3RD SEM./ AE & IE/ ELECTRICAL &MECH/ ELECTRICAL & ETC/ EE(I&C) / EE[PT]/ ELECTRONICS & COMM/ ELECTRICAL /E&TC / 2022(W)

Th-1 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 × 10

a. Find the modulus and amplitude of the complex number $1 + i\sqrt{3}$.

b. Define the rank of a matrix. Find the rank of the matrix $\begin{pmatrix} 1 & 3 \\ 3 & 9 \end{pmatrix}$.

c. Find the complementary function of $(D^2 + 2D - 15)y = \sin 3x$.

d. Construct a partial differential equation for the function $z = f(x^2 - y^2)$.

e. Define Laplace transform of a function and find $\mathcal{L}(1)$.

f. Define periodic function and find the period of the function $\cos(2x + 5)$.

g. Find a_0 in the Fourier series of $f(x) = x$ in the interval $[-\pi, \pi]$.

h. Define the Shift operator and write the relation between shift operator (E) and forward difference operator (Δ).

i. Calculate $\Delta \tan^{-1} x$ by taking the interval difference as unity.

j. State Lagrange's interpolation formula to interpolate a function.

2. Answer **Any Six** Questions 5 × 6

a If $x + \frac{1}{x} = 2\cos\theta$, Show that $x^n + \frac{1}{x^n} = 2\cos n\theta$.

b. Determine the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ by using elementary row transformation method.

c. Solve $(D^2 + 4D + 3)y = e^{-x} \sin x$.

d. Find the Laplace transform of the function $f(t) = \begin{cases} 3, & 0 \le t < 2 \\ -1, & 2 \le t < 4 \\ 0, & t \ge 4 \end{cases}$

e. Find the Fourier series of the function $(x) = \begin{cases} 0, & 0 < x < \pi \\ 1, & \pi < x < 2\pi \end{cases}$.

f. Find a real root of the equation $x^3 - 2x - 5 = 0$,
by using bisection method in three steps.

g. Find the cubic polynomial which takes the following values:

x	:	0	1	2	3
$f(x)$	:	1	2	1	10

Hence, evaluate $f(4)$.

3 a. For what values of λ and μ the equations 7

$2x + 3y + 5z = 9,\ \ 7x + 3y - 2z = 8,\ \ 2x + 3y + \lambda z = \mu,$

have (i) no solution, (ii) a unique solution and (iii) an infinite number of solutions.

b. If $1,\ \omega,\ \omega^2$ are the three cube roots of unity,

Prove that $(1 - \omega + \omega^2)^5 + (1 + \omega - \omega^2)^5 = 32$ 3

4 a. Solve $x(y - z)p + y(z - x)q = z(x - y)$. 7

b. Find the inverse Laplace transform of $F(s) = \left(\frac{4s-3}{s^2+9}\right)$ 3

5 a. Find $\mathcal{L}(t\ \sin^2 t)$ 5

b. Evaluate $\int_0^6 \frac{1}{1+x^2}\,dx$ by using Simpson's 1/3 rule,

and compare the result with its actual value. 5

6 Obtain the Fourier series for

$$f(x) = \begin{cases} 0, & -\pi < x < 0 \\ \frac{\pi x}{4}, & 0 < x < \pi \end{cases}.$$ 10

Hence Prove that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots \ldots \ldots$

7 a. Develop a recurrence formula for finding the value of $\sqrt{10}$, using Newton-Raphson method and hence, compute this value correct to three decimal places. 7

b. Find the square roots of $-5 + 12\sqrt{-1}$. 3

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Th-2 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

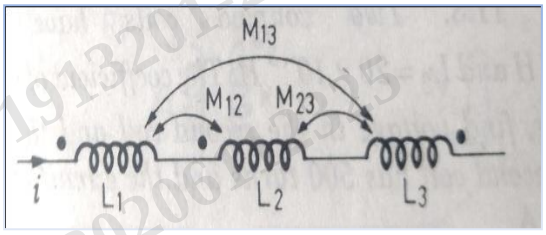
a. What is magnetizing force? Also state its SI unit.

b. What do you mean by mesh analysis of AC networks?.

c. State the Thevenin's theorem.

d. Define (i) Q-factor (ii) Selectivity in series circuit

e. Find the total inductance of three series connected coupled coils as shown below with L_1=1H; L_2=2H; L_3= 5H,
M_{12}=0.5H;M_{23}=1H;M_{13}=1H



f. Give an example of (i) Passive Element (ii) Non linear Element

g. What do you mean by phase sequence in polyphase system?

h. What is impedance and impedance triangle?

i. Define filter. Give an example

j. What are short-circuit admittance parameters?

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

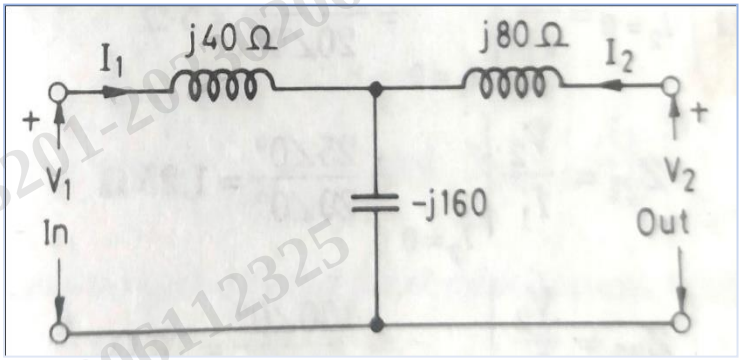
a. Explain the hysteresis loop of magnetic materials in details with a neat diagram.

b. How the 3-phase power is measured by two wattmeter method?

c. Describe briefly about π section of a circuit network.

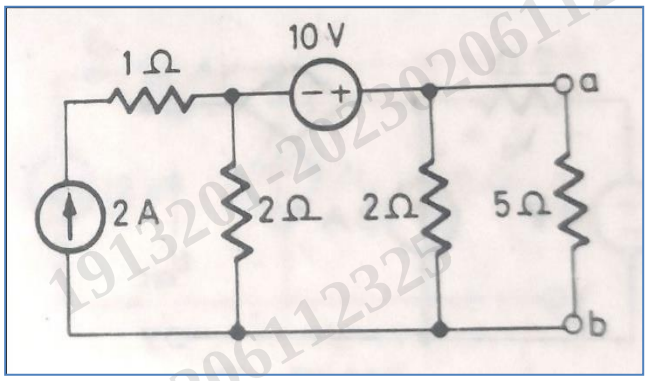
d. Write a short note on hybrid (h) parameters

e. Find the open circuit parameters of the following two port network.



f. Explain the sinusoidal response of series R-C circuit.

g Find the current in 5Ω resistor using Norton's theorem across a-b terminals of the network shown below.



3	Derive the relation between phase and line quantities in star connection.	10
4	Write short notes on (i) Source Transformation technique (ii) Dot Convention.	10
5	Explain the transient response of series R-L-C circuit having DC Excitation.	10
6	Write short notes on (i) Constant K low pass filter (ii) Star to delta transformation	10
7	Explain the series and parallel magnetic circuits in details with neat diagrams.	10

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Th-3 Element of Mechanical Engineering

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2
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1. Answer **All** questions 2 x 10

a. What do you understand by Indicated Horse Power of an engine?
b. Define super-heated steam.
c. State the use of accumulator in a hydraulic circuit.
d. State 1st Law of Thermodynamics.
e. What is the difference between Density and Weight Density?
f. Define condenser.
g. How an IC Engine works?
h. What is the function of a pump?
i. State the Continuity Equation.
j. Name the different types of Boilers.

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

a. A pipe 400 mm diameter is branched into two pipes of diameter 250 mm and 110 mm respectively. If the average velocity in 400 mm diameter pipe is 2.1 m/sec and average velocity in 250 mm diameter pipe is 2 m/sec then find the velocity in 110 mm diameter pipe and total discharge.
b. Explain Specific Weight, Dynamic Viscosity and Surface Tension of a fluid.
c. Define surface condenser? List the merits and limitations of a condenser.
d. Compare Wet Bulb Temperature with Dry Bulb Temperature.
e. Differentiate Hydraulic devices and Pneumatic devices.
f. What is an intensifier? State its use in a hydraulic/pneumatic circuit.
g Derive the relationship of specific heat of gases at constant volume and constant pressure.

3 State Bernoullii's Theorem. Derive the equation. 10

4 Explain about 2-stroke Diesel Engine with neat sketch. 10

5 Define Pressure. Discuss briefly about different pressure measuring instruments. 10

6 Describe about Boiler Mountings and Accessories. 10

7 A cylinder contains 1.1 kg of steam at 1 MPa. If the volume of steam is 0.09 m^3, determine the dryness fraction of the steam, enthalpy and internal energy of the steam per kg. 10

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Th-4 Electrical Engineering Material

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2
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1. Answer **All** questions 2 x 10
   a. Mention the factors which affect the value of resistivity of a material.
   b. Of what material is high voltage overhead lines for power transmission made? Give reasons.
   c. Name the conducting material which is generally used in plug points, socket outlets, switches and lamp holders. State 2 properties of this material should possess for such applications.
   d. Mention what number of electrons in the valence ring makes the best conductor and the best insulator.
   e. State the use of semiconductor in industrial applications.
   f. State the factors which affect the dielectric loss of an insulating material.
   g. State the difference between a dielectric material and an insulating material as regards their functions.
   h. Name the special type of steel used for cores of power transformers. Give reasons.
   i. Explain magnetostriction and eddy current loss.
   j. What are bimetals? Where are these used?

2. Answer **Any Six** Questions 6 x 5
   a. What is resistivity of conductor materials? A resistance wire of length 1 meter and diameter 0.08 mm has a resistance of 95.5 ohms. Calculate the resistivity of the wire material.
   b. Explain with the help of energy diagram n-type and p-type semiconductors.
   c. Name the different classes of varnishes available. Describe what are epoxy resin varnishes and silicone resin varnishes.
   d. Explain the following:
      (i) Permittivity (ii) Dielectric strength (iii) Dielectric constant (iv) Breakdown voltage (v) Loss angle
   e. What are ferrites? What are their advantages over other magnetic materials?
   f. Describe briefly the Hall effect and Hall effect generator.
   g. What is superconductivity? Explain the applications of superconducting materials.

3. What insulating material would you select for the following? Also Mention reasons for the selection: 10
   (a) Flexible wire (b) High Voltage cable (c) Low voltage cable
   (d) Fuse Holder (e) Commutator in D.C machines
4. Explain the process of polarisation of a dielectric material. 10
5. Explain the hysteresis loop for different magnetic material with suitable diagram. 10
6. Write short notes on (a) Soldering material (b) Silica gel 10
7. Discuss the physical, electrical and mechanical properties of copper and its use as an engineering material. Where it can be substituted by aluminium and with what limitations? 10

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Th-5 Environmental studies

Full Marks: 80 Time- 3 Hours

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 natural resources.

   b. Write down two examples of non-renewable resources.

   c. Define soil erosion.

   d. Define producers in eco system.

   e. What is bio diversity?

   f. What do you mean by poaching of wild life?

   g. What is the unit of sound intensity?

   h. What is endangered species.

   i. Define greenhouse effect.

   j. What are the various objectives of family welfare programme.

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

   a. What are the environmental effects of mining?

   b. Give a brief description of man wild life conflict.

   c. What are the effects of acid rain.

   d. Define rainwater harvesting? State the objective of rain water harvesting?

   e. Describe about Bio gas plant.

   f. Write down the role of an individual protecting environment.

   g What are the effects of modern agriculture?

3 Define Global warming, write down the causes and effect of global warming. 10

4 Explain sources of solid waste and solid waste management. 10

5 Describe aquatic ecosystem. 10

6 Write down the effect, prevention and control of noise pollution. 10

7 Write short notes on 10
   a. Pyramid of energy
   b. Green house effect