VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
MECHATRONICS

PROGRAMMABLE LOGIC CONTROLLER

Time : Three Hours   Maximum Marks:100 Marks

Answer **ALL** questions
Part-A (10 x 2 =20 Marks)

1   Compare the analog and digital I/O modules.
2   Which is the most popular language for programming PLCs? Why?
3   State the output control devices.
4   Define programming languages
5   Name and draw the symbol for Retentive timer
6   Explain coil formatted Counter instruction
7   Give the merits of basic PLC instruction.
8   Draw the ladder logic diagram for EX-OR gate.
9   Define process control system.
10   Mention the sensors used in Automatic car washing machine.

Answer **Any FIVE** questions
Part-B (5 x10 =50 Marks)

11 a.   Explain in detail about the block diagram of Programmable Logic Controller.
                                    OR
   b.   Explain in detail about the basic circuit of discrete I/O module and also its applications

12 a.   Illustrate the PLC vs. Computers
                                    OR
   b.   Illustrate the operating principle of an electromagnetic control relay.

13 a.   Describe the construction and working principle of contactor.
                                    OR
   b.   Explain the operation of output control devices commonly used in PLC installations.

14 a.   Explain in detail the switches commonly used in PLC installations.
                                    OR
   b.   Describe in detail the various types of timer instructions.

15 a.   Discuss the functions of PLC counter instructions.   p.t.o

OR

b. Write a detailed note on down counter with an example.

16 a. Illustrate in detail about the various math instructions

OR

b. Name and draw the symbol for five different types of data compare instructions.

17 a. Explain the purpose of the bit distribute instruction.

OR

b. Discuss the PID controller with merits and demerits

18 a. Illustrate various types of process control Applications with examples

OR

b. Describe briefly about the motor driven analog proportional control valve.

Answer ALL questions
PART-C (2 x 15 = 30)

19 a. Explain in detail the Process memory organization in PLC.

OR

b. Explain in detail the various sensors and Transducers used in industries with example.

20 a. Write a program to control traffic lights in two direction

OR

b. Outline how a typical data acquisition and control system operates

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SL.NO:1239

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
HUMANITIES & SCIENCES

ENGINEERING MATHEMATICS

Time : Three Hours   Maximum Marks:100 Marks

Answer **ALL** questions
Part-A (10 x 2 =20 Marks)

1. Obtain the characteristic equation of $\begin{pmatrix} 2 & -3 & 1 \\ 3 & 1 & 3 \\ -5 & 2 & -4 \end{pmatrix}$

2. Define orthogonal matrices.

3. Define evolute.

4. Find the centre of curvature of the curve $y = x^2$ at the origin.

5. If $u = x^2 y^3$ where $x = \log t$ and $y = e^t$ Find $\dfrac{du}{dt}$

6. Examine the maximum and minimum values of $3x^2 - y^2 + x^3$

7. Integrate $\displaystyle\int_0^1 \int_1^2 x(x+y)\,dy\,dx.$

8. Integrate $\displaystyle\int_0^{\pi/2} \int_0^{\pi/2} \sin(\theta + \phi)\,d\theta\,d\phi$

9. Prove that $\nabla\left(r^n\right) = nr^{n-2}\,\vec{r}$

10. State Stoke's theorem

(p.t.o)

Answer **Any FIVE** questions
Part-B (5 x10 =50 Marks)

11 a.

Find the Eigen values and Eigenvectors of the matrix $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{pmatrix}$.

OR

b.

Obtain the Eigen values and Eigenvector of the matrix $\begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$

12 a.

Obtain the equation to the circle of curvature of the curve $xy = c^2$ at (c, c).

OR

b.

Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin \theta); y = a(1 - \cos \theta)$ is $4a\cos\dfrac{\theta}{2}$

13 a.

Find the maximum and minimum values of the function $x^3 y^2 (1 - x - y)$

OR

b.

(i) If $u = \sin^{-1}\dfrac{x}{y} + \tan^{-1}\dfrac{x}{y}$, then find the value of $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y}$

(ii) Find $\dfrac{du}{dt}$ as a total derivative and verify the result by the direct substitution of $u = x^2 + y^2 + z^2$ when $x = e^{2t}, y = e^{2t}\cos 3t$, and $z = e^{2t}\sin 3t$

14 a.

Integrate $\displaystyle\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} \dfrac{dz\,dy\,dx}{\sqrt{a^2-x^2-y^2-z^2}}$

OR

(p.t.o)
Sl.No.17MABS01

b.

Obtain the area enclosed by the parabola $y^2 = 4ax$, $x-$ axis and the latus rectum of the parabola.

15 a.

If $\vec{F} = x^2 \vec{i} + xy \vec{j}$ evaluate $\int \vec{F}.d\vec{r}$ from (0, 0) to (1, 1) along the line $y=x$

OR

b.

Obtain the values of a and b so that the surfaces $ax^3 - by^2z = (a+3)x^2$ and $4x^2y - z^3 = 11$ may cut orthogonally at $(2, -1, -3)$

16 a.

Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$.

OR

b.

For the given curve $x = a\cos\theta$, $y = b\sin\theta$ Find ρ at $\left(\dfrac{a}{\sqrt{2}}, \dfrac{b}{\sqrt{2}} \right)$

17 a.

Obtain the equation to the circle of curvature of the curve $xy = c^2$ at (c, c).

OR

b.

Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin\theta)$; $y = a(1 - \cos\theta)$ is $4a\cos\dfrac{\theta}{2}$

18 a.

Prove that $\nabla^2 (r^n) = n(n+1)r^{n-2}$ where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = |\vec{r}|$

OR

(p.t.o)

b.

For the curve $x^3 + y^3 = 2$ find the co-ordinates of the centre of curvature at the point $(1, 1)$

Answer ALL questions
PART-C (2 x 15 = 30)

19 a.

Diagonalise the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ and hence find A^5

OR

b.

Obtain the equation of the evolute of the curve $x^{2/3} + y^{2/3} = a^{2/3}$

20 a.

Determine the value of $\int_0^1 \int_0^{x^2} (x^2 + y^2)\,dy\,dx$

OR

b.

Change the order of integration in $\int_0^a \int_y^a \dfrac{x^2}{\sqrt{x^2 + y^2}}\,dx\,dy$ and then evaluate it.

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SL.NO:1165

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
COMMON TO ALL

SMART MATERIALS

Time : Three Hours   Maximum Marks:100 Marks

Answer ALL questions
Part-A (10 x 2 =20 Marks)

1   Demonstrate, how the Metallic glasses can be used for transformer core materials?

2   Explain briefly about transformation temperature in SMA.

3   Distinguish between Type I and Type II Superconductors.

4   Interpret unit cell.

5   Demonstrate top-down and bottom-up approach for producing nanoparticles.

6   Interpret any two techniques for the synthesis of nanophase materials.

7   Explain briefly about top-down approach.

8   Describe coercivity and retentivity.

9   Explain briefly about soft magnetic materials.

10   Identify the reason, why the superconductor exhibits the property of diamagnetism?

Answer Any FIVE questions
Part-B (5 x10 =50 Marks)

11 a.   Categorize metallic glasses? Give examples. Mention the properties of metallic glasses.

OR

   b.   Draw the unit cells of SC, BCC, FCC and HCP structures

12 a.   Examine the effects of temperature, magnetic field and current on the superconductivity.

OR

   b.   Schedule the following for SC, BCC, FCC and HCP structures

13 a.   Explain the properties of diamagnetic materials with neat diagram.

OR

   b.   Explain two characteristics of SMA with neat diagrams.

14 a.   Explain the properties of Ni-Ti alloy.   p.t.o

OR

b.   Express the outline of magnetic and electrical properties of metallic glasses. Mention any two applications of metallic glasses.

15 a.   Describe the following (i) unit cell (ii) coordination number (iii) nearest neighbour distance (iv) packing factor

OR

b.   Explain the advantages, disadvantages and applications of ball milling method.

16 a.   Explain Carbon Nano Tubes? How are they classified? Explain.

OR

b.   Explain in detail about any one of the methods of fabrication of CNT.

17 a.   Differentiate the properties of dia, para and ferromagnetic materials

OR

b.   Discuss the properties of superconductors.

18 a.   Describe about Type – I super conductor. Write down its characteristics.

OR

b.   Discuss Isotope Effect and Meissner effect.

Answer ALL questions
PART-C (2 x 15 = 30)

19 a.   Categorize hard and soft magnetic materials? Mention their applications.

OR

b.   Generalize the properties of metallic glasses.

20 a.   Illustrate sol-gel method of preparing nanophase materials and mention its advantages.

OR

b.   Illustrate hysteresis on the basis of domain theory.

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SL.NO:1119

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
MECHATRONICS

ELE - ENERGY PHYSICS

Time : Three Hours   Maximum Marks:100 Marks

Answer **ALL** questions
Part-A (10 x 2 =20 Marks)

1   Discuss the effect of air pollution on human health.
2   What is the average range of solar radiation received on the earth's surface during day?
3   How the wind mills are classified?
4   Define Pitch angle.
5   What are the methods used to analysis of biomass?
6   Name the materials used in bio gas generation.
7   What is an Electrolyte?
8   Define Specific Energy.
9   What are the steps of energy conservation planning?
10   List out the energy management techniques?

Answer **Any FIVE** questions
Part-B (5 x10 =50 Marks)

11 a.   Explain the principle and operation of non convective solar pond in detail.
OR
   b.   Explain briefly the functioning of Darrieus Wind Turbine

12 a.   What is biomass direct combustion? Explain in detail.
OR
   b.   What is meant by fermentation, aerobic, anaerobic digestion? Explain.

13 a.   Explain with a neat sketch the production process of biogas indicating its composition & calorific value.□
OR
   b.   Explain the Lead-acid battery charge operation.

14 a.   Explain the Lead-acid battery discharge operation.
OR
   b.   Explain different modes of hydrogen transportation and utilization of hydrogen gas.

15 a.   Explain in brief about the following. a) Primary and secondary energy sources   p.t.o

OR

b. Explain in detail about energy management strategies for industry

16 a. Assess the need of renewable energy resources.

OR

b. Enumerate the different types of concentrating type collectors

17 a. Classify the wind energy systems and explain their working with neat sketch

OR

b. Define the following: i) Latitude ii) Declination angle
iii) Surface azimuth angle iv) Hour angle v) Zenith angle.

18 a. Write short notes on Hydrogen storage.

OR

b. Write brief note on Hydrogen technology development in India

Answer ALL questions
PART-C (2 x 15 = 30)

19 a. With a suitable block diagram, explain the functions of different components of WECS.

OR

b. Explain how the wind energy data are collected and energy available in the wind is estimated

20 a. Explain in detail about performance parameters of cogeneration systems.

OR

b. With a neat diagram of a bio-gas plant write its construction and working?

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SL.NO:1078

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
MECHATRONICS

ELECTIVE - DESIGN OF MECHATRONICS SYSTEMS

Time : Three Hours   Maximum Marks:100 Marks

Answer **ALL** questions
Part-A (10 x 2 =20 Marks)

1   What is a display system?

2   Define Safety.

3   Define Mechanical Damper.

4   What is a Gyrator element?

5   Define Life cycle of a system.

6   What do you mean by Voltage amplifier?

7   List two basic forms of Control systems?

8   What is deflection?

9   What is Bond Graph?

10   Mention the type of Actuator.

Answer **Any FIVE** questions
Part-B (5 x10 =50 Marks)

11 a.   Explain sequential control

OR

   b.   Explain the Engine management system.

12 a.   Discuss about the Mechanical Gyrator.

OR

   b.   Construct a Cantilever beam.

13 a.   Describe the experimental set up of the beam.

OR

   b.   With an appropriate Bond graph representation describe the RLC network.

(p.t.o)

14 a.   Discuss about the different types of Sensors.

OR

b.   Explain the steps involved when designing a mechatronic system.

15 a.   Describe the function of a PLC.

OR

b.   Write short notes on Power variables and Energy variables.

16 a.   Give the design flow in synthesis of Mechatronic system

OR

b.   Discuss about the Deployment of Embedded Software.

17 a.   List the properties and dimensions of the Cantilever beam.

OR

b.   Elucidate the Electro-mechanical model of a beam containing piezoelectric sensors and actuators

18 a.   Write short notes on Sequential controllers.

OR

b.   Examine the Life cycle optimization.

Answer ALL questions
PART-C (2 x 15 = 30)

19 a.   Analyse the Controller used in the development of PID VI.

OR

b.   Write in detail the experimental set up of the Cantilever beam

20 a.   Explain the modeling of the beam with PZT sensor.

OR

b.   Explain Life cycle optimization in detail.

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SL.NO:1058

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB - 2022
MECHATRONICS

FINANCE AND ACCOUNTING FOR ENGINEERS

Time : Three Hours   Maximum Marks:100 Marks

Answer **ALL** questions
Part-A (10 x 2 =20 Marks)

1   If Profitability Index of a project is 2, Can we accept the project or Reject explain
2   Write the journal entry for sale of old machinery for Rs. 2,40,000 at profit Rs. 40,000
3   "At positive Margine of safety business firm will get profits," True or False Explain.
4   Explain the rule for accepting the project under pay back period method .
5   Define Accounting.
6   What does the Intangiable Assets?
7   What is Temporary Working capital?
8   What is Selling and Distribution Overheads?
9   What is Cash management?
10   List any two Nature of Variable Cost.

Answer **Any FIVE** questions
Part-B (5 x10 =50 Marks)

11 a.   What are EOQ and Reorder level in inventory management, How will you determine
        Economic Order Quantity and Reorder Level.

OR

   b.   A company budgets for a production of 1,50,000 units. The variable cost per unit is Rs. 14
        and fixed cost is Rs. 2 per unit. The company fixed its selling price to fetch a profit of 15% on
        cost.
        (a) What is the break-even point?
        (b) What is the profit-volume ratio?
        (c) If it reduced its selling price by 5%, how the revised selling price affect the break-even
        point and the profit-volume ratio?

12 a. From the following information of Sri Kiran Ltd., you are required to calculate:
(a) Net operating cycle period.
(b) Number of operating cycles in a year
The information is Given below:

(i) Raw material inventory consumed during the year	Rs.6,00,000	
(ii) Average stock of raw material	Rs. 50,000	
(iii) Work in progress inventory	Rs.5,00,000	
(iv) Average work-in-progress inventory	Rs. 30,000	
(v) Cost of goods sold during the year	Rs.8,00,000	
(vi) Average finished goods stock held	Rs. 40,000	
(vii) Average collection period from debtors	45 days	
(viii) Average Credit period availed	30 days	
(xi) Number of days in a year	360 days	

OR

b. Write about any 3 subsidiary books and its uses

13 a. Ganapathi Brothers acquired a machine on July 1, 2017 at a cost of Rs. 70,000 and spent Rs. 5,000 on its installation. The firm writes off depreciation @ 10% on straight line method. The books are closed on December 31 every year. Show the machinery and depreciation account for three years.

OR

b. You are given the following information:

Year	Sales (Rs.)	Profit or Loss (Rs.)
2010	90,000	(-) 10,000
2011	1,30,000	+ 10,000

Calculate: (a) P/V ratio, (b) Fixed Expenses, (c) B.E.P

14 a. Identify the issues to face the dangers of Inadequate working capital

OR

b. How can you measure hour method for heavy Industry

15 a. Evaluate the process of calculating PAYBACK period in case of cash inflows are constant per year and not constant per year with example

OR

b. Explain the accounting treatment for following adjustments:
i) Outstanding Expenses ii) Prepaid Expenses iii)Bad debts

16 a. Define cash management and write down the objectives of cash management

OR

b. What are the different types of capital budgeting deisions exist, Explain

17 a. What is Trail balance? Explain its objectives and limitations

OR

b. Briefly explain sum of years of degits Method with example

18 a. Explain important sources of financing of account receivables.

OR

b. What is meant by Cost Sheet and briefly specify its advantages

Answer ALL questions
PART-C (2 x 15 = 30)

19 a. Discuss in detail the capital budgeting. How do you use the suitable techniques for profitable business.

OR

b. Write down the acceptance rule, advantages and limitations of Pay Back Period method and Accounting Rate of Return method.

20 a. Define Cash management? Identify the motives for holding cash.

OR

b. How do you analysis the accounting concepts and principles for non profit organisation.

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SL.NO:1026