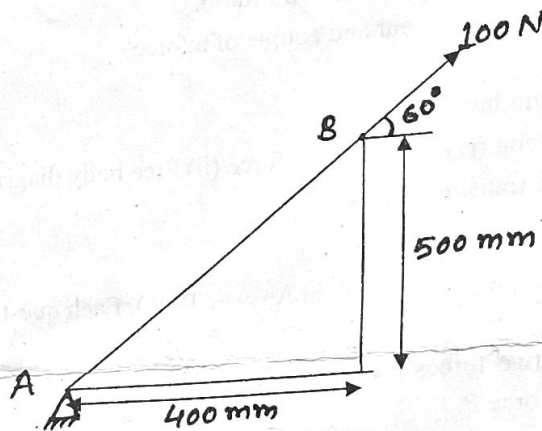$$\frac{P}{Sin\,\alpha} = \frac{Q}{Sin\,\beta} = \frac{R}{Sin\,\gamma}$$

   c)  Define young modulus, shear modulus and bulk modulus.

   A tensile load of 56 kN was applied to a bar of 30 mm diameter with 300 mm gauge length. Measurements showed 0.12 mm increase in length and the corresponding 0.0036 mm contraction in diameter. Make calculations for the Poisson's ratio and the values of three moduli(elastic constants).

P.T.O.

d) Determine the horizontal force **P** to be applied to a block of weigh 1500N to hold it in position on a smooth inclined plane AB which makes an angle of 30° with the horizontal.



e) State and prove **Varignon's theorem.**
Find the moment of 100 N force acting at B about point A as shown in figure-



## Section – B (CO - 2 ) # Attempt both the questions # 30 Marks

Q.3 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks.    (2 x 6 = 12 Marks)

  a) Define internal and external combustion engines.
  b) What is electric vehicle? Draw block diagram.
  c) If the displacement volume of an engine is 2700m³ while its clearance volume is 300 m³, calculate the compression ratio.
  d) Classify the IC engines.
  e) Write any four advantages of I.C. engines.
  f) Define I.D.C and O.D.C related to IC engines.
  g) Define clearance volume and swept volume related to IC engines.

Q.4 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

  a) Explain with suitable sketches the working of a four-stroke CI engine. Also draw p-v and T-S diagram for Otto and diesel cycles.
  b) Differentiate between (i) SI and CI engines, (ii) 2-stroke and 4-stroke engines.
  c) Compare EV and HEV? Write the advantages and disadvantages of Electric Vehicles along with types of batteries and chargers required for EV's.
  d) Write short notes on- (i) EV Transmission system  (ii) EV Power devices
  e) What is the scavenging process? Explain working of two stroke petrol engine with neat sketch.

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# MEERUT INSTITUTE OF ENGINEERING AND TECHNOLOGY
NH-58, Delhi-Roorkee Highway, Baghpat Road, Meerut – 250 005 U.P.

## Sessional Examination / Class Test – II : Odd Semester 2022-23

13/1/23
240

| | | | |
|---|---|---|---|
| Course/Branch | : B Tech (OC-4, OC-6, OC-8, OC-10) | Semester | : I |
| Subject Name | : Fundamental of Mechanical Engineering | Max. Marks | : 60 |
| Subject Code | : BME101 | Time | : 120 min |

**CO-1** : *Explain the construction detail and working of refrigerator, heat pump and air conditioner.*

**CO-2** : *Understand fluid properties, conservation laws and hydraulic machinery used in real life.*

## Section – A  (CO-3) # Attempt both the questions # 30 Marks

Q.1 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks.    (2 x 6 = 12 Marks)

a) Define refrigeration and it applications in different fields.

b) A heat pump has a COP of 1.7. Determine the heat transferred to and from this heat pump when 50 kJ of work is supplied.

c) Define:- (i) dry bulb temperature,(ii) wet bulb temperature, (iii) dew point temperature.

d) Define specific humidity and relative humidity.

e) Define one ton of refrigeration.

f) Derive the relation between the COP of refrigerator and heat pump.

g) Give the name of any four environment friendly refrigerants.

Q.2 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. *(3 x 6 = 18 Marks)*

a) With the help of neat sketch describe the working of *window type air-conditioner.*

b) A fish freezing plant requires 40 tons of refrigeration. The freezing temperature is –35 °C while the ambient temperature is 30°C. If the performance of the plant is 20 % of the theoretical cycle working within the same temperature limits, calculate the power required.

c) A domestic food freezer maintains a temperature of – 15°C. The ambient air temperature is 30°C. If heat leaks into the freezer at the continuous rate of 1.75 kJ/s what is the least power necessary to pump this heat out continuously?

d) Explain the difference between a refrigerator and a heat pump with suitable diagram. Explain the factor which affects human comfort. What are the conditions for comfort air conditioning?

e) What are the different methods of refrigeration? Explain vapour compression refrigeration system (VCRS) in details with T-s diagram.

## Section – B  (CO - 4 ) # Attempt both the questions # 30 Marks

Q.3 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks.    (2 x 6 = 12 Marks)

a) Calculate the density, specific weight and weight of one liter of petrol of specific gravity = 0.7

b) What is the difference between gauge pressure and absolute pressure?

c) State Newton's law of viscosity.

d) What is conservation of mass principle? Write the continuity equation for compressible fluids.

e) Differentiate between impulse and reaction turbines.

f) Define viscosity. How viscosity of liquid and gases varies with temperature.

g) Hydraulic press has a ram of 20 cm diameter and a plunger of 3 cm diameter. It is used for lifting a weight of 30 N. Find the force required at the plunger.

P.T.O.

NH-58, Delhi-Roorkee Highway, Baghpat Road, Meerut – 250 005 U.P.
OF ENGINEERING AND TECHNOLOGY
Roll No. : ..............
(620)
Pre University Test (PUT) : Odd Semester 2022-23
23/2/23

**Course/Branch** : B Tech – ALL
**Subject Name** : FME
**Subject Code** : BME101

**Semester** : I
**Max. Marks** : 100
**Time** : 180 min

CO-1 : Apply the concept of force resolution and stress and strain to solve basic problems
CO-2 : Understand the construction details and working of internal combustion engines, electric vehicle and hybrid vehicles.
CO-3 : Explain the construction detail and working of refrigerator, heat pump and air conditioner.
CO-4 : Understand fluid properties, conservation laws and hydraulic machinery used in real life.
CO-5 : Understand the working principle of different measuring instrument and mechatronics with their advantages, scope and Industrial application.

## Section – A  # 20 Marks (Short Answer Type Questions)

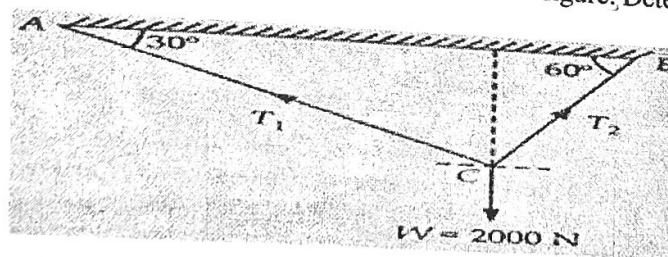Attempt ALL the questions. Each Question is of 2 marks (10 x 2 = 20 marks)

| Q. No. | | COx | Question Description # Attempt ALL the questions. Each Question is of 2 marks |
|---|---|---|---|
| 1 | A | CO1 | What do you mean by moment and couple of a force? |
| | B | CO1 | State Parallelogram law of forces. |
| | C | CO2 | What are Internal Combustion engines? |
| | D | CO2 | What are hybrid electric vehicles (HEV)? |
| | E | CO3 | What do you mean by '1 ton of refrigeration' |
| | F | CO3 | Define Dry bulb, Wet bulb and Dew point temperature. |
| | G | CO4 | State the Newton's law of viscosity. What are Newtonian and non-Newtonian fluids? |
| | H | CO4 | State the Pascal's law. Also write down its applications. |
| | I | CO5 | What do you mean by measurement and Error in measurement? |
| | J | CO5 | What do you mean by linear and rotary actuator? |

## Section – B  # 30 Marks (Long / Medium Answer Type Questions)

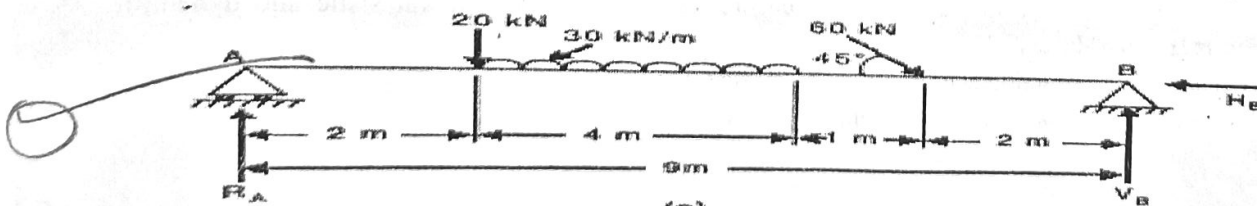Attempt ALL the questions. Each Question is of 6 marks (5 x 6 = 30 marks)

Q.2 (CO-1) : Explain force system in details.

A weight of 2000 N is supported by two chains AC and BC as shown in figure. Determine the tension in each chain.



### OR

Explain different types of loads and supports. Also find the reactions at point A and B as shown in figure.

**Q.3 (CO-2):** Write the differences between (i) Two stroke and four stroke engines (ii) S.I. and C.I. engines.

**OR**

What are electric vehicles? What are the main components of electric vehicle? Write advantages and disadvantages of using electric vehicles.

**Q.4 (CO-3):** With the help of neat sketches explain differences between *refrigerator and heat pump*.

A fish freezing plant requires 40 tons of refrigeration. The freezing temperature is –35 °C while the ambient temperature is 30°C. If the performance of the plant is 20% of the theoretical cycle working within the same temperature limits, calculate the power required.

**OR**

Explain the factor which affects human comfort. What are the conditions for comfort air conditioning?

The food compartment of a refrigerator is maintained at 4°C by removing heat from it at a rate of 360 kJ/min. If the required power input to the refrigerator is 2 kW, determine COP of the refrigerator and the rate of heat rejection to the room.

**Q.5 (CO-4):** Define pump. Explain the construction and working of centrifugal pump with neat sketch.

**OR**

What are reaction turbines? Explain the construction and working of Reaction turbine with neat sketches.

**Q.6 (CO-5):** Define Mechatronics. What are its advantages and disadvantages? Also explain Autotronics, Bionics and Avionics with examples.

**OR**

Explain in brief Pressure control valves and Direction control valves with suitable diagrams.

### Section – C # 50 Marks (Medium / Long Answer Type Questions)

Attempt **ALL** the questions. Each Question is of 10 marks.

**Q.7 (CO-1):** Attempt any TWO questions. Each question is of 5 marks.

   a. State the Hooke's law. Also draw stress-strain diagram for mild steel and cast iron.

   b. State and proof Varignon's theorem.

   c. Develop the relationship between E (Young's modulus), G (Shear modulus), and μ (Poisson ratio).

**Q.8 (CO-2):** Attempt any ONE question. Each question is 10 marks.

   a. What is compression ratio? With the help of neat sketches explain the working of FOUR stroke **S.I.** engine with P-V diagram.

   b. What is scavenging process? With the help of neat sketches explain the working of TWO stroke **C.I.** engines with P-V diagram.

**Q.9 (CO-3):** Attempt any ONE question. Each question is of 10 marks.

   a. What do you mean by refrigeration? Explain basic components and working of domestic refrigerator with suitable sketch.

   b. What is air conditioning? With the help of neat sketches explain working of window type **'air-conditioner'**.

**Q.10 (CO-4):** Attempt any TWO questions. Each question is of 5 marks.

   a. What is turbine? Explain the construction and working of Impulse turbine with neat sketches.

   b. Explain the construction and working of Hydraulic lift.

   c. Explain the construction and working of reciprocating pump with neat sketch.

**Q.11 (CO-5):** Attempt any TWO questions. Each question is of 5 marks.

   a. Define sensors and transducers. List various types of sensors and transducers. Explain static and dynamic characteristics of sensors and transducers?

   b. Define Pressure. Explain the construction and working of Bourdon Tube pressure gauge.

   c. Explain different types of Mechanical actuation system in details.

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# B TECH
## (SEM I) THEORY EXAMINATION 2022-23
### Fundamentals of Mechanical Engineering

Total Marks: 70
पूर्णांक: 70

Time: 3 Hours

समय: 03 घण्टे

**Note:**
1. Attempt all Sections. If require any missing data; then choose suitably.
2. The question paper may be answered in Hindi Language, English Language or in the mixed language of Hindi and English, as per convenience.

नोट: 1. सभी प्रश्नों का उत्तर दीजिए। किसी प्रश्न में, आवश्यक डेटा का उल्लेख न होने की स्थिति में उपयुक्त डेटा स्वतः मानकर प्रश्न को हल करें।
2. प्रश्नों का उत्तर देने हेतु सुविधानुसार हिन्दी भाषा, अंग्रेजी भाषा अथवा हिंदी एवं अंग्रेजी की मिश्रित भाषा का प्रयोग किया जा सकता है।

## SECTION A

2 x 7 = 14
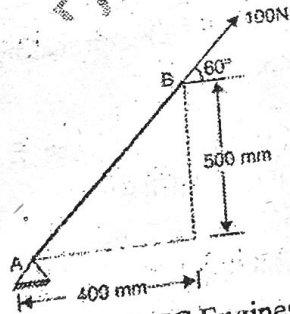
1. **Attempt any SEVEN questions in brief.**

निम्न मे से किन्ही सात प्रश्नों का संक्षेप में उत्तर दीजिए।

a. Explain the principle of transmissibility of forces.
ट्रांसमिसिबिलिटी ऑफ़ फोर्सेज (transmissibility of forces) के सिद्धान्त की व्याख्या करें।

b. Find the moment of 100 N force acting at B about point A as shown in Figure.
चित्र में दिखाए अनुसार बिंदु A के सापेक्ष B पर कार्य करने वाले 100 N बल का आघूर्ण (moment) ज्ञात कीजिए।



c. Describe the purpose of scavenging in IC Engines.
IC इंजिन्स में स्केवेंजिंग (scavenging) के उद्देश्य का वर्णन कीजिए।

d. Explain the parallel type of hybrid electrical vehicle.
समानांतर प्रकार के हाइब्रिड विद्युत वाहन को समझाइए।

e. Describe the one ton of refrigeration in SI system.
SI पद्धति में एक टन रेफ्रिजरेशन का वर्णन कीजिए।

f. Differentiate between dry bulb and wet bulb temperatures.
ड्राई बल्ब (dry bulb) और वेट बल्ब (wet bulb) तापमानों के बीच अंतर बताइये।

g. Calculate the specific gravity of one liter of a liquid that weighs 7N.
एक लीटर तरल, जिसका वजन 7N है, के विशिष्ट गुरुत्व (specific gravity) की गणना करें।

h. What is the working principle of an impulse turbine?
आवेग (impulse) टरबाइन का कार्य सिद्धांत क्या है?

i. Differentiate between accuracy and precision.
यथार्थता (accuracy) और परिशुद्धता (precision) के बीच अंतर बताइये।

j. What is a transducer? Describe with any one example.

ट्रांसड्यूसर क्या है? किसी एक उदाहरण के साथ वर्णन कीजिए।

## SECTION B

2. Attempt any *three* of the following:  7x3=21

निम्न में से किन्ही तीन प्रश्नों का उत्तर दीजिए।

a. Draw the stress-strain curve for mild steel and describe its salient points. Also, draw the stress curve for a ductile material, a brittle material, and a plastic material.

मृदु (mild) इस्पात के लिए प्रतिबल-विकृति वक्र (stress-strain curve) खींचिए तथा इसके मुख्य बिन्दुओं का वर्णन कीजिए। इसके अलावा, तन्य (ductile) पदार्थ, भंगुर (brittle) पदार्थ और प्लास्टिक पदार्थ के लिए प्रतिबल वक्र बनाएं।

b. Discuss any four important components of an IC Engine and the major functions of those components.
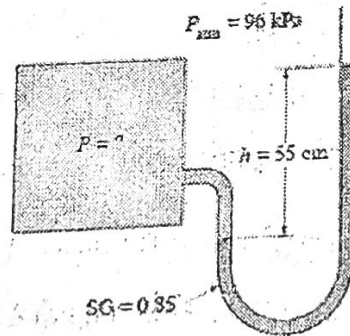
आईसी (IC) इंजन के किन्हीं चार महत्वपूर्ण घटकों और उन घटकों के प्रमुख कार्यों की चर्चा कीजिए।

c. Explain the basic vapor compression cycle and describe the working of a domestic refrigerator.

बेसिक वाष्प-संपीडन चक्र (vapor compression cycle) को समझाइए और एक घरेलू रेफ्रिजरेटर की कार्यप्रणाली का वर्णन कीजिए।

d. Differentiate between the absolute, gage and vacuum pressure. A manometer, shown in figure, is used to measure the pressure of a gas in a tank. The fluid used has a specific gravity of 0.85, and the manometer column height is 55 cm. If the local atmospheric pressure is 96 kPa, determine the absolute pressure within the tank.

निरपेक्ष, गेज और वैक्यूम दबाव के बीच अंतर बताइये। टैंक में गैस के दबाव को मापने के लिए चित्र में दिखाए गए मैनोमीटर का उपयोग किया जाता है। उपयोग किए गए द्रव का विशिष्ट गुरुत्व 0.85 है, और मैनोमीटर स्तंभ की ऊंचाई 55 सेमी है। यदि स्थानीय वायुमंडलीय दबाव 96 kPa है, तो टैंक के भीतर पूर्ण दबाव (absolute pressure) की गणना करें।

$P_{atm} = 96\ kPa$

$P = ?$

$h = 55\ cm$

$SG = 0.85$

e. Explain the Seebeck effect and the working principle of thermocouples with help of a neat sketch. Also discuss their advantages and disadvantages.

एक चित्र की सहायता से सीबेक प्रभाव और थर्मोकपल के कार्य सिद्धांत को समझाइए। साथ ही उनके लाभ और हानि पर भी चर्चा करें।
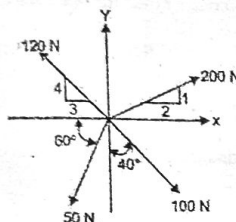
## SECTION C

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

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

a. A system of four forces acting on a body is as shown in figure. Determine the resultant.

एक पिंड पर कार्य करने वाले चार बलों , जैसा कि चित्र में दिखाया गया है, के परिणामी बल का मान बताये,



b. At an axial load of 22 kN, a 45-mm-wide by 15-mm thick polyimide polymer bar elongates 3.0 mm while the bar width contracts 0.25 mm. The bar is 200 mm long. At the 22-kN load, the stress in the polymer bar is less than its proportional limit. Determine
   1. The modulus of elasticity.
   2. Poisson's ratio.
   3. The change in the bar thickness.

22 kN के अक्षीय भार पर, एक 45-मिमी-चौड़ा x 15-मिमी मोटा पॉलीमाइड पॉलीमर छड़ 3.0 मिमी लंबा हो जाता है जबकि छड़ की चौड़ाई 0.25 मिमी सिकुड़ जाती है। छड़ 200 मिमी लंबा है। 22- kN भार पर, बहुलक छड़ में प्रतिबल (stress) इसकी आनुपातिक सीमा से कम है। गणना करें।
   1. प्रत्यास्थता गुणांक (modulus of elasticity )
   2. पायसन अनुपात (Poisson's ratio)
   3. छड़ की मोटाई में परिवर्तन

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

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

a. With help of a neat sketch discuss the construction and working principle of a 4-stroke SI engine.

एक स्वच्छ रेखाचित्र की सहायता से 4-स्ट्रोक SI इंजन के निर्माण और कार्य सिद्धांत की चर्चा कीजिए।

b. Discuss the working principle of an electric vehicle. What are the major demerits of these vehicles?

इलेक्ट्रिक वाहन के कार्य सिद्धांत पर चर्चा करें। इन वाहनों के प्रमुख अवगुण क्या हैं?

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

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

a. Explain the following terms related to air conditioning:

एयर कंडीशनिंग से संबंधित निम्नलिखित शब्दों की व्याख्या करें:

i. Dry bulb temperature (ड्राई बल्ब टेम्परेचर)
ii. Wet bulb temperature (वेट बल्ब टेम्परेचर)
iii. Dew point temperature ( ड्यू पॉइंट टेम्परेचर)
iv. Relative humidity (सापेक्ष आर्द्रता)

b. Define coefficient of performance (COP) for a refrigeration system. Why do we express the performance in terms of COP instead of efficiency? Also, compare the COPs of a refrigerator and a heat pump.

एक प्रशीतन प्रणाली के लिए निष्पादन गुणांक (coefficient of performance) को परिभाषित कीजिए। हम निष्पादन को दक्षता के बजाय सीओपी (coefficient of performance) के रूप में क्यों व्यक्त करते हैं? इसके अलावा, रेफ्रिजरेटर और हीट पंप के सीओपी की तुलना करें

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

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

a. Explain Pascal's law with help of a neat sketch. What are its practical applications? The small piston of a hydraulic lift has an area of 0.20 m$^2$. A car weighing 1.2 x 10$^4$ N sits on a rack mounted on the large piston. The large piston has an area of 0.90 m$^2$. How large force must be applied to the small piston to support the car.

स्वच्छ चित्र की सहायता से पास्कल के नियम की व्याख्या कीजिए। इसके व्यावहारिक अनुप्रयोग क्या हैं? एक हाइड्रोलिक लिफ्ट के छोटे पिस्टन का क्षेत्रफल 0.20 वर्ग मीटर है। 1.2 x 10$^4$ N वजन वाली एक कार बड़े पिस्टन पर लगे रैक पर बैठती है। बड़े पिस्टन का क्षेत्रफल 0.90 वर्ग मीटर है। कार को सहारा देने के लिए छोटे पिस्टन पर कितना बल लगाया जाना चाहिए?

b. Describe the working principle of a reciprocating pump. Why are these pumps called positive displacement pumps?

प्रत्यागामी पम्प (reciprocating pump) के कार्य सिद्धांत का वर्णन कीजिए। इन पंपों को सकारात्मक विस्थापन पंप क्यों कहा जाता है?

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

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

a.
   i. Briefly explain a Bourbon tube-based pressure measurement device.
   ii. Differentiate between bonded and unbonded strain gauges systems.
   i. बोरबॉन (Bourbon) ट्यूब आधारित दाब मापन यंत्र को संक्षेप में समझाइए।
   ii. बॉन्डेड (bonded) और अनबॉन्डेड (unbounded) स्ट्रेन गेज (strain gauges ) सिस्टम के बीच अंतर करें।

b.
   i. Differentiate between Autotronics, Bionics, and Avionics along with their applications.
   ii. Discuss the merits and demerits of mechatronics systems.
   i. ऑटोट्रोनिक्स, बायोनिक्स और एविओनिक्स के बीच उनके अनुप्रयोगों के साथ-साथ अंतर स्पष्ट करें।
   ii. मेकाट्रॉनिक्स सिस्टम के गुणों और दोषों पर चर्चा करें