III-SEM./ELECTRICAL/ ETE/MECHANICAL /AUTO/AE & IE/CSE/IT /EEE/MECH(IND INTG)/ ELECTRICAL(INST &CTRL)/ 2021(W)

BST-301 ENGINEERING MATHEMATICS -III

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2

Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. State Rouche's Theorem.

b. Solve $(D^2 + 1)y = 0$

c. Frame a partial differential equation for the function $z = (x - a)^2 + (y - b)^2$

d. What is Gamma function? Find $\Gamma(-3.5)$

e. Find $L^{-1}\left(\frac{3}{S+3}\right)$

f. Define even and odd functions with examples.

g. Write Newton Raphson formula to find $\sqrt{N}$.

h. Evaluate $\Delta^2(e^x)$

i. State Newton Cotes Quadrature Formula.

j. Define Rank of a matrix.

2. Answer **Any Six** Questions 5X6

a. Find the root of the equation $x^3 - x - 1 = 0$ correct to three places of decimal using Bisection Method.

b. Find the Laplace Transform of

$$f(t) = \begin{cases} t, & 0 \le t < 3 \\ 5, & t \ge 3 \end{cases}$$

c. State the Convergence condition of Fourier Series.
Find a_0 of $f(x) = e^x$ $in - \pi < x < \pi$

d. Evaluate $\int_1^3 \frac{1}{x} dx$ using Trapezoidal Rule taking h= 0.5

e. Find f(2.8) using Newton's Backward Interpolation Formula

x	0	1	2	3
F(x)	1	2	11	34

f. Solve $(D^2 + 3D + 2)y = xe^x \sin x$

g Find the rank of the matrix $\begin{pmatrix} -1 & -2 & 3 \\ 6 & 12 & 6 \\ 5 & 10 & 5 \end{pmatrix}$ by Row reduced Echelon form.

3 i) Find the Fourier Series of $f(x) = x + x^2 in\ (-\pi, \pi)$ 6

ii) Solve $(D^2 - 10D + 25)y = 0$ 4

4 i) Check the consistency and solve by Matrix method 5

2x+y+z=5

x+ y+z=4

x-y+2z=1

ii) Evaluate $\int_2^6 \frac{1}{1+x^3} dx$ using Simpson's $\frac{1}{3}rd$ rule and taking h =1 5

5 i) Solve the following partial differential equation 5

$x(y-z)p + y(z-x)q = z(x-y)$

ii) Find $L(t \sin 3t)$ 5

6 i) Solve by Transform Method 6

$\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^t$ with $x = 2, \frac{dx}{dt} = -1\ at\ t = 0$

ii) Solve $(D^2 - 1)y = x^2 e^x$ 4

7 i) Using Interpolation estimate the output of a factory in 1986 from the following data 5

year	1974	1978	1982	1990
Output in 1000 tones	25	60	80	170

ii) Find the Inverse Laplace Transform of $L^{-1}(\ log \frac{s^2+1}{s(s+1)}\ )$ 5

III-SEM./ Electrical Engg./EEE/2021(W) OLD

EET301 Circuit and Network Theory

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2

Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. What are open-circuit impedance parameters?

b. Give an example of (i) Passive Element (ii) Bilateral Element

c. A current of 15 A divides between two branches in parallel resistance of 8 ohm & 16 ohm respectively. Calculate the current in each branch.

d. Draw impedance triangle of RL and RC series circuit.

e. Write down the analogous between electrical and magnetic circuit.

f. Define band pass filter and low pass filter.

g. What do you mean by self and mutual inductance.

h. Write down the relationship between line current and phase current in both star and delta connection.

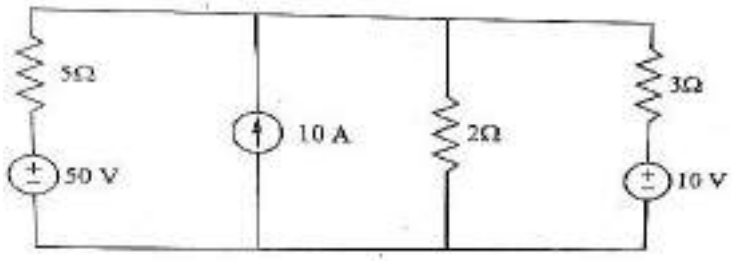
i. What is the true power consumed in a 30V series RLC circuit if Z= 20 ohm and R= 10 ohm?

j. A series RC circuit has $|V_R|$ = 12 V and $|V_C|$ = 5V. Calculate the magnitude of supply voltage.

2. Answer **Any Six** Questions 5X6

a. A 230 V, 50 Hz ac supply is applied to a coil of 0.06 H inductance and 2.5 Ω resistance connected in series with a 6.8 µF capacitor. Calculate (i) Impedance (ii) Current (iii) Phase angle between current and voltage (iv) power factor

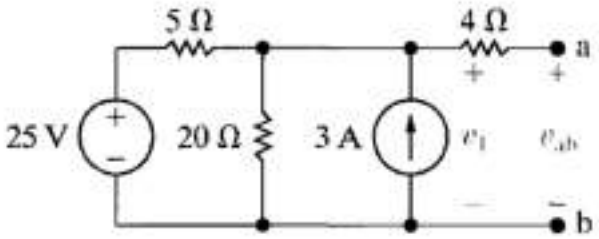
b. Use nodal analysis method, find current through 5Ω resistor in the below circuit.



c. Derive the bandwidth of RLC series resonance circuit.

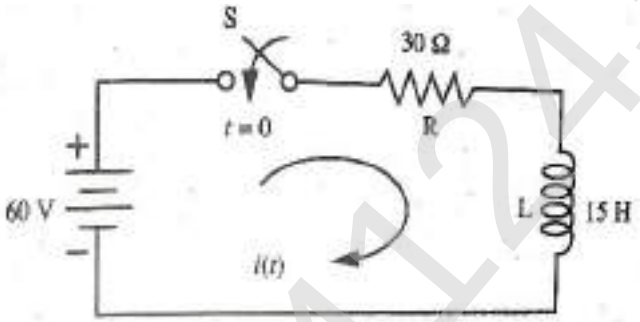
d. Write short notes on hysteresis loop.

e. Find Rth and Vth in the below circuit using Thevenin theorem.

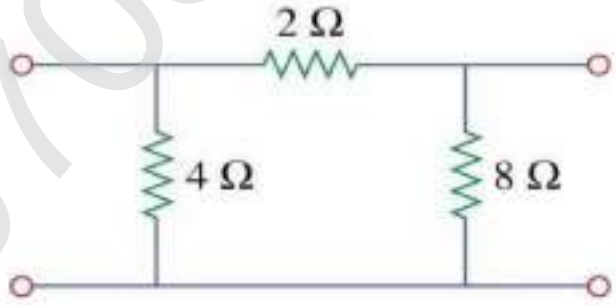


f. Explain dot conversion rules for coupled circuits.

g Derive the expression for the current in the below circuit when the switch, S is closed at t=0.



3	State Maximum Power Transfer theorem. Derive the condition of maximum power transfer.	10
4	Explain the concept of Super-mesh and Super-node with one suitable example for each.	10
5	Obtain the Y-parameter of below circuit.	10



6	A 3-phase balanced, star connected load of (2+j4) ohm is connected to a 3-phase balanced delta connected source with a phase voltage of 220V. Determine line voltage, phase voltage across the load, line current and phase current in the load, assume RYB phase sequence. Also calculate the power drawn by the load.	10
7	An impedance Z_L= (10+j10)ohm is connected in parallel with another impedance of resistance 8.5ohm and a variable capacitance connected in series. Find the capacitance such that circuit is in resonance at 5KHz.	10

3rd Sem./ELECTRICAL/2021(W) OLD
EET302 Electrical Engineering Material

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. What is breakdown voltage?
b. What is skin effect?
c. What is thermocouple material?
d. What do you mean by covalent bond?
e. What is the effect of porosity?
f. What do you mean by dielectric loss?
g. Write down any two chemical properties of an insulating material.
h. Why conducting materials like copper and aluminium are not used for making the element for electrical heaters?
i. What are bimetals?
j. What is super conductivity?

2. Answer **Any Six** Questions 5X6

a. Write in brief about PVC and rubber.
b. Classify various types of dielectrics and explain it.
c. Write in brief about photovoltaic cell.
d. State four factors which decide the selection of insulating material for given purpose.
e. Write short notes on Hall effect.
f. Write short notes on Varnishes.
g Explain briefly about fuse material.

3 Explain the hysteresis loop for ferromagnetic material with suitable diagram. 10

4 Explain with the help of energy diagram n-type and p-type semiconductor. 10

5 Explain the effect of temperature on resistivity. 10

6 Write notes on hard magnetic materials and their applications. 10

7 Explain briefly about magnetostriction and polarisation. 10

3rd Sem./Electrical [PT]/2021(W)

EET302 ELECTRICAL ENGINEERING MATERIAL

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2

Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. State any two applications of copper and Aluminium.
b. Define resistivity and conductivity.
c. Write two electrical properties of insulating materials.
d. What is extrinsic semiconductors?
e. Define permittivity.
f. What is magneto-striction?
g. State two applications of superconducting materials.
h. Write the difference between bundled and stranded conductors.
i. Define polarization.
j. Define eddy current loss.

2. Answer **Any Six** Questions 6 x 5

a. Explain about P-type and N-type materials.
b. Why carbon material is used as brushes in electrical machines? Write down other applications of carbon in the field of electrical engineering.
c. Write short notes on Hall effect generators.
d. What is aging of insulating materials? What are the commonly used insulating gases?
e. With the help of energy band concept differentiate between semiconductors, conductors and insulators.
f. Give a comparison between soft magnetic materials and hard magnetic materials.
g Explain briefly about electric conductivity of dielectrics and their breakdown.

3 (a) State and explain about hysteresis curve with a neat diagram. 10
(b) Define diamagnetism, paramagnetism and ferromagnetism

4 Classify insulating materials. Write down properties and applications. 10

5 (a) Briefly explain about the properties of dielectrics. 10
(b) Write down five low resistivity materials and five high resistivity materials.

6 Write notes on fuse materials and soldering materials. 10

7 Write short notes on 10
(a) Thermistors
(b) bimetals

III-SEM./ELECTRICAL/EEE/ 2021(W) OLD

ETT-321 ANALOG ELECTRONICS AND OP-AMP

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2

Figures in the right hand margin indicates marks

1.		**Answer All questions**	**2 x 10**
	a.	**What is knee voltage?**	
	b.	**What is a clipping circuit?**	
	c.	**What is a filter? Why we need a filter in a circuit?**	
	d.	**What is ripple and ripple factor?**	
	e.	**What is avalanche breakdown?**	
	f.	**Define DC load line.**	
	g.	**What is the need of biasing?**	
	h.	**Write down the difference between oscillator and amplifier?**	
	i.	**Draw the circuit diagram of 741 OP-AMP IC.**	
	j.	**What do you mean by stability factor in transistor?**	
2.		**Answer Any Six Questions**	**5X6**
	a.	**Explain the construction and working principle of a PN junction diode in forward and reverse bias condition.**	
	b.	**With a neat circuit diagram full-wave centre tap rectifier? State its advantages.**	
	c.	**Explain the working principle of a Tunnel diode. Explain its characteristics and use.**	
	d.	**State the relation between α,β,γ.**	
	e.	**Define Oscillator and explain working of basic Oscillator with simple block diagram.**	
	f.	**With a neat circuit diagram, explain the voltage divider biasing used in a transistor amplifier.**	
	g	**Derive the expression for overall gain of a negative feedback amplifier.**	
3		**Explain how a Zener diode act as a voltage regulator.**	**10**
4		**Explain the principle of operation of a Class-B push pull amplifier, with neat circuit diagram.**	**10**
5		**Describe the principle of operation of inverting and non-inverting types of OP-AMP.**	**10**
6		**Write down the working principle of PNP and NPN transistors.**	**10**
7		**What is feedback amplifier? Explain the general theory of feedback amplifier.**	**10**

3rd Sem./Electrical Engineering/ 2021(W)OLD

MET321 Elements of Mechanical Engg.

Full Marks: 80 Time- 3 Hrs

Answer any **FIVE** Questions including **Q No. 1** & **2**
Figures in the right-hand margin indicates marks

1.		Answer **ALL** questions	2 x 10
	a.	What is continuity equation?	
	b.	State Zeroth Law of Thermodynamics.	
	c.	Define Mean effective pressure.	
	d.	What is the difference between Pascal and Bar?	
	e.	What do you mean by Heat? State its unit.	
	f.	What is a perfect gas?	
	g.	Give two examples of reaction turbine.	
	h.	What is the necessity of safety valve in boiler?	
	i.	What is diagram factor?	
	j.	Define mechanical efficiency of a steam engine.	
2.		Answer **Any SIX** Questions	6 x 5
	a.	Derive $C_P - C_V = R$	
	b.	The diameter of a pipe at the sections 1-1 and 2-2 are 250 mm and 300 mm respectively. If the velocity of water flowing through the pipe at section 1-1 is 4 m/sec. Find discharge through the pipe and velocity of water at section 2-2.	
	c.	Describe properties of fluid.	
	d.	Differentiate between two stroke engine and four stroke engine.	
	e.	What is a boiler? Classify it.	
	f.	Derive an expression to determine hypothetical mean effective pressure of a steam engine without clearance.	
	g	Compare surface condenser with Jet condenser.	
3		State and Prove Bernouli's Theorem.	10
4		Find the dimension of a single cylinder double acting steam engine on the basis of the following data. I.P=70 kW. Admission Pressure = 7 bar, Back Pressure of steam = 1.5 bar, Stroke Length = 1.6 times the cylinder bore, Engine Speed = 120 rpm, Cut-off = 1/4 of the stroke. Neglect Clearance.	10
5		With a neat sketch explain construction and working of Cochran Boiler.	10
6		Calculate the enthalpy of 1.2 kg of steam at a pressure of 8.5 bar and dryness fraction of 0.7. How much heat would be required to raise 6 kg of this team from water at 25 ^oC.	10
7		State different types of condenser and explain its functions.	10

III-SEM./ELECTRICAL/ETE/AE&IE/EME/ ELECTRICAL[PT]
/EEE/ELECTRICAL(INST & CTRL)/ECE/2021(W)
TH-I ENGINEERING MATHEMATICS -III

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. What are homogeneous equations? State the condition to get non-trivial solutions for homogeneous equations.

b. Find Particular Integral of $(D^2 + 16)y = e^{-4x}$.

c. Frame a differential equation for the function $z = f\left(\frac{xy}{z}\right)$.

d. Write the Existence Theorem of Laplace Transform.

e. Find $L^{-1}\left\{\frac{2S}{S^2-9}\right\}$.

f. Define Periodic function. Give one example of periodic function with its period.

g. Write Newton Raphson Formula to find a root of equation $f(x) = 0$.

h. Evaluate $\Delta(ab^{cx})$.

i. State Trapezoidal Rule. Why this is called Trapezoidal Rule?

j. Express $\frac{3i}{4-i}$ in the form of $a + ib$.

2. Answer **Any Six** Questions 5x6

a. Find the root of the equation $2x^3 - 2x - 5 = 0$ correct to 3-places of decimal by Newton Raphson Method.

b. Find the Laplace Transform of $f(t) = cos^2(3t)$

c. State Dirichlet's condition for a function to be expanded in Fourier Series. Find a_0 $of\ the\ Fourier\ Series\ for\ the\ function\ f(x) = 2$ In $0 \leq x \leq 2\pi$.

d. Evaluate $\int_{2.5}^{4} lnx\, dx$ using Trapezoidal Rule with 5 subintervals.

e. Find the Inverse Laplace Transform of
$F(s) = \frac{1}{(s+1)(s^2-1)}$

f. Find $f(x)$ when x=32 from the following data using Newton Forward Interpolation Formula

x	30	35	40	45	50
f(x)	15.9	14.9	14.1	13.3	12.5

g Solve the following differential equation
$(D^3 - 7D + 6)y = 0$

3 i) Express $f(x) = \frac{1}{2}(\pi - x)$ as a Fourier Series in the interval $(0,2\pi)$ 7
Hence deduce the value of the series $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$

ii) Find $\sqrt{-15 + 8i}$ 3

4 i) Solve the following partial differential equation 6
$x^2(y - z)p + y^2(z - x)q = z^2(x - y)$

ii) Evaluate $\int_0^6 \frac{dx}{4x+5}$ using Simpson's $\frac{1}{3}rd$ Rule correct up to 3-places of decimal taking h=1. 4

5 i) Solve the differential equation 5
$(D^2 + 5D + 6)y = e^{-2x} \sin 2x$

ii) Find the Laplace Transform of $L(t^3e^{-3t})$ 5

6 i) Find k if the following equations are consistent 5
X+2y-3z=-2
3x-y-2z=1
2x+3y-5z=k

ii) Find f(x) when x=15

x	3	7	11	19
F(x)	42	43	47	60

5

7 i) Solve the following differential equation 5
$(D^2 - 2D - 3)y = e^{3x} + \sin x$

ii) If ω is the cube root of unity, show that 5
$(1 - \omega + \omega^2)^6 + (1 + \omega - \omega^2)^6 = 128$

III-SEM./ELECTRICAL/ EME/ELECTRICAL[PT] /EEE / ELECTRICAL(INST & CTRL) 2021(W)

TH-II Circuit & Network Theory

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. **Answer All questions** 2 x 10

a. State Ohm's law.

b. What do you mean by active element. Give two examples.

c. Define permeability and reluctance.

d. State KCL & KVL.

e. Give the statement of Thevenin's theorem.

f. State the necessary mathematical formulation for conversion from star to delta and vice versa.

g. Define power factor and power triangle.

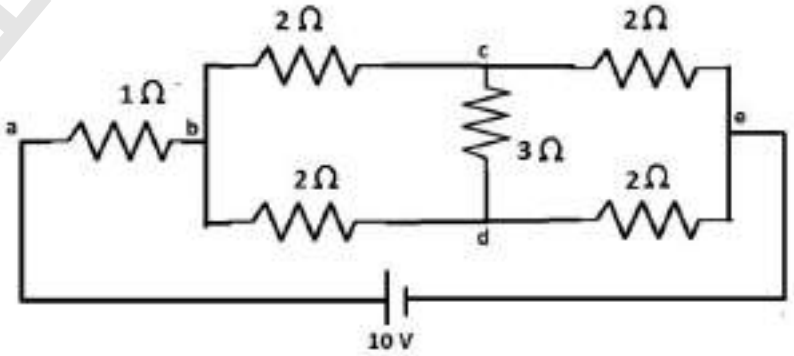
h. Define Q-factor and selectivity in series circuit.

i. Define coefficient of coupling.

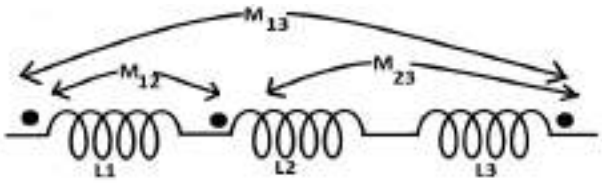
j. Write two property of series resonance.

2. Answer **Any Six** Questions 5X6

a. (a) Find the power loss in 1Ω resistor of the figure as shown below.



b. (a) Find the total inductance of the series connected coupled coils as shown below.



M12=0.5H,M23=1H,M31=1 H,L1=2H,L2=1 H,L3=2 H

c. Explain briefly about B-H curve.

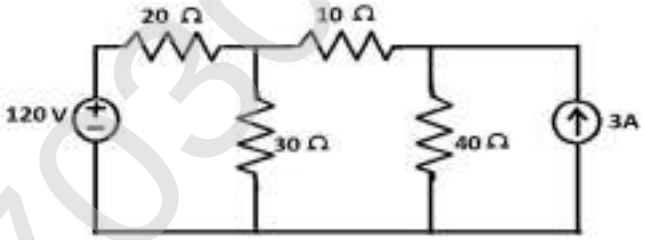
d. State the condition of resonance in series R,L,C circuit. Derive the expression of resonant frequency for series R,L,C circuit.

e. State and derive the condition for maximum power transfer in a circuit and write the expression for maximum power.

f. Define filter. Classify pass band, stop band filters with neat diagram.

g Briefly explain about the Z,Y,ABCD and h parameters.

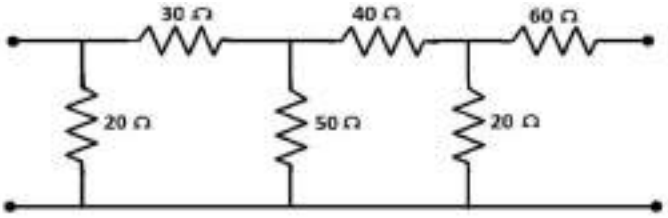
3 By using superposition theorem find the current through 20 Ω resistor of the circuit as shown in the figure below. 10



4 Draw the characteristics curve between charging current and time during charging current and time during charging and discharging condition of a series RL circuit. 10

5 Design a HPF (both T and ∏ network) having a cut off frequency of 2 kHz with a load resistance of 300 Ω. 10

6 Obtain Z-parameters of the below circuit. 10



7 A resistance of 10 Ω, an inductor of inductance of 20 H and a capacitor of capacitance 100 micro farad are connected to a single phase 230 V AC source. Find (i) current, (ii) power factor, (iii) active power consumption corresponding to supply frequencies of 50 Hz and 100 Hz respectively. 10

3rd Sem./Electrical Engineering/ 2021(W)

Th-3 Element of Mechanical Engineering.

Full Marks: 80 Time- 3 Hrs

Answer any **FIVE** Questions including **Q No. 1** & **2**
Figures in the right-hand margin indicates marks

1. Answer **ALL** questions 2 x 10

a. What is continuity equation?

b. State Zeroth Law of Thermodynamics.

c. Define Mean effective pressure.

d. What is the difference between Pascal and Bar?

e. What do you mean by Heat? State its unit.

f. What is a perfect gas?

g. Give two examples of reaction turbine.

h. What is the necessity of safety valve in boiler?

i. What is diagram factor?

j. Define mechanical efficiency of a steam engine.

2. Answer **Any SIX** Questions 5X6

a. Derive $C_P - C_V = R$

b. The diameter of a pipe at the sections 1-1 and 2-2 are 250 mm and 300 mm respectively. If the velocity of water flowing through the pipe at section 1-1 is 4 m/sec. Find discharge through the pipe and velocity of water at section 2-2.

c. Describe properties of fluid.

d. Differentiate between two stroke engine and four stroke engine.

e. What is a boiler? Classify it.

f. Derive an expression to determine hypothetical mean effective pressure of a steam engine without clearance.

	g	Compare surface condenser with Jet condenser.	
3		State and Prove Bernouli's Theorem.	10
4		Find the dimension of a single cylinder double acting steam engine on the basis of the following data. I.P=70 kW. Admission Pressure = 7 bar, Back Pressure of steam = 1.5 bar, Stroke Length = 1.6 times the cylinder bore, Engine Speed = 120 rpm, Cut-off = 1/4 of the stroke. Neglect Clearance.	10
5		With a neat sketch explain construction and working of Cochran Boiler.	10
6		Calculate the enthalpy of 1.2 kg of steam at a pressure of 8.5 bar and dryness fraction of 0.7. How much heat would be required to raise 6 kg of this team from water at 25 ^{o}C.	10
7		State different types of condenser and explain its functions.	10

3rd Sem./ ELECTRICAL/ EME/2021(W)

Th4 Electrical Engineering Materials

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2

Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

   a. What do you mean by resistivity and state its SI unit.

   b. Define dielectric constant. What is the dielectric constant of air?

   c. What is N-type semiconductor? Give an example.

   d. Which properties should a fuse material possess?

   e. What are the factors affecting dielectric strength of insulating material?

   f. Name the materials used in making (i) element of a filament lamp (ii) resistors for loading rheostats.

   g. What is magnetostriction in magnetic materials?

   h. What is photovoltaic cell?

   i. What do you mean by thermocouple? Give an example of thermocouple.

   j. State an application of (i) Teflon (ii) PVC insulating material.

2. Answer **Any Six** Questions 5X6

   a. Differentiate between soft and hard magnetic materials.

   b. Describe about the electron energy and energy band theory briefly.

   c. Write a short note on soldering materials.

   d. Explain the domain theory of ferromagnetic material briefly.

   e. What are the factors affecting insulation resistance?

   f. Describe the applications of superconductor materials.

   g Explain the mechanical properties affecting the selection of insulator in brief.

3 Explain the low resistivity materials and their applications in details. 10

4 Describe about fuse and fuse materials. Draw also a cross section view of cartridge fuse. 10

5 Write a short note on(i)Hall Effect generators(ii) Solar power 10

6 Explain the electrical conductivity and the breakdown of (i) Gaseous dielectrics(ii) Liquid dielectrics 10

7 Describe about natural and synthetic rubber and their applications. 10

3rd Sem. Common 2021(W)

Th-5 Environmental Studies

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

   a. Define acid rain.
   b. What is ecological succession?
   c. What do you mean by soil erosion?
   d. Define genetics and species.
   e. Mention any two causes of marine pollution.
   f. Define environment.
   g. What is mortality?
   h. What do you mean by sustainable development?
   i. What leads to conflicts over water?
   j. Define water pollution.

2. Answer **Any Six** Questions 6 x 5

   a. Define and explain food chain with at least one example.
   b. Explain the changes caused by modern agriculture.
   c. Explain Biodiversity at National level.
   d. Give a brief note on ozone layer depletion along with its consequences.
   e. Discuss in brief 'Human Rights'.
   f. Discuss the needs of public awareness towards environment.
   g Explain cyclone disaster management.

3 Explain the effects of mine extraction on environment and tribal people. 10

4 Explain different threats to biodiversity. 10

5 Describe forest ecosystem. 10

6 Write down the causes, effects and controlling measures of soil pollution. 10

7 a Urban problems related to energy. 5

   b Family welfare program. 5