

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0222]

**FEBRUARY 2022
(OCTOBER 2021 EXAM SESSION)**

Sub. Code: 4012

**M.Sc. MEDICAL PHYSICS
FIRST YEAR
(Candidates admitted from 2010-2011 onwards – Paper II)
(Candidates admitted from 2020-2021 onwards – Paper III)
PAPER II & III – RADIOLOGICAL MATHEMATICS
Q.P. Code : 284012**

Time: Three hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate notes on:

(2 x 20 = 40)

1. a) Find the Pearson's correlation coefficient between SBP and DBP.

SBP(mmHg) X	70	80	100	110	75	85	90
DBP(mmHg) Y	100	110	120	130	125	135	115

- b) Sensitivity, Accuracy and Precision

2. a) Discuss precautions for applying chi square distribution.
b) Define sampling and Probability sampling methods.

II. Write Short Notes on:

(10x6 = 60)

1. Define Linear and Non linear graphs
2. Oscillation and waves.
3. Detective efficiency, Geometrical efficiency, Intrinsic efficiency.
4. Decay constant and Branding ratio.
5. Central limit theorem.
6. Newton-Rapson method.
7. Define Signal to noise ratio.
8. Three orders of Runge-kutta method.
9. Solve $y' + y = e^x$, $y_0 = 0$ by using Picard's method.
10. Evaluate $\int_0^1 \frac{1}{1+x^2}$ by using 1) Trapezoidal rule 2) Simpson's 1/3 rule.

THE TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY

[AHS 1022]

OCTOBER 2022

Sub. Code: 4011

M.Sc. MEDICAL PHYSICS

FIRST YEAR

(Candidates admitted from 2010-2011 onwards - Paper II)

(Candidates admitted from 2020-2021 onwards - Paper III)

PAPER II & III – RADIOLOGICAL MATHEMATICS

Q.P. Code: 284012

Time : Three Hours

Answer ALL questions

Maximum : 100 marks

I. Elaborate notes on:

(2 x 20 = 40)

1. a. Derive Newton-Raphson formula to find the actual root of an equation $f(x) = 0$.
b. Using Newton-Raphson iteration method show that the root of the equation $X \log_{10} X = 1.2$ is approximately 2.5.
2. a. A bag contains 10 Aspirin, 3 Paracetamol, 2 Analgin and 5 Crocin tablets. One tablet is drawn at random. Find the probability that the tablet drawn is Aspirin or Analgin or Crocin.
b. Discuss discrete and continuous probability distributions.

II. Write Short Notes on:

(10x6 = 60)

1. Prepare the decay chart for cobalt-60 teletherapy isotope for the period of one half-life.
2. Define: (i) Minimum detectable activity (ii) uncertainty in the counting rate.
3. Define signal to noise ratio
4. Discuss the conditions for applying student t-test.
5. Runge-Kutta method.
6. Define: (i) Truncation error (ii) Round-off error (iii) Relative error.
7. Calculate Mean, standard deviation for the following Diastolic blood pressure data: 93, 90, 95, 85, 90, 78.
8. Merits and Demerits in using STATISTICA.
9. Presentation of Data.
10. Discuss difference between Binomial and Poisson distribution.

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 1023]

OCTOBER 2023

Sub. Code: 4012

M.Sc. MEDICAL PHYSICS
FIRST YEAR (From 2020-2021 onwards)
PAPER III – RADIOLOGICAL MATHEMATICS

Q.P. Code: 284012

Time : Three Hours

Answer ALL questions

Maximum : 100 Marks

I. Elaborate notes on:

(2 x 20 = 40)

1. In an attempt to plot Dose Response Curve (DRC), a bioassay was performed with the following results. Find whether any relationship exists.

Log dose	0.3	0.6	0.9	1.2	1.5	1.8	2.1
Response	32	58	94	120	150	174	214

2. a) Derive Newton-Raphson formula to find the actual root of an equation $f(x) = 0$.
b) Evaluate $\int_1^0 dx/1+x^2$ using Simpson's three-eighth rule and compare with the solution.

II. Write Short Notes on:

(10x6 = 60)

1. Oscillations and Waves.
2. Prepare the decay chart for Iridium-192 teletherapy isotope for the period of one half-life.
3. Trapezoidal rule.
4. STATISTICA and MATLAB.
5. Confidence interval and P-value.
6. Properties of 't' distribution.
7. The values of capacitances in μF of ten capacitors selected at random from a large batch of similar capacitors are: 34.3, 25.0, 30.4, 34.6, 29.6, 28.7, 33.4, 32.7, 29.0 and 31.3. Determine the standard deviation from the mean for these capacitors.
8. Law of Weak Numbers.
9. Define Linear and Non linear graphs.
10. Use the Taylor series method of order four to solve the initial value problem $u' = t^2 + u^2$, $u(0) = 1$.

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 1024]

OCTOBER 2024

Sub. Code: 4012

M.Sc. MEDICAL PHYSICS
FIRST YEAR (From 2020-2021 onwards)
PAPER III – RADIOLOGICAL MATHEMATICS

Q.P. Code: 284012

Time: Three Hours

Answer ALL questions

Maximum: 100 Marks

I. Elaborate on:

(2 x 20 = 40)

- a) Concept of accuracy and precision with example.
b) Calculate the diagnostic accuracies ie. sensitivity, specificity, positive predictive value, negative predictive value and positive likelihood ratio for the following data.

Reference Test	Gold Standard Test	
	Positive	Negative
Positive	18	20
Negative	2	80

- Find the regression equation Y on X for the following data. Predict the Creatinine level when urine albumin is 15.

Urine Albumin (mm/dl) X	9	8	10	20	22	24	28
Creatinine(mm/dl) Y	0.7	0.9	1.5	1.8	1	1.2	1.6

II. Write Short Notes on:

(10x6 = 60)

- Calculate the decay constant for cobalt-60 ($T_{1/2}=5.26\text{yrs}$) in units of month^{-1} .
- Explain about (a) Skewness (b) Kurtosis in detail.
- Brief on Scales of measurement with examples.
- Discuss the graphical methods of finding outlier and use of connecting lines in diagrams.
- Define: (i) law of large numbers (ii) Central limit theorem.
- Define: (i) Minimum detectable activity (ii) uncertainty in the counting rate.
- Discuss Euler's method and modified Euler's method.
- Differences between standard deviation and standard error.
- Define vector and scalar quantity, give examples.
- Define ratio. Treatment was planned to deliver total dose of 60Gy in three course of time. The dose planned to deliver in the ratio of 3:2:1. Calculate the dose delivered in each course and percentage of dose delivery.

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 1025]

OCTOBER 2025

Sub. Code: 4012

**M.Sc. MEDICAL PHYSICS
FIRST YEAR (From 2020-2021 onwards)
PAPER III – RADIOLOGICAL MATHEMATICS**

Q.P. Code: 284012

Time: Three Hours

Answer ALL questions

Maximum: 100 Marks

I. Elaborate on:

(2 x 20 = 40)

1. What are the steps to be followed to test an hypothesis? Describe the Parametric test in detail with its merits and demerits.
2. Describe Regression analysis with the prerequisite to do the same. Explain with an illustration the need for regression analysis in Radiology.

II. Write Short Notes on:

(10x6 = 60)

1. Derived Units of measurement related to Medical Physics.
2. Decay constant calculation.
3. Measures of central Tendency.
4. Skewness and Kurtosis.
5. Binomial and Poisson distribution.
6. Statistical aspects of gamma ray and beta ray counting.
7. The two regression equations of X on Y and Y on X are given below:
 $Y = 100.26 + 0.77 X$; $X = 1.28 Y - 143.7$. Find out the means of X and Y.
8. Euler's method and modified Euler's method.
9. Non-Probability Sampling.
10. Write a function to draw a circle of unit radius using MATLAB function. For generating data, use the parametric equation of a unit circle; $X = \cos\theta$, $Y = \sin\theta$, $0 \leq \theta \leq 2\pi$.
