
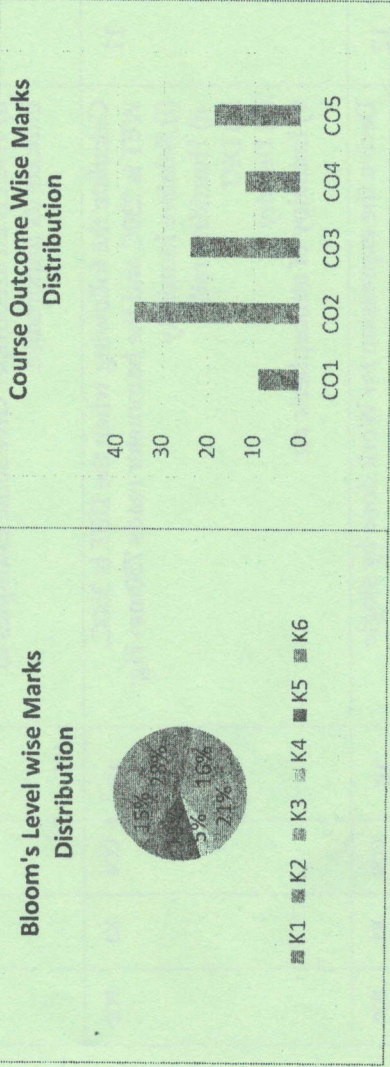


6/7/23 70

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|---|--|---|-----------------|
|  ARKAJAIN University Jharkhand | | END TERM EXAMINATION School of Engineering & IT | |
| Branch | Mechanical Engineering | Program | B. Tech |
| Subject Name | Applied Thermodynamics | Semester | IV |
| | | Year | 2023/ Even |
| Time: 3 Hour Max. Marks : 70 | <ul style="list-style-type: none"> Start writing from 2nd page onwards; don't write on the 1st Page Backside Answer all Questions of Section A (Compulsory) Answer Any Four out of Six of Section B Answer Any Three out of Five of Section C Steam Table and Refrigeration Table is Allowed Possession of <u>Mobile Phones</u> or any kind of <u>Written Material, Arguments with the Invigilator or Discussing with Co-Student</u> will come under <u>Unfair Means</u> and will <u>Result in the Cancellation of the Papers.</u> | | |
| Knowledge Level (KL) | K1 : Remembering | K3 : Applying | K5 : Evaluating |
| | K2 : Understanding | K4 : Analysing | K6 : Creating |

| | | |
|----------------------|---|----------------------|
| CO- Course Outcomes, | KL- Knowledge Level, | PO - Program Outcome |
| CO1 | Understand phenomena of energy conversion in various thermal devices. occurring in high-speed compressible flows. | |
| CO2 | Apply various practical vapor, power cycles and refrigeration cycles. | |
| CO3 | Evaluate the air quality after humidification or dehumidification using psychometric chart. | |
| CO4 | Analyse the Stagnation properties of choked flow, subsonic and supersonic flows and normal shocks | |
| CO5 | Analyze energy conversion in reciprocating compressors | |

GRAFICAL REPRESENTATION



| Section A (Each question Carry 02 Marks from Q1-i to Q1-x) - 20 Marks | | Q. N1 | QUESTIONS | Marks | COs | KL | PO |
|---|---|-------|-----------|-------|-----|----|-----|
| i | What are primary fuels? List some important primary fuels. | 2 | | 2 | CO1 | K1 | PO2 |
| ii | What is 'adiabatic flame temperature'? | 2 | | 2 | CO1 | K2 | PO1 |
| iii | Define specific steam consumption of an ideal Rankine cycle. | 2 | | 2 | CO2 | K1 | PO2 |
| iv | What is the function of feed water heaters in the regenerative cycle with bleeding? | 2 | | 2 | CO2 | K2 | PO3 |
| v | Write any four major differences between Otto and diesel cycle. | 2 | | 2 | CO2 | K3 | PO1 |
| vi | Define tonne of refrigeration | 2 | | 2 | CO3 | K1 | PO2 |
| vii | Name any four commonly used refrigerants. | 2 | | 2 | CO3 | K3 | PO2 |
| viii | Define moist air. | 2 | | 2 | CO4 | K1 | PO3 |
| ix | Classify the various types of air compressors. | 2 | | 2 | CO5 | K2 | PO2 |
| x | Give two merits of rotary compressor over reciprocating compressor. | 2 | | 2 | CO5 | K3 | PO1 |

Section B (Answer any FOUR out of SIX) – 20 Marks

(Each question 5 Marks)

| Q. No. | QUESTIONS | Marks | COs | KL | PO |
|--------|---|-------|-----|----|-----|
| 2 | A coal sample gave the following analysis by weight, Carbon 85 per cent, Hydrogen 6 per cent, Oxygen 6 per cent, the remainder being incombustible. Determine minimum weight of air required per kg of coal for chemically correct composition. | 5 | CO1 | K4 | PO2 |
| 3 | The Dry saturated steam of a steam power plant enters the turbine at 17.5 bar and expands to the condenser pressure of 0.75 bar. Determine the Rankine cycle efficiency's. Also find the work ratio of the Rankine cycle | 5 | CO2 | K3 | PO3 |
| 4 | Derive an expression for Otto cycle efficiency with usual notation | 5 | CO2 | K6 | PO1 |
| 5 | Describe the essential components of the refrigeration plant. | 5 | CO3 | K1 | PO3 |
| 6 | Mention the chemical formula and the refrigerant number of following refrigerants: i) Dichloro difluoro methane, ii) Dichloro tetrafluoro ethane, iii) propylene, iv) ethylene v) sulphur dioxide. | 5 | CO3 | K1 | PO1 |
| 7 | Derive the expression for minimum work done for two stage compressors. | 5 | CO5 | K5 | PO2 |

Section C (Answer any THREE out of FIVE) – 30 Marks-

(Each question Carry 10 Marks)

| Q. No. | QUESTIONS | Marks | COs | KL | PO |
|--------|--|-------|-----|----|-----|
| 8 | In a gas turbine plant working on Brayton cycle, the air at inlet is 27°C, 0.1 MPa. The pressure ratio is 6.25 and the maximum temperature is 800°C. The turbine and compressor efficiencies are each 80%. Find compressor work, turbine work, heat supplied, cycle efficiency and turbine exhaust | 10 | CO2 | K5 | PO1 |

| | | | | | |
|----|---|----|-----|----|-----|
| 9 | temperature. Mass of air may be considered as 1 kg. Draw T-s diagram. | 10 | CO2 | K6 | PO3 |
| 10 | The temperature limits of an ammonia refrigerating system operating on simple vapor compression cycle are 25°C and -10°C respectively. If the gas is dry at the end of compression, calculate the C.O.P of the system, assuming no under cooling of the liquid ammonia. i) Explain the various desirable properties of ideal refrigerants. ii) What is an azeotrope? Give some examples to indicate its importance. | 10 | CO3 | K2 | PO2 |
| 11 | Calculate the following when the DBT is 350C, WBT is 230C and the barometer reads 750mm Hg: (i) Relative humidity ii) Humidity ratio iii) DPT iv) Density v) Enthalpy of atmospheric air. | 10 | CO4 | K3 | PO2 |
| 12 | Derive the expression for Work done by single stage reciprocating air compressor with clearance volume. | 10 | CO5 | K1 | PO1 |

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|--------------|--------------------------------------|----------|----------|
| Branch | Mechanical Engineering | Program | B. Tech |
| Subject Name | Fluid Mechanics & Hydraulic Machines | Semester | IV |
| | | Year | 2023/Odd |

• Start writing from 2nd page onwards; don't Write on the 1st Page Backside
 • Answer all Questions of Section A (Compulsory)
 • Answer Any Four out of Six of Section B
 • Answer Any Three out of Five of Section C
 • Possession of Mobile Phones or any kind of Written Material, Arguments with the Invigilator or Discussing with Co-Student will come under Unfair Means and will Result in the Cancellation of the Papers.

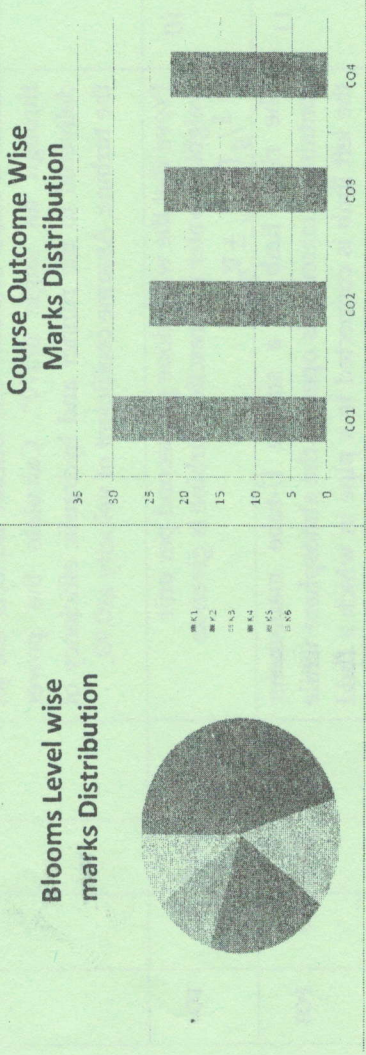
Time: 3 Hour
 Max. Marks: 70

| | | | |
|----------------------|--------------------|----------------|-----------------|
| Knowledge Level (KL) | K1 : Remembering | K3 : Applying | K5 : Evaluating |
| | K2 : Understanding | K4 : Analysing | K6 : Creating |

| Section A (Each question Carry 02 Marks from Q1-i to Q1-x) – 20 Marks | | | |
|---|---|--------|------------|
| Q.N | QUESTIONS | Mark s | CO KL PO |
| i | Define the following fluid properties: density, weight density. | 2 | CO1 K1 PO2 |
| ii | Define specific volume and specific gravity of fluid. | 2 | CO1 K1 PO2 |
| iii | Make a list of minor losses in Pipes? | 2 | CO2 K4 PO3 |
| iv | Explain the terms: (i) Dynamic viscosity, and (ii) Kinematic viscosity, Give their dimensions. | 2 | CO3 K2 PO3 |
| v | State the Newton's law of viscosity and give examples of its application. | 2 | CO2 K4 PO4 |
| vi | One litre of crude oil weighs 9.6 N. Calculate its specific weight, density and specific gravity. | 2 | CO3 K5 PO4 |
| vii | Brief on consequence of Pascal's Law | 2 | CO2 K2 PO3 |
| viii | What is the difference between Steady and unsteady flow | 2 | CO3 K3 PO4 |
| ix | Calculate mass density and specific volume of 1 lit of liquid which weighs is 7N | 2 | CO4 K4 PO3 |
| x | State the moment of momentum Equation | 2 | CO4 K4 PO3 |

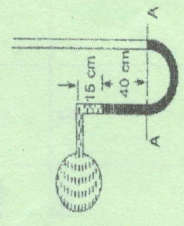
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|----------------------|--|----------------------|
| CO- Course Outcomes, | KL- Knowledge Level, | PO – Program Outcome |
| CO1 | Remembering various properties of fluid to solve the real life fluid problems. | |
| CO2 | Applying basic principles like Bernoulli's equation for fluid system. | |
| CO3 | Analysing fluid forces- drag and lift on immersed bodies. | |
| CO4 | Understanding working of impact of jet, pumps and turbines. | |

GRAPHICAL REPRESENTATION



| 8 | Difference between (i) impulse turbine and reaction turbine (ii) Inward and outward flow turbine | 5 | Co4 | K5 | PO4 |
|---|--|--------|------|----|-----|
| Section C (Answer any THREE out of FIVE) – 30 Marks- (Each question Carry 10 Marks) | | | | | |
| Q. No. | QUESTIONS | Mark s | CO s | KL | PO |
| 9 | A pelton wheel has a mean bucket speed of 35 m/sec jet of water flowing at the rate of $1 \text{ m}^3/\text{sec}$ under a head of 270 m . The bucket deflects the jet through an angle of 170° . Calculate the power delivered to the runner and hydraulic efficiency of the turbine. Assume coefficient of velocity at 0.93 . | 10 | CO2 | K5 | PO3 |
| 10 | Prove that the work done per second per unit weight of water in a reaction turbine is given as $= \frac{1}{g} (\mathbf{V}_{w1} \cdot \mathbf{u}_1 \pm \mathbf{V}_{w2} \cdot \mathbf{u}_2)$ | 10 | CO1 | K2 | PO4 |
| 11 | The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The center of the pipe is 12 below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm | 10 | CO3 | K3 | PO3 |
| 12 | A pipe line 60 cm diameter bifurcates at a Y-junction into two branches 40 cm and 30 cm in the diameter. If the rate of flow in the main pipe is $1.5 \text{ m}^3/\text{s}$ and mean velocity of flow in 30 cm diameter pipe is 7.5 m/s , determine the rate of flow in the 40 cm diameter pipe. | 10 | Co4 | K5 | PO4 |
| 13 | A pelton wheel has a mean bucket speed of 10 meters per second with a jet of water flowing at the rate of 700 lit/s under a head of 30 m . The bucket deflects the jet through an angle of 160° . calculate the power given by the water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of viscosity as 0.98 . | 10 | Co4 | K1 | PO5 |

| Section B (Answer any FOUR out of SIX) – 20 Marks (Each question 5 Marks) | | | | | |
|---|---|--------|------|----|-----|
| Q. No. | QUESTIONS | Mark s | CO s | KL | PO |
| 3 | An orifice meter which orifice diameter 10 cm is inserted in a pipe of 20 cm diameter the pressure gauges fitted upstream and downstream of the orifice meter gives reading of 19.62 N/cm^2 and 9.8 N/cm^2 respectively coefficient of discharge of orifice meter = 0.6 find the discharge through the pipe. | 5 | CO1 | K2 | PO3 |
| 4 | Prove that the momentum thickness and energy thickness for boundary layer flow are given by $\theta = \int_0^{\delta} \frac{\mu}{U} \left[1 - \frac{u}{U} \right]^2 dy$ and $S^{**} = \int_0^{\delta} \frac{\mu}{U} \left[1 - \frac{u}{U} \right] dy$ | 5 | CO1 | K3 | PO2 |
| 5 | A Simple u-Tube manometer is used to measure pressure of fluid (Sp. Gravity 0.8) flowing through a pipe. The heights of mercury column and fluid column is shown in figure. Find the vacuum/gauge pressure and also absolute pressure of fluid in the pipe if atmospheric pressure is 101.325 kPa . | 5 | CO2 | K4 | PO3 |
| 6 | 6. Difference between (i) liquid and gases (ii) Real fluid and ideal fluid (iii) specific weight and specific volume of fluid. | 5 | CO2 | K4 | PO4 |
| 7 | Calculate the capillary rise in a glass tube of 3.0 mm diameter when immersed vertically in (a) water, and (b) mercury. Take surface tensions for mercury and water as 0.0725 N/m and 0.52 N/m respectively in contact in air. Specific gravity of mercury is given as 13.6 . | 5 | CO3 | K4 | PO3 |

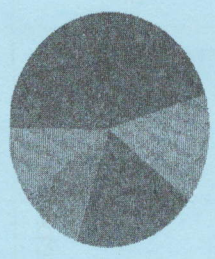


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|--------------------------------|---|----------------|-----------------|
| Branch | Mechanical Engineering | Program | B. Tech |
| Subject Name | Theory of Machine | Semester | IV |
| | | Year | 2023/ Odd |
| Time: 3 Hour Max. Marks: 70 | <ul style="list-style-type: none"> Start writing from 2nd page onwards; don't Write on the 1st Page Backside Answer all Questions of Section A (Compulsory) Answer Any Four out of Six of Section B Answer Any Three out of Five of Section C Possession of Mobile Phones or any kind of <u>Written Material, Arguments with the Invigilator or Discussing with Co-Student will comes under Unfair Means</u> and will <u>Result in the Cancellation of the Papers.</u> | | |
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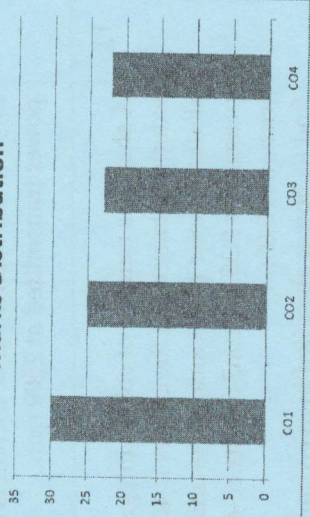
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|----------------------|--|----------------------|
| CO- Course Outcomes, | KL- Knowledge Level, | PO - Program Outcome |
| CO1 | Remembering various properties of fluid to solve the real life fluid problems. | |
| CO2 | Applying basic principles like Bernoulli's equation for fluid system. | |
| CO3 | Analysing fluid forces- drag and lift on immersed bodies. | |
| CO4 | Understanding working of impact of jet, pumps and turbines. | |

GRAPHICAL REPRESENTATION

Blooms Level wise marks Distribution



Course Outcome Wise Marks Distribution



Section A (Each question Carry 02 Marks from Q1-i to Q1-x) – 20 Marks

| Q. N | QUESTIONS | Marks | COs | KL | PO |
|------|---|-------|-----|-----|-----|
| 1 | | | | | |
| i | What is gyroscopic couple? | 2 | CO1 | K1 | PO2 |
| ii | Compare Flywheel and Governor | 2 | CO1 | KL2 | PO1 |
| iii | What is the difference between a brake and a clutch? | 2 | CO2 | KL1 | PO3 |
| iv | What is a dynamometer? | 2 | CO2 | KL1 | PO4 |
| v | What is Clutch? | 2 | CO3 | KL2 | PO3 |
| vi | What is a flywheel? What is its use? | 2 | CO4 | KL2 | PO2 |
| vii | Define these terms- Coefficient of fluctuation of speed and coefficient of Fluctuation of energy. | 2 | CO3 | KL3 | PO4 |
| viii | What is the function of a governor? | 2 | CO3 | KL1 | PO2 |
| ix | Define Inertia Force? | 2 | CO3 | KL2 | PO2 |
| x | Explain D'Alemberts Principle? | 2 | CO2 | KL2 | PO2 |

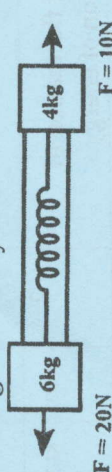
Section B (Answer any FOUR out of SIX) – 20 Marks

(Each question 5 Marks)

| Q. No. | QUESTIONS | Mark s | CO s | KL | PO |
|--------|--|--------|------|-----|-----|
| 2 | Discuss the effect of the gyroscopic couple on a disc fixed at a certain angle to a rotating shaft. | 5 | CO1 | KL1 | PO1 |
| 3 | A dynamometer D is attached to two bodies of masses $M=6\text{kg}$, force's $F=20\text{N}$ are applied on the masses. What will be the reading of the dynamometer? | 5 | CO3 | KL4 | PO3 |
| 4 | Explain with neat sketch construction and working of eddy current dynamometer. | 5 | CO2 | KL2 | PO1 |
| 5 | What is brake? Explain any one with neat sketch. | 5 | CO3 | KL4 | PO4 |
| 6 | The height of a governor is 300 mm at some time. The load on the engine is increased and the height is increased 40 mm. Find the percentage change in the speed of the governor. | 5 | CO4 | KL1 | PO4 |
| 7 | Discuss the effect of inertia force on connecting rod. | 5 | CO3 | KL4 | PO4 |

Section C (Answer any THREE out of FIVE) – 30 Marks-

(Each question Carry 10 Marks)

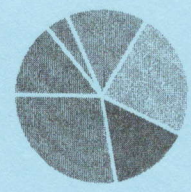
| Q. No. | QUESTIONS | Mark s | CO s | KL | PO |
|--------|--|--------|------|-----|-----|
| 8 | A dynamometer is attached to two blocks of masses 6 kg and 4 kg. Forces of 20 N and 10 N are applied on the blocks as shown in figure. Find the dynamometer reading in the steady state.  | 10 | CO1 | KL2 | PO1 |
| 9 | For a certain engine having an average speed of 1200 rpm, a flywheel approximated as a solid disc, is required for keeping the fluctuation of speed within 2% about the average speed. The fluctuation of kinetic energy per cycle is found to be 2 kJ. What is the least possible mass of the flywheel if its diameter is not to exceed 1m? | 10 | CO3 | KL1 | PO4 |

| | | | | | |
|----|---|----|-----|-----|-----|
| 10 | The arms of a Porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation. The lower arms are attached to a sleeve at a distance of 35 mm from the axis of rotation. The mass of the dead load on the sleeve is 54 kg and the mass of each ball is 7 kg. Find out the equilibrium speeds of the governor if radii of rotation are 200 mm and 250 mm. | 10 | CO2 | KL5 | PO1 |
| 11 | The outer and inner diameters of a single plate clutch are 300 mm and 200 mm respectively. The Both sides of the clutch are effect. The maximum pressure intensity should not be more than 0.1 N/mm^2 . If coefficient of friction is 0.3, find the power transmitted at 2500 rpm. | 10 | CO4 | KL6 | PO4 |
| 12 | A shaft has number of collars integral with it. The external diameter of the collars is 400 mm and the shaft diameter is 250 mm. If the uniform intensity of pressure is 0.35 N/mm^2 and its co-efficient of friction is 0.05; find (i) power absorbed in overcoming friction when shaft rotates at 105 rpm and carries a load of 150 kN, and (ii) number of collars required. | 10 | CO5 | KL3 | PO1 |

| | | |
|-----------------------------|---|-----------------------------|
| CO- Course Outcomes, | KL- Knowledge Level, | PO – Program Outcome |
| CO1 | Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology | |
| CO2 | Distinguish between various types of errors. | |
| CO3 | Understand the principle of operation of an instrument and select suitable measuring device for a particular application. | |
| CO4 | Explain the concept of calibration of an instrument. | |
| CO5 | Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form. | |

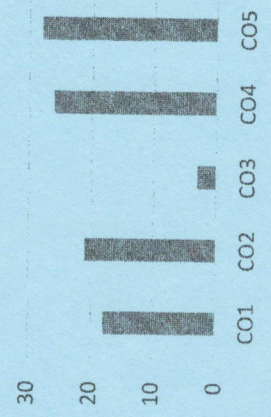
GRAFICAL REPRESENTATION

Bloom's Level wise Marks Distribution



■ K1 ■ K2 ■ K3 ■ K4 ■ K5 ■ K6

Course Outcome Wise Marks Distribution



| | | | | |
|---------------------------------|---|------------------------------------|---|---------|
| | ARKAJAIN University Jharkhand | | END TERM EXAMINATION School of Engineering & IT | |
| | Branch | Mechanical Engineering | Program | B. Tech |
| | Subject Name | Mechanical Measurement and Control | Semester | IV |
| Time: 3 Hour Max. Marks : 70 | Start writing from 2nd page onwards; don't Write on the 1st Page Backside • Answer all Questions of Section A (Compulsory) • Answer Any Four out of Six of Section B • Answer Any Three out of Five of Section C • Possession of Mobile Phones or any kind of Written Material, Arguments with the Invigilator or Discussing with Co-Student will comes under <u>Unfair Means</u> and will <u>Result in the Cancellation of the Papers.</u> | | | |
| Knowledge Level (KL) | K1 : Remembering K2 : Understanding | K3 : Applying K4 : Analysing | K5 : Evaluating K6 : Creating | |

| Section A (Each question Carry 02 Marks from Q1-i to Q1-x) – 20 Marks | | Q. N1 | QUESTIONS | Marks | COs | KL | PO |
|---|---|-------|-----------|-------|-----|-----|-----|
| i | What do you understand by the term of measurement? | | | 2 | CO2 | KL1 | PO1 |
| ii | What are the types of Transducer | | | 2 | CO3 | KL5 | PO3 |
| iii | Define Hysteresis and Dead Zone | | | 2 | CO3 | KL1 | PO1 |
| iv | What is the error in measurements? | | | 2 | CO5 | KL1 | PO1 |
| v | Describe Repeatability and Reproducibility | | | 2 | CO5 | KL1 | PO1 |
| vi | What is difference between accuracy and precision | | | 2 | CO3 | KL5 | PO2 |
| vii | Define the term Sensitivity | | | 2 | CO3 | KL1 | PO3 |
| viii | Differentiate between Orificemeter and Venturimeter | | | 2 | CO1 | KL1 | PO1 |
| ix | Explain the term Random errors. | | | 2 | CO1 | KL1 | PO1 |
| x | List the devices used for pressure measurement? | | | 2 | CO1 | KL1 | PO1 |

Section B (Answer any FOUR out of SIX) - 20 Marks

(Each question 5 Marks)

| Q. No. | QUESTIONS | Marks | COs | KL | PO |
|--------|---|-------|-----|-----|-----|
| 2 | Classify Transducers and explain any one with diagram. | 5 | CO3 | KL2 | PO3 |
| 3 | What is error and classify the errors in measurement system | 5 | CO3 | KL2 | PO2 |
| 4 | Explain the following terms with reference to static characteristics of the measuring instruments. 1.Resolution 2.Precision | 5 | CO4 | KL4 | PO4 |
| 5 | Define measurement, Explain Significance of measurement, and also Define calibration | 5 | CO2 | KL4 | PO1 |
| 6 | Draw labelled sketch of Liquid in Glass Thermometer and Pressure Thermometer. | 5 | CO4 | KL2 | PO2 |
| 7 | Draw the neat label sketch of working principle Optical Pyrometer. State its advantages and disadvantages. | 5 | CO3 | KL2 | PO2 |

Section C (Answer any Three out of Five) - 30 Marks-

(Each question Carry 10 Marks)

| Q. No. | QUESTIONS | Marks | COs | KL | PO |
|--------|---|-------|-----|-----|-----|
| 8 | Draw block Diagram of generalized Measurement System, Label it. State functions and examples of any three elements in it | 10 | CO2 | KL3 | PO1 |
| 9 | Explain Standards of measurements: Primary & Secondary, Define accuracy and precision | 10 | CO1 | KL2 | PO1 |
| 10 | Explain the function of Rosettes. Explain the working of 1. Rectangular strain gauge rosettes. 2. Delta type strain gauge rosettes. | 10 | CO5 | KL4 | PO4 |
| 11 | Explain the construction and principle of working of RVDT with the help of neat sketch | 10 | CO5 | KL3 | PO4 |
| 12 | Explain Open loop and closed loop systems with working principle. | 10 | CO5 | KL1 | PO4 |