Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: 23ES1005

2nd Semester Regular/Back Examination: 2024-25
SUBJECT: Basic Civil Engineering
BRANCH(S): AE, AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CST, ECE, EEE, EEVDT, ELECTRICAL, ELECTRICAL & CE, ETC, IT, EE, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: S533
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** (2 x 10)

a) Distinguish between coarse aggregates and fine aggregates.

b) Name two important disciplines of Civil engineering.

c) Write the basic Components of a Road.

d) List out the various applications of mortar.

e) Provide two examples of adhesives.

f) List out the various constituent materials of plane cement concrete.

g) Name two advances of conveyor system.

h) Define the term "Per capita demand".

i) Explain the term "disinfection".

j) Mention the importance of Irrigation in our country.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)

a) State in detail about the Importance of civil engineering in infrastructure development of the country.

b) Draw the neat sketches of basic components of a building.

c) Name the different Physical, mechanical and durability properties of construction materials.

d) Describe in detail about various applications of stones as construction material.

e) State in detail about different types of tiles used for building construction.

f) Write short note on urban road classification.

g) Distinguish between rigid pavement and flexible pavement with examples.

h) Write short note on the sedimentation aided with coagulation process in water treatment.

i) Provide a detailed classification bricks as per Bureau of Indian Standards (BIS).

j) State the various purposes of construction of dam.

k) Discuss the layout of canal Irrigation system with neat sketches.

l) List out the various non-ferrous metals used as construction material. Write two advantages of non-ferrous metals over ferrous metals.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 Provide a detailed classification of cement used in construction. **(16)**

Q4 Summarize in detail about basic characteristics, advantages, and disadvantages of various transportation modes i.e. air, rail, road, and water transport. **(16)**

Q5 Describe in detail about the various sources of water. State the importance of water treatment in cities. **(16)**

Q6 Elaborate in detail about NBC Classification of buildings. **(16)**

Registration No.:

2ⁿᵈ Semester Regular/Back Examination: 2024-25
SUBJECT: Basic Electrical Engineering
BRANCH(S): AE, AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, ECE, EEE, EEVDT, ELECTRICAL, ELECTRICAL & C.E, ETC, IT, MECH, METTA, MINERAL, MINING, MME
Time: 3 Hours
Max Marks: 100
Q.Code: S611
Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   (2 x 10)
  a)   Mention the limitations of Ohm's law.
  b)   Two resistances of 4 Ω and 6 Ω are connected in parallel across 10 V battery. Calculate the current through 6 Ω.
  c)   Mention the Faraday's law of Electromagnetic Induction.
  d)   DC machines are called double excited machines. Justify the statement.
  e)   What is the efficiency of a transformer? What is the condition when the efficiency will be maximum?
  f)   Mention the advantages of 3-phase circuits over 1-phase circuit.
  g)   An alternating voltage is given by V = 230sin314t. Calculate I) frequency, II) maximum value, III) average value, IV) RMS value.
  h)   By which method we can control the speed of a DC shunt motor above rated speed?
  i)   Mention the type of 3-phase induction motor. Give one example of application of 3-phase induction motor.
  j)   What is the reason? we are neglecting the core loss in Short-circuit test of a transformer.
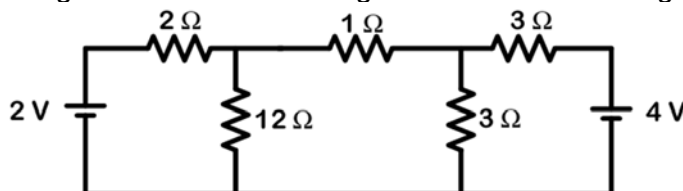
Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)
  a)   Explain about the Star-Delta and Delta-Star transformation in 3-phase circuit.
  b)   Find the current through 12Ω resistor for the given circuit below using Kirchoff's laws.

c) A non-magnetic ring has a mean diameter of 46.5 cm and a cross-sectional area of 12 cm². It is uniformly wound with 500 turns. Calculate the Field strength and Total flux produced in the ring by a current of 1A.

d) Define Thevenin's theorem. Find the Thevenin's equivalent R_{AB} for the circuit shown below.
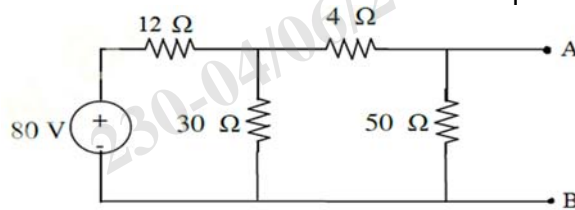
e) The impedances of series circuit are Z1 = (6 + j8) ohms and Z2 = (8 – j6) ohms. If the applied voltage is 120V, find total impedance, current, and power factor. Draw the phasor diagram.

f) Explain about various parts of a three-phase induction motor and describe the function of each component.

g) Write down the analogy between magnetic circuits and electric circuits.

h) A 4-pole DC motor takes an armature current of 6 A. The armature has 480 lap connected conductors. The flux per pole is 20 mWb. Calculate the gross torque developed by the motor.

i) Define transformer efficiency and derive the condition under which it will have maximum efficiency.

j) A balanced star connected load having an impedance (15 + j20) Ω per phase is connected to a three phase 440 V, 50 Hz supply. Find the line currents and the power absorbed by the load. Assume RYB phase sequence.

k) Explain the basic structure of the electrical power system.

l) Calculate the emf generated by a 6 pole DC generator having 480 conductors and driven at a speed of 1200 rpm. The flux per pole is 0.012 Wb. Assume the generator to be (I) Lap wound, (II) Wave wound.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   (16 x 2)

Q3   Explain the concept of back EMF in a DC motor and its significance. The counter emf of Shunt   **(16)**
motor is 227 V. The field resistance is 160 Ω and field current 1.5 A. If the line current is 36.5 A, find the armature resistance also find armature current when the motor is stationary.

Q4   Derive the expression for the torque developed by a three-phase induction motor. Show the   **(16)**
torque-slip characteristics. Explain about the slip value under different operating regions of the Induction motor.

Q5   Explain with neat schematics about different tests on a single phase transformer and develop   **(16)**
an equivalent circuit from the tests.

Q6   Define Torque and derive the expression for torque in a D.C. Motor. How to control the speed   **(16)**
of D.C. Shunt motor? Explain it with any one example.

Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: 23ES1002

2nd Semester Regular/Back Examination: 2024-25
SUBJECT: BASIC ELECTRONICS
BRANCH(S): AE, AEIE, AERO, AUTO, BIOMED, BIOTECH, CE, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, MANUTECH, MECH, METTA, MME, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: S613
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   **(2 x 10)**

a)   What is forbidden energy gap? What is it's magnitude for Ge and Si Semiconductor?

b)   Determine the forward resistance of a silicon diode when the forward current is 4 mA at T = 300K

c)   The reverse gate voltage of JFET when changes from 4.4 V to 4.2 V, the drain current changes from 2.2 mA to 2.4 mA. Find out the value of Transconductance of the JFET.

d)   What is the relation between I_{CO} and I_{CEO} in a transistor?

e)   Why the input impedance of a FET is more than that of a BJT?

f)   What is virtual ground concept in OPAMP?

g)   Calculate CMRR in decibel for the OPAMP circuit measurement of V_d = 1 mV, V_0 = 120 mV and V_C = 1 mV, V_0 = 20 μV

h)   Convert $(35.45)_{10}$ = (_____)$_2$ and $(AE.2B)_{16}$ = (_____)$_8$

i)   How does negative feedback influence input and output impedances in a voltage-series feedback amplifier?

j)   If an AM signal has a carrier amplitude of 100 V and a modulating signal amplitude of 20 V, what is the modulation index?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   **(6 x 8)**

a)   A Silicon diode has reverse saturation current of 2.5 μA at 300 K. Find forward voltage for a forward current of 10 mA.

b)   Simplify the Boolean expression $F = ABC + A\bar{B}(\overline{\overline{AC}})$ using Boolean laws and draw the logic diagram of the output expression using logic gates?

c)   With neat sketch, explain the operation of a center tapped full wave rectifier.

d) Discuss the current amplification factor in different configuration of BJT with circuit diagram and find out their relationship with one another.

e) Develop the basic diode equation. Using the same, find the percentage increase in reverse saturation current of a PN junction diode if the temperature increases form 25 °C to 50 °C.

f) What is DC load line? Explain fixed biasing method with necessary equations.

g) Write the difference between zener breakdown and avalanche Breakdown.

h) Determine the base of the numbers in each case for the following operations to be correct (I) 14/2 = 5 (II) 54/4 = 13 (III) 24 + 17 = 40.

i) In a negative feedback system, gain without feedback is 60 dB. It decreases to 40 dB with feedback. Calculate the feedback factor.

j) Explain OPAMP as a voltage subtractor circuit and find the expression for output voltage.

k) Explain the working principle of DSO with neat diagram.

l) What is Frequency modulation? Derive the mathematical representation of a frequency-modulated signal.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3 A Silicon Diode having 20 Ω internal resistance is used as half wave rectifier. If the applied input voltage is 50 Sin (100πt) and load resistance is 800 Ω, then find (i) I_M (ii) I_{DC} (iii) I_{RMS} (iv) Output Frequency (v) Ripple factor (vi) AC Input power (vii) AC Output Power (vii) Efficiency   **(16)**

Q4 a) Draw the transfer characteristics or $I_D \sim V_{GS}$ graph of a JFET for given I_{DSS} = 20 mA and V_p = –3 Volt.   **(8)**

b) Describe Inverting and Non Inverting configuration of an OPAMP circuit. Derive the expression for the closed loop gain of the above configuration.   **(8)**

Q5 a) Find the complement of F = wx + yz, then show that FF' = 0 and F + F' =1.   **(8)**

b) Explain in detail the fabrication process of a monolithic IC.   **(8)**

Q6 a) Given the AM signal equation x(t) = (20 + 4sin(500πt)) cos (2π × 10^5t), calculate (i) Carrier power (PC) (ii) Total Power (Pt) (iii) Sideband power.   **(6)**

b) Explain the working principle of a cathode ray oscilloscope (CRO) with suitable block diagram.   **(10)**

Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: 23ES1006

2nd Semester Regular/Back Examination: 2024-25
SUBJECT: Basic Mechanical Engineering
BRANCH(S): AE, AEIE, AERO, AUTO, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, MECH, METTA, MINING
Time: 3 Hours
Max Marks: 100
Q.Code: S535
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   Answer the following questions: (2 x 10)

a) Define a thermodynamic system and differentiate between open and closed systems.

b) State the limitations of the first law of thermodynamics.

c) State the second law of thermodynamics in terms of heat engines.

d) What is a perpetual motion machine? Differentiate between PPM1 and PMM2.

e) How does viscosity of a fluid vary with temperature?

f) Define vapor pressure. How does it affect the boiling of a liquid?

g) What is the role of flux in arc welding?

h) What is the function of a mould in casting?

i) What is a clutch used for in power transmission systems?

j) What is a link in robotic anatomy?

Part-II

Q2   Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)   (6 x 8)

a) Define and explain the terms: system, boundary, surroundings, and universe in thermodynamics.

b) Define internal energy in a thermodynamic system. Prove that it's a property of the system.

c) Define efficiency and COP of a heat engine (heat pump). Establish the relation between COP of a heat pump and a refrigerator.

d) A heat pump is used to heat the house in the winter. A house requires 80 kJ/s heat for heating in winter which is delivered by heat pump from outside air. Work required to operate the heat pump is 10 kW. Calculate COP of heat pump and heat abstracted from the outside.

e) What are different modes of heat transfer? Explain with suitable examples.

f) Describe the working of a four-stroke SI engine with a neat schematic diagram.

g) Write short notes on: (I) kinematic viscosity, (II) surface tension, (III) compressibility and (IV) specific gravity of a fluid.

h) Classify engineering materials and explain their properties with examples from each category.

i) Discuss the advantages and limitations of casting as a manufacturing process.

j) What are composite materials? Give two examples and explain their typical applications in manufacturing.

k) Compare and contrast belt drives and gear drives in terms of maintenance and typical usage.

l) Explain with diagrams the common robot configurations: Cartesian, cylindrical, and articulated.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   (16 x 2)

Q3 **a)** A piston cylinder device operates 1 kg of fluid at 20 atm pressure. The initial volume is 0.04 m^3. The fluid is allowed to expand reversibly following a process $pV^{1.45}$ = Constant so that the volume becomes double. The fluid is then cooled at constant pressure until the piston comes back to its original position. Keeping the piston unaltered, heat is added reversibly to restore it to the initial pressure. Calculate work done in the cycle.   **(8 + 8)**

b) Air flows through a diffuser entering at 200 m/s and 250 K, and exits at 40 m/s. The inlet area is 0.01 m² and the exit area is 0.05 m². Assume adiabatic flow. Calculate the mass flow rate of air and determine the exit temperature. Use R = 0.287 kJ/kg.K and C_p = 1.005 kJ/kg.K.

Q4 **a)** Two large parallel plates are spaced 5 mm apart. The gap is filled with a viscous oil of viscosity μ = 0.25 Pa.s. The top plate (1 m² area) is to be moved at 1.5 m/s while the bottom plate is fixed. Calculate the force required to move the top plate.   **(8 + 8)**

b) A tank contains water to a height of 5 m. Determine the pressure at the bottom of the tank in kPa. If oil (specific gravity = 0.8) is added on top of the water to a height of 2 m, calculate the new total pressure at the bottom.

Q5 **a)** Describe the steps involved in the casting process and explain any three defects that may occur during casting.   **(8 + 8)**

b) What is metal forming? Explain the basic types of forming operations such as forging, rolling, and extrusion.

Q6 **a)** Explain the working of mechanical brakes with a suitable sketch.   **(8 + 8)**

b) A robotic arm in an automated manufacturing unit uses an articulated configuration driven by motors through gear drives. It also has an emergency stop mechanism using a braking system. Discuss the role of each power transmission device in this system. Explain the robot configuration and joint types that would be most suitable for this application.

2nd Semester Regular/Back Examination: 2024-25
SUBJECT: Chemistry
BRANCH(S): AE, AEIE, AERO, AUTO, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ETC, MANUTECH, MECH, METTA, MINING, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: S385
Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** (2 x 10)

a) What is penetration power? Compare the penetration power of different orbitals with a probability density plot.

b) What is the metallic radius of an atom 'X' if the distance between two adjacent 'X' atoms in solid form is 270 pm?

c) Calculate the entropy change when 2 moles of lead is heated from 25 °C to 30 °C. The Specific heat of lead over this temperature range is 0.03 cal.gm^{-1}, and the atomic weight of lead is 207.

d) Calculate the free energy change when 4 moles of an ideal gas expand from a pressure of 100 to 10 atm at 25 °C.

e) Arrange the following in increasing order of energy and wavelength:
X-ray, Visible, Gamma ray, Infrared, Microwave, Radiowave, Ultraviolet

f) State the reason for a molecule being infrared active. Which of the following molecules will show a vibrational spectrum: HCl, Br_2, CH_2Cl_2, CO_2

g) Draw the Saw horse projection and Newman projection of Ethane.

h) Which of the conformations of cyclohexane is more stable and why?

i) Write the difference between α- and β-eliminations.

j) Which type of SN reaction gives an inverted product and why?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)

a) What is shielding/screening effect? How does it affect the Z_{eff}? How does the shielding effect vary within a period and across a group?

b) I. Define polarization and polarizing power of ions. What is the trend in polarising power for cations Be^{2+}, Mg^{2+}, Ca^{2+}, Sr^{2+}, and Ba^{2+}? Justify your answer.
II. How does polarization affect the covalent character? State Fajan's rule. What are the limitations of Fajan's rules in predicting covalent character?

c) Derive the integrated form of Claypeyron – Clausius equation for liquid – vapor equilibrium. Write the significance of this equation.

d) Describe Gibbs free energy as a criterion of equilibrium and spontaneous change. Enthalpy and entropy changes of a reaction are 40.63 kJ mol^{-1} and 108.8 J K^{-1} mol^{-1}, respectively. Predict the feasibility of the reaction at 27 °C.

e) Derive the expression for entropy of mixing. 1 mole of H_2 and 9 moles of N_2 are mixed at 298 K and 1 atmosphere. Assuming the ideal behavior of the gas, calculate the entropy of mixing per mole of the mixture formed.

f) The equilibrium constant for the reaction H_2 (g) + S (s) $\leftrightarrow$ H_2S (g) is 18.5 at 925 K and 9.25 at 1000 K. Calculate standard enthalpy of the reaction. Also, calculate ΔG^0 and ΔS^0 at 925 K.

g) Write the principle of Microwave spectroscopy. Which of the following molecules will show a microwave rotational spectrum: H_2, HCl, CH_4, CH_3Cl, CH_2Cl_2, SF_6, CS_2, SO2, CO, and OCS. Derive the expression for radius of a diatomic molecule using the application of microwave spectroscopy.

h) Discuss the basic principle of UV-Visible spectroscopy, giving a detailed description of different types of transitions.

i) Explain electrophilic substitution reactions and discuss the mechanism of Friedel-Crafts reaction.

j) Differentiate between
I) Enantiomers and diastereomers.
II) Racemic Mixture and Meso-compounds.

k) Compare and contrast elimination reactions with substitution reactions.

i) Explain the factors affecting the stability of free radicals, including ease of formation, hyperconjugation, and resonance taking suitable example.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3 **a)** Define electronegativity, and describe its periodicity. Discuss the different scales to express the electronegativity of elements.   **(8 x 2)**

b) List the different applications of electronegativity with a detailed description of any four.

Q4 What are Maxwell's relations? Write the significance. Derive the various forms of Maxwell's relations.   **(16)**

Q5 **a)** State Beer's Law. Derive an expression for the intensity of transmitted radiation when light is passed through a homogeneous solution.   **(4)**

b) At a definite wavelength, an absorber, when placed in a cell of 1 cm path length, absorbs 20% of the incident light. If the absorptivity of the absorber at this wavelength is 2. Find out its concentration.   **(4)**

c) Write the basic principle of IR spectroscopy and write the expression for vibrational frequency. Mention the factors affecting the vibrational frequency. Also, describe the different types of vibration.   **(8)**

Q6 **a)** What is conformational isomerism? Discuss the conformational isomerism of n-butane using a potential energy diagram for various conformations of n-butane.   **(8 x 2)**

b) Compare the stability of free radicals, carbocations, and carbanions based on their structural features.

Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: 23ES1004

2nd Semester Regular/Back Examination: 2024-25
SUBJECT: Engineering Mechanics
BRANCH(S): AE, AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, MANUTECH, MECH, METTA, MINING, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: S464
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III. The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Two forces of 100 N and 150 N are acting simultaneously at a point. What is the resultant of these, if the angle between two forces is 45°?

b) What is meant by moment of a force? How will you explain it mathematically?

c) How will you find the forces in the members of a truss by method of joints when the truss is supported on rollers at one end and hinged at other end and carries vertical load.

d) State the difference between co-efficient of friction and angle of friction.

e) State the principle of virtual work with a suitable example.

f) Find the centroid of a triangular lamina with base 6 m and height 4 m.

g) Find an expression for the moment of inertia of a rectangular section:
(I) about a horizontal axis passing through the C.G. of the rectangular section, and
(II) about a horizontal axis passing through the base of the rectangular section.

h) State the D' Alembert's Principle giving equations expressing the principle for a rigid body in plane motion.

i) A projectile is fired at an angle of 30° with a velocity of 50 m/s. Calculate the maximum height and range.

j) A body of mass 5 kg is moving with a velocity of 10 m/s. Calculate its kinetic energy and momentum.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Find the angle between two equal forces P, when their resultant is equal to (I) P and (II) P/2.

b) A beam AB of length 5 m supported at A and B carries two point loads W_1 and W_2 of 3 kN and 5 kN which are 1 m apart. If the reaction at B is 2 kN more than that at A, find the distance between the support A and the load 3 kN.

c) Three forces acting on a particle are in equilibrium. The angles between the first and second is 90° and that between the second and third is 120°. Find the ratio of the forces.

d) State and prove Lami's Theorem.

e) Explain the method of joints for analysis of trusses with a suitable example.

f) Derive the expression for moment of inertia of a rectangular area about its centroidal axis.

g) A simply supported beam AB of span 4 m is subjected to a point load of 10 kN at a distance of 1.5 m from A. Using the principle of virtual work, determine the reactions at the two supports.

h) The truss ABC shown in Fig. 1 has a span of 5 metres. It is carrying a load of 10 kN at its apex. Find the forces in the members AB and AC.

Fig.1
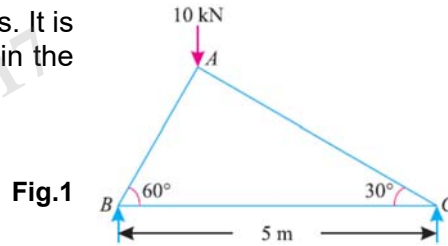
i) Derive an expression for the moment of inertia of a triangular section about an axis passing through the C.G. of the section and parallel to the base.

j) A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force, which can move the body, while acting at an angle of 25° with the horizontal.

k) A body is moving with a velocity of 3 m/s. After five seconds the velocity of the body becomes 13 m/s. Find the acceleration of the body.

l) A bullet of mass 10 gm is fired into a body of mass 1 kg, which is suspended by a string 1 m long. The bullet gets embedded in the body and due to the impact, the body swings through an angle of 11.2°. Find the velocity of the bullet.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   (16 x 2)

Q3   Three cylinders weighting 100 N each and of 80 mm diameter are placed in a channel of 180 mm width as shown in Fig. 2. Determine the pressure exerted by the cylinder A on B at the point of contact.   **(16)**

Fig. 2
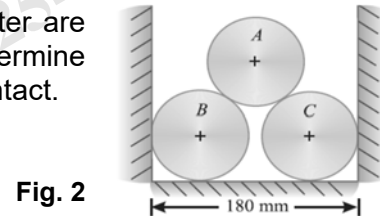
Q4   What should be the value of the angle θ in Fig. 3 so that the motion of the 90 N block impends down the plane? The co-efficient of friction 'μ' for all the surfaces is 1/3.   **(16)**

Fig. 3
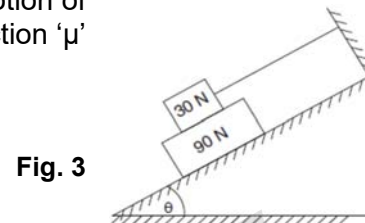
Q5   A uniform lamina shown in Fig. 4 consists of a rectangle, a semi-circle and a triangle. Determine the centroid of the lamina. All dimensions are in mm.   **(16)**

Fig. 4
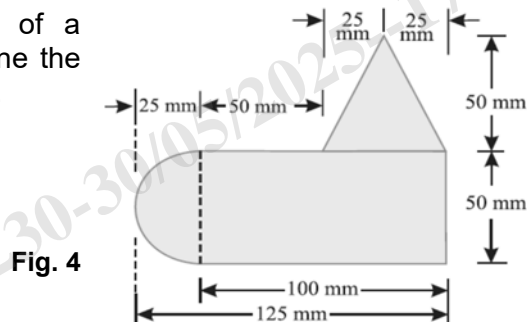
Q6   Find the acceleration of bodies and tension in the string joining A and B as shown in Fig. 5.   **(16)**

Fig. 5

2ⁿᵈ Semester Regular/Back Examination: 2024-25
SUBJECT: English for Technical Writing
BRANCH(S): AE, AEIE, AERO, AUTO, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ETC, MECH, METTA, MINING
Time: 3 Hours
Max Marks: 100
Q.Code: S306
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the righthand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   **(2 x 10)**

a) What do you mean by the "you" attitude in drafting Business letters?

b) What can be the closing while writing a business letter making a claim or requesting an adjustment?

c) Warren Bent is preparing a brief memo to his staff to explain a new policy. Which of the following should not be included in the memo? a) personal pronouns b) Contractions c) gerunds d) minor grammatical lapses

d) What are the four different formats used for preparing Business Reports?

e) What is the first step in planning a report?

f) Emergency supplies _____the earthquake area as soon as possible by the help of UN. It is crucial. (Fill in the blank with appropriate grammatical usage)

I) must reach II) should have reached III) had to reach IV) can reach V) was going to reach

g) The money in our pocket_____ far less today than it_____ bought ten years ago. (Fill in the blanks with appropriate grammatical usage)

I) could buy / would have II) can buy / had III) should buy / had
IV) might buy / should V) may buy/had to

h) Before the computer could be repaired, a special part had _____ from Germany. (Fill in the blank with appropriate grammatical usage)

I) to import II) a very long delivery III) to have been important IV) to be imported

i) Have you met the secretary _____ last week? (Fill in the blank with appropriate grammatical usage)

I) hired II) was hired III) she was hired IV) when she was hired

j) The special information ___ in an hour or so, that's why it ___ in the newspapers yesterday. (Fill in the blanks with appropriate grammatical usage)

I) brings / didn't publish II) will bring / don't publish III) will be brought / wasn't published
IV) will be brought / didn't publish V) brought / wasn't published

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Is it necessary to write a Subject line in a business letter? If so, it is written after which part?

b) How important are Correctness and Conciseness in Business correspondences?

c) Memo or E-mail, which is comparatively less formal? Why?

d) Who is given importance while drafting an Enquiry letter and a Complaint letter?

e) What are the key components of a job application letter?

f) Write short notes on the key components generally evaluated in a GD.

g) What is the difference between voiced and voiceless consonants in English?

h) Why do Indian speakers often struggle with the /w/ and /v/ distinction in English?

i) How does word stress differ in English compared to Indian languages?

j) What are the vowel sounds in English, and how are they categorized?

k) What is an agenda, and what are its key components?

l) What is a notice, and what are its essential elements?

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 You wish to buy an inverter to cope with frequent power cuts. Write a letter to Bajaj Batteries, 35, Lewis Road, Ranchi, asking them if they supply branded inverters or those manufactured in their own factory. Ask about voltage, number of batteries, expected life, guarantee, price and other relevant details. You are Rajiv Lochan living at 2/23, Kutchery chowk, Ranchi-834001. **(16)**

Q4 Assume that you are the Sales Manager of Latent Prints and Blocks, Kolkata. Write an Adjustment letter accepting the complain of the local dealer that the fabric he had received from you has not been "Fast Colour" as your label had claimed. Take care to specify what steps you will take to compensate for the fault. **(16)**

Q5 What are the non – functional roles in a GD? Explain in detail. **(16)**

Q6 You are a Ritesh Sahoo, final-year B.Tech student who recently completed a one-month internship with Sarthak Seva Foundation, an NGO based in Pune that works for the education and skill development of underprivileged youth. During your internship, you were assigned to assist in the implementation of a digital literacy program for school dropouts in rural areas. Now, the NGO has requested you to submit a short report summarizing your internship experience, highlighting the objectives, activities undertaken, challenges faced, observations, and suggestions for improvement. **(16)**

2nd Semester Regular/Back Examination: 2024-25
SUBJECT: Mathematics - II
BRANCH(S): AE, AEIE, AERO, AUTO, BIOMED, BIOTECH, CE, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, ECE, EEE, EEVDT, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, CE, CSE, ECE, EE, ME
Time: 3 Hours
Max Marks: 100
Q.Code: S259
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Give an example of a nonexact differential equation which have more than one integrating factors.

b) Write the general form of first order ordinary differential equations.

c) Find the particular integral of y" + y = cos x.

d) Determine the Wronskian of $(t^2, 2t)^T$ and $(e^t, e^t)^T$

e) If $v = \dfrac{\vec{r}}{r} = \dfrac{x\hat{i} + y\hat{j} + z\hat{k}}{\sqrt{x^2 + y^2 + z^2}}$, then compute $\Delta \times v$.

f) Evaluate $\displaystyle\int_2^4 \int_0^1 x^2 y\, dx\, dy$.

g) Show that $F(z) = \bar{z}$ is not analytic

h) Find the residues of $f(z) = \dfrac{z^2 + 1}{z(z - 1)}$

i) Give an example of a function which satisfy Laplace's equation.

j) Discuss the converse part of Cauchy's integral theorem.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) A body originally at 60^0 cools down to 40^0 in 15 minutes, when kept in air at a Temperature of 25^0. What will be the temperature of the body at the end of 30 minutes?

b) Solve the differential equation $(\sin x + \cos x \tan y)(dx + dy) + 2\sin y\, dy = 0$.

c) Show that $P_n(-1) = (-1)^n$

d) Solve the following initial value problem $x^2 y'' - 3xy' + 4y = 0$, $y(1) = 1$, $y'(1) = 1$.

e) Apply Green's theorem to evaluate $\oint_C (2x^2 - y^2)dx + (x^2 + y^2)dy$, where C is the boundary of the surface in the xy-plane enclosed by the x-axis and the semi-circle $y = \sqrt{4 - x^2}$.

f) Find the directional derivative of $f(x, y) = \ln(x^2 + 3y)$ at the point $(1,1)$ in the direction of $\hat{\imath} + \hat{\jmath}$

g) Find the divergence of $\vec{F}(x, y, z) = xyz\hat{i} + x^2 y^2 z^2 \hat{j} + y^2 z^3 \hat{k}$.

h) Evaluate $\oint_C \dfrac{e^z}{(z-i)^4} dz$, where C is the circle $C : |z| = 2$ with positive orientation.

i) Define Cauchy-Riemann equations. Check whether the function $f(z) = \sqrt{|xy|}$ satisfies Cauchy-Riemann equations.

j) Evaluate $\int_{|z|=3} \dfrac{z+i}{z^2 + 4iz - 4} dz$.

k) Evaluate the line integral $\int_0^{1+i} z^2 dz$. Justify the answer.

l) Using Cauchy's integral formula evaluate $\int_{|z-1|=2} \dfrac{1}{z^2 + 1} dz$.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3 a) Find the power series solution of the differential equation $y'' - 2y' + y = 0$.   **(8 x 2)**

b) Solve the differential equation $y' + x^5 y = x^5 y^7$.

Q4 a) Solve the differential equation $y'' - 2y' + y = xe^x \log x$, $x > 0$ by using method of Variation of parameter.   **(8 x 2)**

b) Solve the differential equation $y'' + 2y' + 4y = \cos 4x$ by using the method of undetermined coefficients.

Q5 a) Evaluate $\iint_R (x^2 + y^2)dxdy$, where R is the region is bounded by $x = 0, y = 0, x + y = 1$.   **(8 x 2)**

b) Show that the function $e^x(\cos y + i \sin y)$ is analytic and find its derivative.

Q6 a) Evaluate the integral $\int_{|z-3|=1} \dfrac{z^2}{(z-1)^3(z-2)} dz$ using residue theorem.   **(8 x 2)**

b) Develop $f(z) = \dfrac{2z - 3i}{z^2 - 3iz - 2}$ in a Laurent series valid for $1 < |z| < 2$.

2ⁿᵈ Semester Regular/Back Examination: 2024-25
SUBJECT: PHYSICS
BRANCH(S): AE, AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, ECE, EEE, EEVDT, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, IT, MECH, METTA, MINERAL, MINING, MME, EE
Time: 3 Hours
Max Marks: 100
Q.Code: S402
Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

   a) Show graphically under-damped, over-damped, and critically damped harmonic oscillations.

   b) A 4 kg mass is hung on the end of a helical spring, pulled down, and let go to vibrate vertically. The mass completes 100 vibrations in 55 seconds. Calculate the force constant to the spring.

   c) What is a wavefront? How is it produced according to Huygens' principle?

   d) A light of wavelength 6000Å normally on a straight slit of 0.1mm. Calculate the total angular width of the central maximum.

   e) Show that the vector field $\vec{F} = (x^2 + xy^2)\hat{i} + (y^2 + x^2y)\hat{j}$ is irrotational.

   f) State Gauss divergence theorem in vector field and write the mathematical form.

   g) Calculate the de Broglie wavelength of a particle traveling at a speed of 50 ms⁻¹, given that its mass is 150 g.

   h) Explain the wave-particle duality.

   i) What do you mean by population inversion?

   j) Explain the meaning of metastable state.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

   a) A forced oscillator is in resonance with the external periodic force ($F = F_0 \sin \omega t$). What is the amplitude of the oscillator and the phase difference between the driving force and the velocity of the oscillator?

   b) Determine the differential equation of an electrical simple harmonic oscillator, damped harmonic oscillator, and forced electrical oscillator.

   c) In Fraunhofer diffraction due to a single slit, obtain the conditions for principal maximum, secondary maxima, and minima. Show the distribution of intensity graphically in this diffraction pattern.

d) An LCR circuit contains an inductor of inductance 20.0 mH, a capacitor of capacitance 5.0 mF, and a resistor of resistance 0.2 ohm. Calculate the angular frequency of oscillation. After how long time the charge oscillation will decay to half of its initial amplitude. Assume the initial phase angle to be zero.

e) Write Maxwell's electromagnetic equations in a conducting medium and obtain the electromagnetic wave equations for electric and magnetic fields.

f) Show that the following functions satisfy the wave equation
I) $y(x, t) = a \sin(kx + \omega t)$ II) $y(x, t) = a\, e^{i(kx - \omega t)}$

g) Show that the electromagnetic waves are transverse in nature.

h) A particle trapped in a one-dimensional box of length L is described by the normalized wave function
$$\psi(x) = \sqrt{2/L}\, \sin\frac{n\pi x}{L}$$
What is the expectation value of the momentum of the particle?

i) What are the characteristics of a quantum wave function ψ? Derive an expression for the probability of finding a particle described by the wave function ψ in a certain region.

j) Define phase velocity and group velocity. Find a relation between group velocity and phase velocity.

k) Specify three possible types of transitions between two atomic energy levels and derive relations between Einstein's coefficients.

l) With a suitable diagram, explain the construction and working of a three-level laser.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3 a) Explain the formation of Newton's rings. Obtain an expression for the diameter of dark rings. What will happen to the diameter of the nth dark ring if the air is replaced by water film? Explain.   **(12)**

b) Newton's rings are observed in the light of $\lambda = 5900$ Å. The diameter of the 10th dark ring is 0.005 m. Find the radius of curvature of the lens and the thickness of the air film.   **(4)**

Q4 a) Derive the four Maxwell's equations in differential form. Discuss the significance of each Maxwell's equation.   **(12)**

b) What is the physical significance of the divergence of a vector field? Find the divergence of a vector field $\vec{F} = (xyz)\hat{i} + (3x^2 y)\hat{j} + (xz^2 - y^2 z)\hat{k}$ at point (1, 1, 1).   **(4)**

Q5 a) Explain with a suitable diagram the construction and working mechanism of a He-Ne laser. What are the advantages and limitations of a He-Ne laser?   **(12)**

b) If laser action occurs by the transition from an excited state to the ground state and it produces light of 6930 Å wavelength, what is the energy of the excited state? Take the energy of the ground state to be zero.   **(4)**

Q6 a) Write Schrodinger's equation for a particle in a box and find an expression for the wave function and energy of the particle.   **(10)**

b) The wave function of a particle is $\psi(x) = (2/L)^{0.5} \sin(\pi x/L)$; $0 < x < L$. Find the probability of finding the particle in the region $0 < x < L/2$.   **(6)**

Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: 23ES1003

2nd Semester Regular/Back Examination: 2024-25
SUBJECT: Programming in C and Data Structure
BRANCH(S): AE, AEIE, AERO, AUTO, BIOTECH, C&EE, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, ECE, EEE, EEVDT, ELECTRICAL, ELECTRICAL & C.E, ETC, IT, MECH, MINERAL, MINING, MME
Time: 3 Hours
Max Marks: 100
Q.Code: S489
Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   (2 x 10)
   a) What is the difference between flowchart and algorithm?
   b) Write the rules to name an identifier in C.
   c) What is the output of the program?
```
void main()
{
    int a=10,b=20;
    printf("%d",(a>b)&&(a>c));
    printf("%d",(a>b)||(a>c));
}
```
   d) List out some advantages and disadvantages of linked list over array data structure.
   e) Briefly explain the difference between while and do-while loop.
   f) What is the output of the program?
```
void main()
 {
    int x=5;
    printf("x=%d",x);
    printf("x=%d",x++);
    printf("x=%d",x);
    printf("x=%d",--x);
 }
```
   g) What is file and explain its different modes.
   h) Define a complete binary tree and strictly binary tree with suitable example.
   i) Write overflow and underflow conditions of stack.
   j) What is main difference between structure and union?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)
   a) Explain switch statement with its syntax and example.
   b) Write a program to check whether a number is palindrome or not.
   c) Explain about different parameter passing mechanisms in function with examples.

d) Write a program to swap two numbers using pointer concept.

e) Explain about different file operations that can be performed on files. How to read from and write to a file? Explain with examples

f) Write a program in C to print count the odd numbers present in between 1 to 100.

g) Write a program to create a file and store some information.

h) Briefly explain the functions used in dynamic memory management.

i) Write a menu driven program using C to perform insert, delete, and display operations in a linear queue.

j) Create the Binary Search Tree (BST) by inserting the following elements in order to an empty BST.
   5, 6, 4, 2, 3, 9, 8, 1

k) Explain the working principle of the binary search algorithm. How is it different from linear search?

l) Sort the given elements in ascending order using bubble sort and write its time complexity
   2, 1, 4, 0, 7, 3

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four) (16 x 2)

Q3 **a)** Define recursion. Write a program to calculate factorial of a number using recursion **(8)**

b) What are variables and constants? What are the rules for declaring the variables? **(8)**

Q4 **a)** What is array? How to declare an array? Explain with suitable example. **(8)**

b) Write a program to display the result of 3 x 3 matrix multiplication using an array. **(8)**

Q5 **a)** Given a linked list with elements 10, 20, 30, 40, 50. Write the steps to perform the following operations from the single linked list. **(8)**
   I. Deletion from the beginning
   II. Deletion from the end
   III. Display the list after deletion

b) Convert the following expression written in infix form into its equivalent postfix form using stack by showing each step. **(8)**
Infix: K + (L * M – (N / O ^ P) * Q) * R

Q6 **a)** Let A is the array of the following elements A = {2, 4, 6, 8, 9, 10, 12, and 13}. Search the element 12 using binary search technique. Write its time complexity. **(8)**

b) Discuss the worst case and average case time complexity of quick sort. Apply Quick sort on the following data and show the contents of the array every pass: **(8)**
48, 7, 26, 4, 13, 23, 98, 57, 10, 5, 32

Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: 23HS1001

2ⁿᵈ Semester Regular/Back Examination: 2024-25
SUBJECT: Universal Human Values
BRANCH(S): AE, AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CST, ECE, EEE, EEVDT, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: S327
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   (2 x 10)

a) Define Value. Explain the value of a human being with few examples.

b) Explain the basic guidelines for Value Education.

c) Explain the process of self-exploration. What is the expected result of self-exploration?

d) Four levels of living have been proposed in the textbook. What are these levels? Can you state that you are living at all these levels? Support your answer with examples from your life.

e) What are the possible sources of imaginations? Provide one example for each source.

f) Define self-regulation and health? How are the two related?

g) Define trust, respect, gratitude and love based on the proposal discussed in the book.

h) Give one example each of over evaluation, under evaluation and otherwise evaluation. Why are these evaluations leading to disrespect?

i) What are the common human goals that help ensure harmony in society?

j) What do you understand by the term 'holistic technology' and 'holistic management system'?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)

a) As mentioned in the textbook, as a human being, we have two important questions to resolve:
I. What to do? II. How to do?
Elaborate on the meaning of these two questions with few examples. Describe the two domains of education. How are they complementary? How do they assist in living a fulfilling life?

b) Describe the term 'Natural Acceptance'. How do you make out if it is your natural acceptance or not? Describe the characteristics of Natural Acceptance. Explain with examples from your own life.

c) What are the basic human aspirations and what are the requirements to fulfil them? Indicate their correct priority. Support your answer with three examples.

d) State and explain the prevailing notions of Happiness and Prosperity. What is the right proposal about both of these?

e) Explain the response of the Self and the Body with suitable examples.

f) The domain of consciousness is fulfilled through activities of consciousness, while the material domain is fulfilled by physical things. Explain why consciousness cannot be fulfilled by material things or vice versa.

g) What is the gross misunderstanding about a human being? What is the outcome of it? Relate it to the problems we see in the society.

h) Explain the activities of the Self with a diagram. With the help of an example, show how they are related.

i) The minimum content of respect is to be able to see the other person as being similar to yourself. On what basis is the other similar? What is the complete content of respect? Explain in details.

j) What do you understand about the meaning of excellence? Contrast excellence with competition. What is the effort that you are comfortable with making – effort for competition or making effort for excellence? Explain with the help of examples.

k) List the dimensions (systems) that comprise a human order. Explain how each dimension contributes to the fulfilment of the human goal.

l) State and explain self-regulation in Nature with suitable examples. Why is the human order, by and large, not mutually fulfilling for any of the four orders? Is your natural acceptance to be fulfilling for all four orders? What does human being need to do to be mutually fulfilling for each of the four orders?

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four) (16 x 2)

Q3 What are expectations we can make from education in our life? Is the current education system meeting those expectations? Do you think Education-Sanskar is required? What is the role of Education-Sanskar? How can it facilitate the holistic development? Discuss in details with suitable real-life examples. **(16)**

Q4 What are the dynamic and state activity of the self. How are our behaviour and work decided on the basis of these activities? Which activity of the Self is connecting to behaviour and work? How can self-exploration help to ensure harmony in the Self? How can it lead to mutual happiness, mutual prosperity, and fulfilment of Human Goal. Explain with suitable sketches and examples. **(16)**

Q5 What is the proposal for the definition of trust? Illustrate the feeling of trust with examples, preferably from your own experience. Distinguish between intention and competence. What is the outcome when we confuse between the two and we doubt the intention of the other? What is the outcome when we are able to see them separately and we trust the intention of the other? Explain how trust is the foundation value of relationship. **(16)**

Q6 Existence is all that exists. What are the two types of realities that exist in the context of existence? Explain how you can distinguish these realities. Reason out why it is essential to study about space. Distinguish between units and space. Draw a chart showing all the different categories of units of nature in space. How does co-existence in existence express itself at different levels of living of human being? Describe the role of human being in this existence. What would be the natural outcome of fulfilling this role? Explain in details. **(16)**