END SEMESTER REGULAR/RETEST EXAMINATION, JULY – 2023

Semester : 4th (New)

Subject Code : E1-405

ELECTRICAL ENGINEERING MATERIALS

Full Marks - 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions:

(i) All questions of PART – A are compulsory.
(ii) Answer any five questions from PART – B.

PART – A Marks – 25

1. Fill in the blanks :

1×10=10

(a) 1 Weber = ---- Maxwells.

(b) When the temperature of an intrinsic semiconductor is increased the energy of atom is

- (c) At absolute zero temperature, the conduction band of a semiconductor is _____.
- (d) An insulator has resistivity in the range of ______ Ohm-m to ______ Ohm-m.
- (e) Dielectric strength decreases with the rise of in case of air as dielectric.
- (f) Solders are alloy of _____ and ____.
- (g) A fuse is always connected in _____ with the electric and electronic circuits.
- (h) Ferrites are _____ materials.
- (i) _____ material does not have permanent magnetic dipole.
- (i) At critical temperature T_c the value of critical magnetic field is _____.
- Choose the correct answers
 - (a) Negative magnetism is exhibited by _____ materials.
 - (i) Diamagnetic (ii) Ferromagnetic
 - (iii) Paramagnetic (iv) All of these

60/E1-405/EEM/4th Sem(N) (2)

- (b) Loss in a dielectric may occur due to
 - (i) Polarisation (ii) Conductivity
 - (iii) Ionisation (iv) None of these
- (c) Eddy currents in a core will be reduced considerably by
 - (i) reducing flux density
 - (ii) laminating Core
 - (iii) reducing core volume
 - (iv) increasing the number of turns
- (d) Dielectric Constant of vacuum is
 - (i) infinity (ii) 10
 - (iii) 1 (iv) zero
- (e) In a semiconductor the resistivity decreases with temperature in the following way
 - (i) linearly (ii) non-linearly
 - (iii) exponentially (iv) None of these
- 60/El-405/EEM/4th Sem(N) (3)

[Turn over

1×10=10

- (f) Hall effect may be used for which of the following :
 - (i) determining whether a semiconductor is N-type or P-type
 - (ii) determining the carrier concentration
 - (iii) calculating mobility
 - (iv) All of the above
- (g) Thermistor possess
 - (i) Zero resistivity
 - (ii) Negative temperature resistivity
 - (iii) Positive temperature resistivity
 - (iv) None of these
- (h) The material with highest resistivity is
 - (i) Nickel (ii) Nichrome
 - (iii) Manganin
- (i) At superconductivity stage, the resistance of a conductor is

(iv) Invar

- (i) Zero (ii) 1
- (iii) Infinite (iv) Negative

60/E1-405/EEM/4th Sem(N) (4)

- (j) Breakdown in a dielectric may occur due to
 - (i) Electrical breakdown
 - (ii) Thermal breakdown
 - (iii) Electrochemical breakdown
 - (iv) All of these.
- 3. Write True or False :

1×5=5

- (a) Soft Magnetic materials have high permeability.
- (b) Dielectric materials are essentially semiconducting materials.
- (c) Moisture increases the insulation resistance of an insulator.
- (d) When supply frequency increases, dielectric strength of an insulator increases.
- (e) Eddy current losses are expressed in terms of Watt.
 - PART B Marks – 45
- 4. (a) Explain Band theory of solids.

5

[Turn over

(b) State the properties of a high resistivity material. Mention four applications of high resistivity conducting materials. 2+2=4

60/El-405/EEM/4th Sem(N) (5)

- 5. (a) Give reasons why copper materials are preferred over aluminium for winding of machines. 4
 - (b) Calculate the resistance of a wire at 60°C which is 200m long and has an area of cross-section of 25 mm². The wire is made of aluminium. Resistivity of aluminium at 15°C is 2.7 ohmm. temperature coefficient of aluminium is 0.004 ohm/degree C at 0°C.
- 6. (a) What is "Hall effect" and what are the applications of Hall effect. 2+2=4
 - (b) Describe briefly the process of preparing the Printed Circuit Board (PCB). 5
- (a) Define "Dielectric Strength" of an insulating material and mention its unit. State the factors which affect the dielectric strength of an insulating material.
 - (b) Explain the term "Dielectric loss" and "loss angle" with the help of a phasor diagram. 4
- (a) What are ferrites ? What are their chief properties and field of applications ?1+2+2=5
 - (b) Explain the following phenomenon in magnetic materials 2+2=4
 - (i) Magnetostriction
 - (ii) Eddy current loss.

60/EI-405/EEM/4th Sem(N) (6)

- 9. (a) What are soft and hard magnetic materials?

 - (c) What is a fuse ? Why the fuse material should have low melting point ? 2+2=4
- 10. Write short notes on any three : $3 \times 3=9$
 - (a) Solder
 - (b) ACSR
 - (c) Superconductor
 - (d) B-H Curve.

60/E1-405/EEM/4th Sem(N) (7)

1760(Y)

2

Date and ADD CHOR LARS

erregard act

El-405/EEM/4th Sem/2013/N

ECTRICAL ENGINEERING MATERIALS

Full Marks – 70

Pass Marks - 28

Time - Three hours

- Contest Cont The figures in the margin indicate full marks for the questions.

Answer question No.1 and any four from the rest.

- (a) Which metal has the highest resistivity ? 1.
 - (b) Which metal has the lowest resistivity ?
 - (c) Which meterial is least ductile ?
 - (d) Why steel rods are used in reinforced concrete ?
 - (e) How the permeability of soft iron can be increased ?
 - (f) Which of the following is not the characteristic of glass ?
 - (i) Brittle and hard

- (ii) High chemical resistance
- (iii) High dielectric loss

(iv) Slow aging.

- (g) How is it possible to destroy super conductivity?
- (h) What is the unit of resistivity ?
- (i) Which insulating material has the least affinity for moisture ?

(j) What is non-linear rasistance ? $1 \times 10 = 10$

 (a) State two conducting materials used in house-wiring. Discuss the property of one of them.

(b) Discuss the factors which affect the resistivity of electrical conductors.

- (c) Define conductivity. Explain the effect of temperature, alloying and mechanical stress on the value of resistivity of conducting material. 7
- 3. (a) Define diamagnetic, paramagnetic and ferro magnetic materials. 6
 - (b) What is hysteresis loop ? Draw and describe it with its different parts. 3+6=9

34/EI-405/EEM (2)

- 4. (a) What are the visual properties of insulating material ?
 - (b) Describe upon which factors insulation resistance is dependent. 7
 - (c) Write in brief about the fields of application at enamel in electrical engineering. 5
- 5. (a) Discuss the characteristics of germanium as semiconducting material.
 - Write down the method of formation of PN-Junction.
 - (b) What is P.C.B ? What are its advantages ? What are different types of P.C.B ? 7
- (a) Define non-destructive testing and state the methods adopted for testing different materials.
 7
 - (b) What is a fuse ? Where and why it is used ? 4
 - (c) Describe briefly on soldering and various soldering techniques. 2+2=4
- 34/EI-405/EEM (3) [Turn over

7. Write short notes on any *two* of the following: $7\frac{1}{2}\times2=15$

the creativity india. Online

- (a) Thermocouple
- (b) Isolator
- (c) Bearing materials.

34/EI-405/EEM

1200(W)

EI-405/EEM/4th Sem/2017/N

ELECTRICAL ENGINEERING MATERIALS

Full Marks - 70

Time - Three hours

The figures in the margin indicate full marks for the questions.

Answer all questions.

1. Select the correct answer :

1×10=10

(i) Which material has the highest electrical conductivity?

(a) Steel (b) Silver

(c) Aluminium (d) Lead

- (ii) Nichrome is an alloy of
 - (a) Silver, copper and nickel
 - (b) Aluminium, tin and copper
 - (c) Nickel, chromium, manganese and iron
 - (d) Chromium, manganese and copper.

(iii) Relative permittivity of vacuum is

- (a) 8.854 (b) 8.854×10^{-12}
- (c) unity (d) zero
- (iv) Which medium has least dielectric strength?
 - (a) Air (b) Ouartz
 - (c) Glass (d) Paraffin wax
- (v)Whenever a conductor cuts magnetic flux, an tivityIndi emf is induced. Above statement is due to
 - (a) Faraday's law
 - Joule's law (b)
 - (c) Weber and Ewing's theory
 - (d) Coulomb's law
- (vi) A germanium atom contains
 - (a) Two electron orbits
 - Three valence electrons (b)
 - (c) Four protons
 - (d) Four valance electrons
- (vii) The type of atomic bonding most common in semiconductor is
 - (a) Metallic (b) Ionic
 - (c) Covalent
 - (d) Chemical

364/EI-405/EEM

(2)

- (viii) Which of the following materials used for cable insulation ?
 - Phenol formaldehyde (a)
 - Polytetrafluoroethylene (b)
 - (c) Polyvinyl chloride
 - (d) Acrylontrile Butadine Styrene
- Solder is an alloy of (ix)
 - Nickel, copper and zinc (a)
 - Silver, copper and lead (b)
 - Tin and lead (c)
 - (d) Copper and aluminium
- Overhead telephone wires are (x)
 - Copper wire (a)
 - Steel wire (b)
 - ACSR conductor (c)
 - (d) Aluminium wire
- 2. Mention field of applications of the following insulating materials with reason : $2 \times 5 = 10$

(3)

- Mica (i) (ii) Asbestos
- (iii) Wood (iv) Rubber
- Porcelain. (\mathbf{v})

364/E!-405/EEM

3. Define :

 $1 \times 5 = 5$

1200(P)

- (i) Flux density (ii) MMF
- (iii) Reluctance (iv) Hysteresis
- (v) Remanance.
- (a) Define conductivity, linear and non-linear resistance. 1+1+1=3
 - (b) What are the effects of temperature on resistance of metal, alloy and semiconductor ? 3
 - (c) Determine the temperature co-efficient of resistance at 0°C of a material used in a resistor if the resistance at 25°C is 50Ω and at 70°C is 57.2 Ω.
- (a) What is meant by hysteresis loop? Draw the hysteresis loop for ferromagnetic material.
 - (b) Describe the applications of electro-magnet.
 - (c) What do you mean by dielectric strength of an insulating material? 2
- (a) Define semiconductor. What are the types of semiconductor ? 1+2=3

364/EI-405/EEM (4)

- (b) Write down the method of formation of pn-junction. 4
- (c) State the merits of semiconductor devices used in electrical industry. 3
- Describe about the concept of non-destructive testing and methods adopted for testing different materials.
- 8. What is soldering ? Describe various methods of soldering. 5
- Write down the advantages of using P.C.B for assembly of electronic circuits.

364/EI-405/EEM

(5)

END SEMESTER / RETEST EXAMINATION-2019

Semester : 4th (Regular/Retest)

Subject Code : El-405

ELECTRICAL ENGINEERING MATERIALS

Full Marks - 70

Time - Three hours

The figures in the margin indicate full marks for the questions.

Instruction :

All questions of PART - A and PART - B are compulsory.

PART - A

Marks - 25

Fill in the blanks: 1.

 $1 \times 10 = 10$

has the highest electr ical (a) conductivity.

POTLEV is used as insulating material in spark (b)Covaler plug.

(c) Germanium has bond.

- (e) Dielectric constant for vacuum is 8:854×10 f) Carbon has (d) The relative permeability of paramagnetic
- of resistance.
- (g) The relative permeability of super conducting material is - 7000
- (h) Main alloving element of corrosion resistant steel is _____ nickel, copper
- The electrons present in the outermost orbit **(i)** are called whence duction
- The property of material by which it can be **(i)** rolled into sheet is called
- 2. Choose the correct answers :
 - (i) Electric stress is expressed in terms of
 - (a) Ohm/cm
 - (c) Farad/cm

(b) Henry/cm

(d) kV/cm

 $1 \times 5 = 5$

- (ii) When a ferromagnetic substance is magnetized small changes in dimensions occur. Such a phenomenon is known as
 - (a) Magnetic hysteresis
 - (b) Magnetic expansion
 - (c) Magnetostriction
 - (d) Magneto-calorisation
- (iii) Sulphur hexafluoride is used for
 - (a) Dynamos
 - (b) DC series motor
 - (c) Switchgear
 - (d) Synchronous motor
- (iv) Electric breakdown strength of a material depends on its
 - (a) Composition
- (b) Moisture content
- (c) Thickness
- (d) All of these

39/EI-405/EEM

(3)

Turn over

39/EI-405/EEM

(2)

- (v) Which of the following elements has four valance electrons?
 - (a) Arsenic

(b) Silicon

- (c) Boron
- (d) Indium
- Write true or false: 1×10=10
 - (i) Copper, silver and gold do not exhibit superconducting property.
 - (ii) Electrical resistance of semiconductor increases with the increase of temperature.
 - (iii) Aluminium is easily solderable.
 - (iv) Ferrites are generally hard and brittle.
 - (v) Eureka is copper nickel alloy.
 - (vi) Atomic number of silicon is 32 and that of germanium is 14.
 - (vii) Magnetic susceptibility is dimensionless.
 - (viii) Resistivity of insulator ranges from 10^9 to 10^{18} .
- 39/EI-405/EEM

(ix) Hole current is the movement of negative charges in the opposite direction from the electron flow.

- (x) For DC voltage an inductor is virtually a short circuit.
 - PART B

Marks-45

- (a) Define conductivity and resistivity of electrical materials.
 2
- (b) What are the effects of temperature on resistance of metal, alloy and semiconductor? 2
- (c) State the advantages of copper as compared to aluminium as a conductor of electricity.
- (d) A coil of relay is made of copper wire. At a temperature of 20°C, the resistance of the coil is 400Ω. Calculate the resistance of the coil at temperature of 80°C. The temperature coefficient of resistance of copper is 0.0038 Ω/ Ω/°C at 0°C.

(5)

39/EI-405/EEM

- .5. (a) Classify the following as conductor or semiconductor 2
 - (i) Gold (ii) Germanium
 - (iii) Silver

(iv) Silicon

- (b) Define intrinsic and extrinsic semiconductor.
- (c) Why does a pure semiconductor behave like an insulator at absolute zero temperature ? 3
- (d) What are the advantages of semiconductor materials used in electrical industry ? 3
- (a) Describe the characteristics of ideal insulating materials.
 - (b) Write briefly on the factors affecting the insulation resistance.
 - (c) Write short notes on any one :
 - (i) Impregnation
 - (ii) Hygroscopicity.
- 39/EI-405/EEM

- 7. (a) Define the term 'dielectric strength' of an insulating material.
 - (b) What are the factors which affect the dielectric strength of an insulating material?
- What is soldering? Describe briefly various methods of soldering.
 3
- 9. Describe about the concept of non-destructive testing and methods adopted for testing different materials. 3
- (a) Define the terms 'Permeability' and 'Curie point'.
 - (b) What is meant by hysteresis loop ? Draw the hysteresis loop for ferromagnetic materials. 3
 - (c) Describe the application of electromagnets.

1970

39/El-405/EEM

(7)

1200(Y)

END SEMESTER EXAMINATION – 2020

Semester : 4th (New)

Subject Code : El-405

ELECTRICAL ENGINEERING MATERIALS

Full Marks - 70

Time - Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

P.CY

- 1. All questions of PART-A are compulsory.
- 2. Answer any five questions from PART-B.

PART – A

Marks - 25

Fill in the blanks with suitable words/figures : 1. $1 \times 10 = 10$

- (a) Classification of electrical engineering materials is based upon properties 2 area of pand is applicat
- (b) In insulators conduction band is

- (c) Di-electric material is basically insulators
- (d) Full form of ACSR is alluminour conductor Steel Reinford

660.3.0

- (e) Resistivity is also named as
- (f) Melting point of aluminium is
- (g) When the temperature of an intrinsic semiconductor is increased, the energy of atom is ancrease
- (h) When pentavalent impurity is added to a semiconductor, the semiconductor thus obtained is called expressions semiconductor.
- (i) Semi conducting materials have -ve temperature coefficient of resistance.
- An insulator has resistivity in the range of 10^{12} to 10^{20} ohm-m.
- Choose the correct answer from the given 2. 1×10=10 options :
 - (a) An element has atomic weight of 16 and atomic number of 8. The number of protons, neutrons and electrons are :

(ii) 8, 8 & 8 (i) 8, 10 & 16

- (iii) 2, 8 & 8 (iv) 2, 8 & 18.
- 58/EI-405/EEM(N)
- (2)

- (b) 1.6×100 ohm-m is the value of resistivity of
 - (i) conducting material

(ii) semiconducting material

(iii) insulating material.

(c) The material with highest resistivity is (i) Nichrome

(ii) Constantan

- (iii) Monel metal
- (iv) Manganin.
- (d) The most malleable, ductile and low resistivity material is
 - (i) Copper
 - (ii) Aluminium
 - (iii) Silver
 - (iv) None of the above.
- (e) For Germanium the forbidden energy gap is
 - (i) 0.15ev (ii) 1.1ev (iv) 0.7ev. (iii) 1.5ev (3)

58/EI-405/EEM(N)

- (f) A pure semiconductor under ordinary conditions, behaves like
 - (i) a conductor
 - (ii) an insulator
 - (iii) a magnetic material
 - (iv) a ferromagnetic material.
- (g) The relative permeability of diamagnetic material is

creativit

- (i) 0.00001
- (ii) 100000
- (iii) 0.000001
- (iv) 1000000.
- (h) Insulators have
 - (i) large energy gap
 - (ii) an empty conduction band
 - (iii) a full valence band
 - (iv) None of the above.
- 3/E1-405/EEM(N)
- (4)

- (i) Hard magnetic materials are used for making
 - (i) permanent magnets
 - (ii) temporary magnets
 - (iii) Both (i) and (ii) above
 - (iv) None of the above.
- (j) Eddy current losses are expressed in terms of
 - (i) kV (ii) kVA (iii) Watt
 - (iv) Ampere.
- 3. Answer the following questions in one sentence $1 \times 5 = 5$
 - (a) Name a conductor material used in making thermocouple.
 - (b) What is Super conductivity?
 - (c) Name one impurity material that forms p-type semiconductor.
 - (d) What type of material is Alnico?
 - (e) Mention one application of porcelain in the field of electrical engineering.

58/E1-405/EEM(N)

(5)

PART-B Marks-45

(a) What is Specific resistance?

(b) Explain the factors affecting the value of resistivity of conductor materials. 3

2

- (c) Describe with reason for preferring copper for winding of electrical machines as compared to aluminium. 4
- (a) Write the name of electrical engineering 5. materials used for making : home
 - (i) heater coil
 - (ii) fuse wire.
 - (b) Mention at least two important applications of each of the following: 3
 - (i) Rubber
 - (ii) Wood
 - (iii) Mica.
 - (c) State the electrical, mechanical and thermal properties of insulator materials.
- 58/EI-405/EEM(N)
- (6)

- (a) Define : permeability, residual magnetism. 6.
 - (b) Classify the magnetic materials on the basis of relative permeability.
 - (c) Draw the hysteresis curve for soft and hard magnetic materials. 2

Also give example of each materials.

- (a) Define semiconductor. Explain conductor, insulator and semiconductor materials on the basis of energy level diagram. 5
 - (b) Discuss the advantages of semiconductor and their field of application in industry. 4
- (a) Describe the etching technique of P.C.B. 8.
- (b) What is fuse? Write down the properties of fuse wire materials. Name the best fuse wire material. 5
- 9. (a) What is solder? Write the composition of solder wire. Give the application of different fluxes.
 - (b) Describe the principle and operation of photo-voltaic cell. 5

(7)

58/EI-405/EEM(N)

10. Write short notes on any three :

(a) Dielectrics

(b) Non-destructive test

(c) Soft and hard magnetic materials

(d) Properties of constructional materials.

58/E1-405/EEM(N)

(8)

800(W)

3×3=9

El-405/EEM/4th Sem/2018/M

ELECTRICAL ENGINEERING MATEFIALS

Full Marks - 70

Time - Three hours

The figures in the margin indicate fill marks for the questions.

PART -A

1.	Multiple	choice	questions	•
----	----------	--------	-----------	---

$1 \times 10 = 10$

(a) Which of the materals has negative temperature co-efficien of resistance ?

(i)	Tungsten		(ii)	Steel
(iii)	Tin	24	(iv)	Carbon

(b) Which of the following materials can be used for making cable sheath ?

(i)	Lead	(ii)	Copper
\		()	Copper

(iii) Aluminium (iv) Cast iron

- (c) Constantan contains
 - (i) Copper and nickel
 - (ii) Tungsten and silver
 - (iii) Copper and tungsten
 - (iv) Silver and tin
- (d) The relative permeability of diamagnetic material is of the order of
 - (i) 10^{-5} (ii) $1 10^{5}$
 - (iii) 1^{6} (iv) $1 10^{6}$
- (e) Resistivty of electrical conductor is mostly affected by
 - (i) pressure (ii) size
 - (iii) composition (iv) temperature
- (f) Which of the following has highest resistivity?
 - (i) Mica 📈 🔪 (ii) Paraffin wax
 - (iii) Air (iv) Mineral oil
- 150/EI-405/EEM

(2)

- (g) Ionic bonding in solids depends primarily on
 - (i) transfer of electrons
 - (ii) sharing of electrons
 - (iii) electrical dipole
 - (iv) all of the above
- (h) Iron is a
 - (i) ferromagnetic
 - (ii) anti-ferromagnetic
 - (iii) ferrimagnetic
 - (iv) paramagnetic
- (i) Bakelite is
 - (i) quite hard
 - (ii) uncombustible
 - (iii) highly inflammable
 - (iv) both (i) and (ii)
- (j) Life of an insulating material is affected by

(3)

- (i) voltage application
- (ii) heat
- (iii) chemical action
- (iv) all of these

150/El-405/EEM

[Turn over

22<u>5</u>

- 2. Fill up the blanks : $1 \times 10 = 10$
 - (a) Secondary bonds are _____ than primary bonds.
 - (b) Pure aluminium is than copper.
 - (c) High resistance material have high _____.
 - (d) Tungsten is used in lamp due to _____.
 - (e) The majority carriers are _____ in n-type semiconductor.
 - (f) The conductivity of intrinsic semiconductor is primarily depends on _____ mobility and _____mobility.
 - (g) Core of electrical machine is of
 - (h) Diamagnetic materials are _____ material.
 - (i) Hard magnetic materials have magnetic reluctance.
 - (j) Lubrications _____ wear and tear of the contact surface.

150/EI-405/EEM

(4)

3. Write true or false :

1×5=5

- (a) Coercive force is the demagnetising force which is necessary to neutralise completely the magnetism in a magnetic material.
- (b) Alloying silicon to steel increases the hysteresis loss.
- (c) Dielectric strength of insulator is expressed in KV/mm.
- (d) Fuse has high speed operation.
- (e) Ammonium chloride is used as flux for soldering copper.

PART – B

Answer any five questions.

- 4. (a) Explain how the materials can be classified into three groups on the basis of atomic structure.
 - (b) What are the properties of high resistivity material possess ? 3

(5)

150/EI-405/EEM

Turnover

 (a) What is meant by the term dielectric strength of an insulating material and classify the insulating material on the basis of operating temperature. 2+4=6

5.

7.

- (b) Write short notes on impregnation and hygroscopicity. 3
- 6. (a) Define diamagnetic, paramagnetic and ferromagnetic material. Give example of each.
 - (b) Draw the hysteresis loop for hard steel, wrought iron and alloyed steel. 3
 - (a) Explain semiconductor on the basis of energy level diagram. 2
 - (b) Write down the characteristics of germanium as semiconductor material.
 - (c) Describe briefly the process of preparing the PCB.
- (a) What are the properties to be possessed by constructional material used in electrical engineering?

(6)

150/EL-405/EEM

- (b) What are the various methods of nondestructive test ? 3
- (c) Mention the types of soldering techniques.
- 9. (a) Define fuse and why it is used ? 3
 - (b) Why are fluxes used ? 2
 - (c) Write different fluxes with their applications.

150/El-405/EEM

END SEMESTER / RETEST EXAMINATION-2019

Semester: 4th (Regular/Retest)

Subject Code : El-405

ELECTRICAL ENGINEERING MATERIALS

Full Marks - 70

Time - Three hours

The figures in the margin indicate full marks for the questions.

Instruction :

All questions of PART - A and PART - B are compulsory.

> PART - AMarks - 25

Fill in the blanks : 1×10=10 1.

has the highest electr ical (a) conductivity.

- (b) is used as insulating material in spark (c) Germanium has <u>Covalent</u>
- bond.

- (d) The relative permeability of paramagnetic material is -8'854 ×10
- (e) Dielectric constant for vacuum is ____!
- ---- temperature coefficient Carbon has -(f) of resistance.
- (g) The relative permeability of super conducting
- (h) Main alloying element of corrosion resistant steel is _____ nickel, copper
- The electrons present in the outermost orbit (1) are called whence electron
- The property of material by which it can be rolled into sheet is called
- Choose the correct answers : 2.
 - (i) Electric stress is expressed in terms of
 - (a) Ohm/cm

(b) Henry/cm

1×5=5

(c) Farad/cm

(d) kV/cm

(ii) When a ferromagnetic substance is magnetized small changes in dimensions occur. Such a phenomenon is known as

(a) Magnetic hysteresis

(b) Magnetic expansion

(c) Magnetostriction

(d) Magneto-calorisation

(iii) Sulphur hexafluoride is used for

- (a) Dynamos
- (b) DC series motor
- (c) Switchgear
- (d) Synchronous motor
- (iv) Electric breakdown strength of a material depends on its
 - (a) Composition
- (b) Moisture content

(c) Thickness

(d) All of these

39/EI-405/EEM

(3)

Turn over

39/EI-405/EEM

- (v) Which of the following elements has four valance electrons ?
 - (a) Arsenic

(b) Silicon

(c) Boron

- (d) Indium
- Write true or false :

1×10=10

- Copper, silver and gold do not exhibit superconducting property.
 - (ii) Electrical resistance of semiconductor increases with the increase of temperature.
 - (iii) Aluminium is easily solderable.
- (iv) Ferrites are generally hard and brittle.
- (v) Eureka is copper nickel alloy.
- (vi) Atomic number of silicon is 32 and that of germanium is 14.
- (vii) Magnetic susceptibility is dimensionless.
- (viii) Resistivity of insulator ranges from 10° to 1018. T-102 to 1020

39/EI-405/EEM

(4)

1200(Y)

// peraso

- (ix) Hole current is the movement of negative charges in the opposite direction from the electron flow.
- (x) For DC voltage an inductor is virtually a short circuit.

PART-B Marks-45

- Define conductivity and resistivity of electrical materials.
- (b) What are the effects of temperature on resistance of metal, alloy and semiconductor?
- (c) State the advantages of copper as compared to aluminium as a conductor of electricity.
- (d) A coil of relay is made of copper wire. At a temperature of 20°C, the resistance of the coil is 400Ω . Calculate the resistance of the coil at temperature of 80°C. The temperature coefficient of resistance of copper is 0.0038 $\Omega / \Omega / ^{\circ}C$ at 0°C.

39/EI-405/EEM

(5)

- 5. (a) Classify the following as conductor or semiconductor 2
 - (i) Gold (ii) Germanium
 - (iii) Silver (i

(iv) Silicon

- (b) Define intrinsic and extrinsic semiconductor. 2
- (c) Why does a pure semiconductor behave like an insulator at absolute zero temperature?
- (d) What are the advantages of semiconductor materials used in electrical industry? 3
- (a) Describe the characteristics of ideal insulating materials.
 - (b) Write briefly on the factors affecting the insulation resistance.
 - (c) Write short notes on any one :
 - (i) Impregnation
 - (ii) Hygroscopicity.
- 39/E1-405/EEM

- (a) Define the term 'dielectric strength' of an insulating material.
 - (b) What are the factors which affect the dielectric strength of an insulating material?
- What is soldering? Describe briefly various methods of soldering.
 3
 - Describe about the concept of non-destructive testing and methods adopted for testing different materials.
- 10. (a) Define the terms 'Permeability' and 'Curie point'.
 - (b) What is meant by hysteresis loop ? Draw the hysteresis loop for ferromagnetic materials.
 - (c) Describe the application of electromagnets.

5/0 ×

39/EI-405/EEM

(7)

1200(Y)

2

END SEMESTER EXAMINATION - 2020

Semester: 4th (New)

Subject Code : El-405

ELECTRICAL ENGINEERING MATERIALS

Full Marks – 70

Time - Three hours

The figures in the margin indicate full marks for the questions.

Instructions:

- 1. All questions of PART-A are compulsory.
- 2. Answer any five questions from PART-B.

PART – A Marks – 25

1. Fill in the blanks with suitable words/figures : $1 \times 10 = 10$

(a) Classification of electrical engineering materials is based upon ________ propubles 2 area of

(b) In insulators conduction band is

[Turn over

applica

- (c) Di-electric material is basically insulators
- (d) Full form of ACSR is alluminum conductor

- (f) Melting point of aluminium is specific Resistance. (g) When the to (g) When the temperature of an intrinsic semiconductor is increased, the energy of atom is Increase
- (h) When pentavalent impurity is added to a semiconductor, the semiconductor thus obtained is called extrinsi semiconductor.
- (i) Simiconducting materials have -ve temperature coefficient of resistance.
- An insulator has resistivity in the range of 1012 to 1020 ohm-m.
- Choose the correct answer from the given 2. 1×10=10 options :
 - (a) An element has atomic weight of 16 and atomic number of 8. The number of protons, neutrons and electrons are :

	(i) 8,	10 & 16	(ii) 8,	8&8
• 45	(iii) 2,	8 & 8	(iv) 2,	8 & 18
58/E1-	405/EEM(1	N)	(2)	

- (b) 1.6×100 ohm-m is the value of resistivity of
 - (i) conducting material
 - (ii) semiconducting material
 - (iii) insulating material.
- (c) The material with highest resistivity is
 - (i) Nichrome
 - (ii) Constantan
 - (iii) Monel metal
 - (iv) Manganin.
- (d) The most malleable, ductile and low resistivity material is
 - (i) Copper
 - (ii) Aluminium
 - (iii) Silver

58

- (iv) None of the above.
- (e) For Germanium the forbidden energy gap is

/er

(i) 0.15ev	(ii) 1.1ev		
(iii) 1.5ev	(iv) 0.7ev.		
/EI-405/EEM(N)	(3)	[Turn	01

- (f) A pure semiconductor under ordinary conditions, behaves like
 - (i) a conductor
 - (ii) an insulator
 - (iii) a magnetic material
 - (iv) a ferromagnetic material.
- (g) The relative permeability of diamagnetic material is reativituit
 - (i) 0.00001
 - (ii) 100000
 - (iii) 0.000001
 - (iv) 1000000.
- (h) Insulators have
 - large energy gap (ii) an empty conduction band (iii) a full valence band (iv) None of the above.

- Hard magnetic materials are used for making (i) (i) permanent magnets (ii) temporary magnets (iii) Both (i) and (ii) above (iv) None of the above.
- Eddy current losses are expressed in terms of
 - (i) kV
 - (ii) kVA
 - (iii) Watt
 - (iv) Ampere.
- Answer the following questions in one sentence each : $1 \times 5 = 5$
 - (a) Name a conductor material used in making thermocouple.
 - (b) What is Super conductivity?
 - (c) Name one impurity material that forms p-type semiconductor.
 - (d) What type of material is Alnico?
 - (e) Mention one application of porcelain in the field of electrical engineering.

(5)

58/E1-405/EEM(N)

Turn over

S&TI-40STEMIND

(4)

PART – B Marks – 45

4. (a) What is Specific resistance?

2

(b) Explain the factors affecting the value of resistivity of conductor materials. 3

- (c) Describe with reason for preferring copper for winding of electrical machines as compared to aluminium. 4
- 5. (a) Write the name of electrical engineering materials used for making : 2
 - (i) heater coil Nichnome
 - (ii) fuse wire.
 - (b) Mention at least two important applications of each of the following: 3
 - (i) Rubber
 - (ii) Wood
 - (iii) Mica.
 - (c) State the electrical, mechanical and thermal properties of insulator materials. 4

- 6. (a) Define : permeability, residual magnetism.
 - (b) Classify the magnetic materials on the basis of relative permeability. 3
 - (c) Draw the hysteresis curve for soft and hard magnetic materials. 2

Also give example of each materials.

- (a) Define semiconductor. Explain conductor, insulator and semiconductor materials on the basis of energy level diagram. 5
- (b) Discuss the advantages of semiconductor and their field of application in industry. 4
- 8. (a) Describe the etching technique of P.C.B.

4

- (b) What is fuse ? Write down the properties of fuse wire materials. Name the best fuse wire material. 5
- 9. (a) What is solder? Write the composition of solder wire. Give the application of different fluxes.
 - (b) Describe the principle and operation of photo-voltaic cell. 5

(7)

58/EI-405/EEM(N)

[Turn over

58/EI-405/EEM(N)

(6)

10. Write short notes on any three :

(a) Dielectrics

(b) Non-destructive test

- (c) Soft and hard magnetic materials
- (d) Properties of constructional materials.

58/E1-405/EEM(N)



3×3=9

END SEMESTER EXAMINATION – 2022

Semester: 4th Branch : Electrical Engineering Subject Code : El-405 ELECTRICAL ENGINEERING MATERIALS. Full Marks -70

Time - Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

- Questions of PART-A are compulsory and 1. objective type.
- 2. Answer any three questions from PART B.

PART - A

Marks - 25

- 1. Answer the following questions : 1×10=10
 - (i) What is Electron theory of metal?
 - (ii) What is resistivity ?
 - (iii) What are low resistivity materials ?

- (iv) What are high resistivity materials ?
- (v) Define semi-conductors.
- (vi) What is PCB ?
- (vii) What is measured with a thermistor ?
- (viii) What is a varistor ?-
- (ix) What is the application of a fuse?
- (x) What is curie temperature ?
- Choose correct answers : 2.

1×10=10

- (a) The metal having the lowest temperature, coefficient of resistance is
 - (ii) Copper (i) Gold
 - (iii) Aluminium

(iv) Kanthal

(ii) SiO,

. (iv) B203

- is the main constituent of glass.
- (i) Fe,O,
- (ii) ALO,

(b)

- (c) By increasing impurity content in the metal
 - alloy the residual resistivity always
 - (i) Increases

(iii) Constant

- (ii) Decreases. (iv) None of these
- 21/EI-405/EEM/4th Sem
- (2)

- (d) Which of the following materials does not have covalent bonds ?
 - (i) Organic polymers (ii) Silicon
 - (iv) None of these (iii) Metals
- (e) Which of the following are non-conductors of electricity ?
 - (i) Non-metal solids except carbon
 - (ii) Air and most other gases
 - (iii) Pure water and liquids in general except mercury
 - (iv) All of the above
- (f) Is the property of absorbing moisture from atmosphere ?
 - (ii) Viscosity (i) Solubility ·
- (iii) Porosity (iv) Hygroscopicity
- Spark plug makes use of which of the following (g) materials for insulation?

(3)

- (i) Porcelain (ii) Slate (iv) Glass (iii) Asbestos
- 21/EI-405/EEM/4th Sem

- (h) In conductors, conduction of electricity takes place due to movement of
 - (i) Electrons only
 - (ii) Positive ions only
 - (iii) Negative ions only
 - (iv) Both positive and negative ions
- (i) Total number of crystal systems is
 - (i) 2 (ii) 4 (iii) 7 (iv) 12
- (j) Which of the following is an advantage of stranded conductor over equivalent single conductor?
 - (i) Less liability to kink
 - (ii) Greater flexibility
 - (iii) Less liability to break
 - (iv) All of the above
- 21/EI-405/EEM/4th Sem (4)

3. Fill in the blanks :

1×5=5

- (a) The photoelectric effect occurs only when the incident light has more than a certain critical
- (b) _____ material is not a semi-conductor.
- (c) A carbon resistor contains
- (d) Overhead telephone wires are made of
- (e) has zero temperature coefficient of resistance.

PART - B

Marks - 45

- (a) Define the different types of energy bands in solid with proper diagrams.
 - (b) What is doping ? Define and explain extrinsic semi-conductor and intrinsic semi-conductor. 2+6=8
 - (c) What is biasing ? Draw schematic diagram of biasing circuits for pn junction diode.

1+2=3

21/EI-405/EEM/4th Sem (5)

[Turn over

1920(G)

- (a) What are hysteresis and hysteresis loop? Define hysteresis loss. Write the factors on which hysteresis loss depends.
 - (b) Define soft and hard magnetic materials. Give suitable examples. 5
- 6. (a) What is Soldering process ? Write its different types. What are the different soldering techniques available ? 10
 - (b) Mention some properties of insulating materials. What are the applications of insulating materials in electrical field ? 5
- 7. Write short notes on any three : $5 \times 3 = 15$
 - (a) Piezo-electric materials
 - (b) PCB
 - (c) Thermistor
 - (d) Strain gauge
 - (c) Thermocouple.

21/EI-405/EEM/4th Sem (6)

