Code No. 8563/CBCS/O

FACULTY OF SCIENCE

M. Sc. IV – Semester Examination, May / June 2019

Subject : Physics

Paper – I : Nuclear Physics

Time : 3 Hours **Max. Marks: 80**

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

1 Write semi-empirical mass formula and explain it briefly.
2 Define Yukawa potential.
3 What do you mean by α - decay?
4 What do you mean by multipole radiation?
5 What are stopping power and range of particle in matter?
6 Explain about range-energy relation.
7 What do you mean by compound nucleus?
8 Explain the Q-value of nuclear reaction.

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

9 (a) Give the salient feature of nuclear shell model point out its successes and failures.

OR

(b) Explain about electric quadropole moment of nucleus and discuss its physical significance.

10 (a) Explain about the fine structure of α-spectrum on the basis of Gamow's theory.

OR

(b) What is the Fermi's theory of β-decay? Give its salient features.

11 (a) Mention the processes that are mainly responsible for the attenuation of gamma rays and explain them.

OR

(b) Describe the working principle and construction of scintillation detector.

12 (a) Give the classification of elementary particles and discuss the quark model.

OR

(b) Explain the differences between fission and fusion reactions and explain the Lepton number.

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Code No. 8564/CORE

FACULTY OF SCIENCE

M. Sc. IV – Semester Examination, May / June 2019

Subject : Physics / Applied Electronics

Paper – II : (CB) Spectroscopy

Time : 3 Hours **Max. Marks: 80**

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

1 Explain briefly about L-S and jj coupling schemes.
2 Obtain the spectral terms arising in P^2 and P.P configuration.
3 Discuss about the types of molecular spectra.
4 Discuss briefly about the rotational spectra of a rigid rotation.
5 Explain the normal vibrations of CO_2 and H_2O molecules.
6 Differentiate between Raman and Infrared spectra.
7 What are the applications of ESR?
8 What are spin-lattice and spin-spin relaxation process?

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

9 (a) Evaluate the g-factor in LS and jj coupling schemes.

OR

(b) Obtain the energy expression due to spin-orbit interaction.

10 (a) How do you evaluate the rotational constants from the given rotational spectra?

OR

(b) What is the effect of isotopic substitution on rotational spectra ? Give one application of it.

11 (a) Explain the principle and working of FTIR spectrophotometer.

OR

(b) Discuss classical and quantum theory of Raman effect.

12 (a) What is an NMR? Explain the experimental set-up for study of NMR spectra.

OR

(b) What is resonance condition in ESR? Obtain the expression for resonance condition.

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Code No. 8579/CORE

FACULTY OF SCIENCE

M. Sc. IV – Semester Examination, May / June 2019

Subject : Physics
(Specialization : Electronic Instrumentation)

Paper – III : Instrumentation for Measurement and Data Transmission

Time : 3 Hours **Max. Marks: 80**

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

1 Distinguish between active and passive transducer.
2 What is displacement transducer?
3 What is the principle used for pressure measurement in piezoelectric transducer?
4 Give the classification of temperature measuring devices.
5 With a block diagram, explain closed-loop process control.
6 Give the configuration of IEEE 488 bus.
7 What are the methods used for data transmission?
8 What is digital data transmission?

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

9 (a) What are the basic requirements for a transducer? Explain the working principle of a variable capacitance transducer, for displacement measurement.

OR

(b) Give the theory of operation of a strain-gauge. Explain the working principle of full bridge strain gauge in detail.

10 (a) Explain the working principle of platinum-resistance thermometer. Comment on different types of thermocouples.

OR

(b) What is Venturi tube? Explain the principle of it and compare with Pitot tube.

11 (a) Obtain closed loop transfer function of servomotor, used for process control.

OR

(b) What is interfacing of a transducer? Explain how digital to analog multiplexer can be used for interfacing a transducer.

12 (a) Describe the functional blocks of telemetry systems. Distinguish between types of telemetric systems.

OR

(b) Explain PAM and PCM telemetering. Which is better for telemetric transmission of voltage telemetry system?

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Code No. 8580/CORE

FACULTY OF SCIENCE

M. Sc. IV – Semester Examination, May / June 2019

Subject : Physics
(Specialization : Electronic Instrumentation)

Paper – IV : Embedded Systems and its Applications

Time : 3 Hours **Max. Marks: 80**

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

1 What are the flag bits and PSW register of 8051 micorcontroller?
2 Explain accessing memory using various addressing modes.
3 Explain the packed and unpacked BCD numbers.
4 Write and discuss the single bit instructions with example.
5 Draw the Memory organization and discuss.
6 Explain the function of I/O ports in Flash microncontroller.
7 Explain the diagram of RPM meter and explain.
8 What are applications of PID controllers?

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

9 (a) Draw the diagrams of RISC and CISC processors. Explain.

OR

(b) Explain the special function registers associated with timer / counter programming.

10 (a) Explain various arithmetic instructions with examples in 8051 microcontroller.

OR

(b) With examples discuss the time delay generation program.

11 (a) Draw the pin diagram of PIC 16C6X/7X microcontroller and discuss the significance of each pin.

OR

(b) Explain the interfacing of ADC to PIC 16F8XX microcontroller.

12 (a) What are the latches and relays? Explain their functioning.

OR

(b) Draw the diagram of Digital Thermometer and explain its working.

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Code No. 8497 / Core

FACULTY OF SCIENCE

M.Sc. IV – Semester Examination, May / June 2019

Subject: Maths / Applied Mathematics

Paper – I
Advanced Complex Analysis

Time: 3 Hours **Max.Marks: 80**

Note: Answer all questions from Part-A and Part-B.
Each question carries 4 marks in part-A and 12 marks in Part-B.

PART – A (8x4 = 32 Marks)
[Short Answer Type]

1 State and prove Walli's product formula

2 Find the order of growth of e^{bz^n} for $b \neq 0$.

3 If Re(s) > 0, then prove that $\Gamma(s+1) = \Gamma(s)$.

4 Prove that $\xi(s) = \xi(1-s)$ ∀ s ∈ ¢.

5 Prove that $\zeta(s)^2 = \sum_{n=1}^{\infty} \frac{d(n)}{n^s}$ for Re(s) > 1.

6 Prove that $\frac{1}{\zeta(s)} = \sum_{n=1}^{\infty} \frac{\mu(n)}{n^s}$ for Re(s) > 1.

7 Define a conformal mapping and give an example.

8 Prove that $u(x,y) = \mathrm{Re}\,\frac{i+z}{i-z}$ and $u(0,1) = 0$ is harmonic in the unit disc and is zero on its boundary.

PART – B (4x12 = 48 Marks)
[Essay Answer Type]

9 a) Prove that the canonical products satisfy $|E_k(z)| \geq e^{-c|z|^{k+1}}$ for $|z| \leq \frac{1}{2}$ and $|E_k(z)| \geq |1-z|\, e^{-c'|z|^k}$ for $|z| \geq \frac{1}{2}$ for some c, c'.

OR

b) Find Hadamard's products for
i) $\sin \pi z$
II) $\cos \pi z$.

10 a) Prove that $\Gamma(s)$ defined for Re(s) > 0 has an analytic continuation to a meromorphic function on ¢ where only poles are 0, -1, -2, …

OR

b) For all s ∈ ¢, prove that $\frac{1}{\Gamma(s)} = e^{rs}\, s \prod_{n=1}^{\infty} \left(1+\frac{s}{n}\right) e^{\frac{-s}{n}}$.

11 a) If $\psi(x) \sim x$ as $x \to \infty$, then prove that $\pi(x) \sim \frac{x}{\log x}$ as $x \to \infty$.

OR

b) Prove that, for Re(s) > 1, $\frac{\zeta'(s)}{\zeta(s)} = -\sum_{h=1}^{\infty} \frac{\wedge(n)}{n^s}$.

12 a) If H, D respectively denote the upper half plane and the unit disc, then prove that F: H$\to$D is a conformal map, where $F(z) = \frac{i-z}{i+z}$, $z \in H$.

OR

b) State and prove the Schwarz's lemma.

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Code No. 8498 / Core

FACULTY OF SCIENCE

M.Sc. IV – Semester Examination, May / June 2019

Subject: Mathematics

Paper – II : General Measure Theory

Time: 3 Hours Max.Marks: 80

Note: Answer all questions from Part-A and Part-B.
Each question carries 4 marks in part-A and 12 marks in Part-B.

PART – A (8x4 = 32 Marks)
[Short Answer Type]

1 Let (X, B, μ) be a measure space and g a non-negative measurable function on X. Define $v(E) = \int_E g\, d\mu$. Show that v is a measure on B.

2 Define a σ-finite measure on a measurable space. Give an example of a σ-finite measure.

3 Prove that a countable union of negative sets is a negative set.

4 Show that if v is a signed measure such that $v \perp \mu$ and $v \ll \mu$, then $v = 0$.

5 Define a measure μ on an algebra A of subsets of X and also define outer measure μ^* induced by μ.

6 Prove that the set of all measurable rectangles is a semi-algebra.

7 Prove that, under usual notations, $\mu_*(E) \leq \mu^*(E)$.

8 If $\mu(X) < \infty$, then prove that $\mu_*(E) = \mu_*(X) - \mu^*(\tilde{E})$.

PART – B (4x12 = 48 Marks)
[Essay Answer Type]

9 a) State and prove generalized Fatou's lemma.

OR

b) Suppose that to each α in a countable dense set D of real numbers there is assigned a set $B_\alpha \in B$ such that $B_\alpha \subset B_\beta$ for $\alpha < \beta$. Then prove that there is a measurable extended real valued function f on X such that $f \leq \alpha$ on B_α and $f \geq \alpha$ on $X - B_\alpha$.

10 a) State and prove Hahn's decomposition theorem.

OR

b) State and prove Jordan decomposition theorem.

11 a) State and prove Tonelli's theorem.

OR

b) Prove that the class B of all μ^* - measurable sets is σ-algebra.

12 a) Let $\langle A_i \rangle$ be a disjoint sequence of sets in an algebra A. Then prove that, under usual notation, $\mu_*\left(E \cap \bigcup_{i=1}^{\infty} A_i\right) = \sum_{i=1}^{\infty} \mu_*(E \cap A_i)$.

OR

b) Let Γ be a set of real valued functions on a set X. If μ^* is a Caratheodory outer measure w.r.t. Γ then prove that every function in Γ is μ^* – measurable.

Code No. 8501 / CORE

FACULTY OF SCIENCE

M.Sc. IV – Semester Examination, May / June 2019

Subject: Mathematics / Applied Maths

Paper – III (A)

Integral Equations and Calculus of Variations

Time: 3 Hours **Max.Marks: 80**

Note: Answer all questions from Part-A and Part-B.
Each question carries 4 marks in part-A and 12 marks in Part-B.

PART – A (8x4 = 32 Marks)
[Short Answer Type]

1 Form an integral equation corresponding to the differential equation
$y''' + xy'' + (x^2-x)y = xe^x+1.\ y(0)= y'(0) = 1, y''(0) = 0.$

2 Solve the integral equation $\int_0^x \sin(x-t)\ \varphi(t)\, dt = e^{x^2/2} - 1$

3 Write aid of resolvent kernel solve the integral equation $\varphi(x) - \lambda\int_0^1 x\ \xi\ \varphi(\xi)\, d\xi = x.$

4 Show that the eigen values of a symmetric kernel are real.

5 State and prove the fundamental lemma of calculus of variation.

6 Find the extremals of the functional $V[y_1, y_2] = \int_0^{\pi/2} \left[y_1'^2 + y_2'^2 + 2y_1y_2\right] dx;$

$y_1(0) = 0,\ y_1\left(\frac{\pi}{2}\right) = 1,\ y_2(0) = 0,\ y_2\left(\frac{\pi}{2}\right) = -1.$

7 Write the ostrogradsky equation for the functional $V = \iint_D \left[\left(\frac{\partial z}{\partial x}\right)^2 - \left(\frac{\partial z}{\partial y}\right)^2\right] dx\, dy.$

8 State and prove Hamilton's principle.

PART – B (4x12 = 48 Marks)
[Essay Answer Type]

9 a) With aid of resolvent Kenel solve the integral equatio

$$\varphi(x) = e^{x^2+2x} + 2\int_0^x e^{x^2-t^2}\ \varphi(t)\, dt$$

OR

b) Solve the integro-differential equation.

$$\varphi''(x) - 2\varphi'(x) + \varphi(x) + 2\int_0^x \cos(x-t)\,\varphi''(t)\, dt + 2\int_0^x \sin(x-t)\,\varphi'(t)\, dt = \cos x;$$

$\varphi(0) = \varphi'(0) = 0$

10 a) Define characteristic numbers and eigen functions of a homogeneous Fredholm integral equation of the second kind. Also solve the integral equation

$$\varphi(x) = \lambda\int_0^1 xt\,\varphi^2(t)\, dt.$$

OR

b) Construct Green's function for the homogeneous BVP
$y^{IV} = 0;\ y(0) = y'(0) = y''(1) = y'''(1) = 0.$

11 a) Define Brachistochrone problem and show that it is a cycloid.

OR

b) Find the extremals of the functional $u[y(x)] = \int_{x_0}^{x_1} \left[x^2 (y')^2 + 2y^2 + 2xy\right] dx.$

12 a) Determine the extremal of the functional $V[y(x)] = \int_{-\ell}^{\ell} \left[\frac{1}{2} u y''^2 + \rho y\right] dx$ that satisfies the boundary conditions $y(-\ell) = 0 = y'(-\ell) = y(\ell) = y'(\ell).$

OR

b) Derive the differential equation of the free vibrations of a bar using the variational principle.

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Code No.8509/CORE

FACULTY OF SCIENCE

M.Sc. IV-Semester Examinations, May/June 2019

Subject : Mathematics

Paper-IV (C)

Advanced Operation Research

Time : 3 Hours **Max. Marks : 80**

Note : Answer all questions from Part-A and Part-B. Each question carries 4 marks in Part-A and 12 marks in Part-B.

PART – A (8 x 4 = 32 Marks)

1 State the rules for determining a saddle point.

2 State the basic assumptions in a two-person zero-sum game.

3 Explain the terms lead time and time Horizon.

4 Describe the basic characteristics of an inventory system.

5 State the necessary conditions for maximum/minimum objective function of a non linear programming problem.

6 Define Hessin matrix. What is its use?

7 State the sufficiency of Kuhn Tucker conditions.

8 How does quadratic programming problem differ from the linear programming problem?

PART – B (4 x 12 = 48 Marks)

9 a) i) Use dominance property to solve the game whose pay off matrix is given by

		Player-B				
		I	II	III	IV	V
Player-A	I	3	5	4	9	6
	II	5	6	3	7	8
	III	8	7	9	8	7
	IV	4	2	8	5	3

ii) Outline briefly maximum strategies as applied to solution of two person zero-sum games.

OR

b) i) Summarise the systematic methods for solving the rectangular games.
ii) Explain the graphical method of solving 2 x n and m x 2 games.

10 a) i) What is ABC analysis? What are its advantages and limitations if any.
ii) Obtain the formula for EOQ value with shortage when the production is instantaneous.

OR

b) The following information is known about a group of items. Classify the material in A, B, C classification.

Model number	Annual consumption (in pieces)	Unit price (in paise)
501	30,000	10
502	2,80,000	15
503	3,000	10
504	1,10,000	5
505	4,000	5
506	2,20,000	10
507	15,000	5
508	80,000	5
509	60,000	15
510	8,000	10

11 a) Use Kuhn-Tucker conditions to solve the following nonlinear programming problem

Maximize $Z = 2x_1^2 + 12x_1x_2 - 7x_2^2$

Subject to the constraints $2x_2 + 5x_2 \leq 98$; $x_1, x_2 \geq 0$

OR

b) Solve graphically the following NLPP

Maximize $Z = 2x_1 + 3x_2$

Subject to the constraints $x_1, x_2 \leq 8$; $x_1^2 + x_2^2 \leq 20$; $x_1, x_2 \geq 0$

12 a) Solve the following QPP using Wolf's method

Minimize $Z = x_1^2 + x_2^2 + x_3^2$

Subject to $x_1 + x_2 + 3x_2 = 2$

$5x_1 + 2x_2 + x_3 = 5$

$x_1, x_2, x_3 \geq 0$

OR

b) Solve the following QPP by Bealis method

Maximize $= 2x_1 + 3x_2 - x_1^2$

Subject to the constraints

$x_1 + x_2 \leq 4$

$x_1, x_2 \geq 0$

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