

Total No. of Questions : 4]

SEAT No. :

P700

[5115]-501

[Total No. of Pages : 2

T.Y.B.Sc.

PHYSICS

PH - 333 : Classical Mechanics

(2008 Pattern) (Paper - III) (Semester - III)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of logtables and calculators is allowed.

Q1) Attempt all of the following: [1 mark each]

[10]

- a) What is the effect of magnetic field on the speed of charged particle?
- b) State the principle of rocket motion.
- c) List any two properties of central forces.
- d) Give the purpose of using the geostationary satellites.
- e) What is elastic scattering?
- f) Define the term total cross section.
- g) What do you mean by phase space?
- h) Give the nature of constraint in case of a pendulum with variable length.
- i) What is meant by non-inertial frame of reference?
- j) Write the relation between velocities of a particle in a fixed and rotating frame.

Q2) Attempt any two of the following:

- a) What do you mean by centre of mass of the system of particles? Obtain the position, velocity and acceleration for the system of particles. **[5]**
- b) Obtain the equation of orbit in the form. **[5]**

$$\theta = \int \frac{(L/r^2)dr}{\sqrt{2m\left(E - V(r) - \frac{L^2}{2mr^2}\right)}} + \theta_0$$

- c) Obtain the Hamilton's canonical equations of motion. **[5]**

P.T.O.

Q3) Solve any two of the following:

- a) Two projectiles are projected with the same velocity. One is projected at an angle of 30° and the other at 60° to the horizontal. Find the ratio of maximum heights and ranges. [5]
- b) Determine the degrees of freedom for [5]
 - i) Particle moving on circumference of a circle.
 - ii) Simple pendulum.
 - iii) Two particles connected by a rigid rod.
- c) A body is fired horizontally in the north direction with a velocity of 600 m/s at 30° N. Calculate the horizontal component of coriolis acceleration. If the mass of the body is 10 gm calculate the coriolis force. [5]

Q4) A) Attempt any one of the following:

- a) What do you mean by lab and CM systems. Show that the scattering angles θ in lab system and θ' in CM system are related through ratio of masses of two particles. [8]
- b) i) State and explain the D' alembert's principle. [4]
ii) Draw the graph of effective potential energy against position vector and explain different shapes of orbits quantitatively. [4]

B) Attempt any one of the following:

- a) A charged particle having charge $2 \mu\text{C}$ enters the magnetic field of induction of 4×10^{-5} tesla with velocity of 3×10^4 m/s with an angle 30° with the field. Find the force acting on the particle. [2]
- b) What is the effect of coriolis force on the particles moving in southern and northern hemisphere. [2]

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P701

[5115]-502

T.Y.B.Sc.

PHYSICS

**PH - 335 : 'C' Programming & Computational Physics
(2008 Pattern) (Semester - III) (Paper - V)**

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Flowcharts may be drawn with pencil.*
- 4) *Use of electronic calculator or logtable is allowed.*

Q1) Attempt all of the following (one mark each):

[10]

- a) State any two advantages of algorithm.
- b) Write general format of printf statement.
- c) What is the scope of automatic variable?
- d) Convert following into 'C' equivalent.

$$y = \frac{a}{x^2} + \frac{b}{x^3} + \frac{c^2}{d^3}$$

- e) What is loop?
- f) State use of initgraph function in graphics.
- g) What is the difference between ++i & i++.
- h) What is operator in C-Programming?
- i) In what way does an array differ from ordinary variable?
- j) State purpose of exit () function.

Q2) Attempt any two of the following (5 marks each):

[10]

- a) Write C-Program to display digits from 0 to 5 using while statement.
- b) What is symbolic constant? State rules applied to a # define statement which define symbolic constant.
- c) Write 'C' program to sort numbers in descending order.

P.T.O.

Q3) Attempt any two of the following (5 marks each):

[10]

- a) What is FUNCTION? State types of Function. State advantages of function.
- b) Draw flowchart to find factorial of given number.
- c) Fit the straight line for following.

V (volts)	1	2	4	5	6	8	9
I (mA)	2	5	7	10	12	15	19

Q4) A) Attempt any one of the following:

- a) i) Draw flowchart for Newton Raphson method. **[4]**
ii) How array elements can be passed to function? Explain it with examples. **[4]**
- b) Evaluate following integral by using trapezoidal rule with 10 points. **[8]**

$$\int_0^1 \sin x dx.$$

B) Attempt any one of the following:

[2]

- a) State the syntax for the following getpixel, lineto.
- b) Determine the output of following logical expression if i=8 (int); j=5 (int), x=0.005 (float) & y= -0.01 (float).
(x>y) && (i>0) && (j<5).

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P702

[5115]-503

T.Y.B.Sc.

PHYSICS

PH - 336 (E) : Medical Electronics

(2008 Pattern) (Semester - III) (Paper - VI) (Elective - I)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*

Q1) Attempt all of the following (one mark each):

[10]

- a) What is cardiac pacemaker?
- b) Define the term 'Diestole'?
- c) What is hematology?
- d) What is polarization?
- e) State the difference between reactance and resistance.
- f) Draw the circuit diagram of OPAMP as differentiator.
- g) What is the use of spectrophotometry.
- h) State the uses of chromatography.
- i) What is the normal range of WBC count in human being?
- j) Draw bridge circuit for measurment of resistance.

Q2) Attempt any two:

- a) Explain polarizable and non polarizable electrodes in brief. **[5]**
- b) Explain the OPAMP as differentiator with the help of a suitable diagram. **[5]**
- c) Write a short note on chromatography. **[5]**

P.T.O.

Q3) Attempt any two:

- a) Explain blood gas and acid base measurement. [5]
- b) Draw circuit diagram of low pass and high pass active filters and explain it in detail. [5]
- c) Why are instruments essential in electronics? [5]

Q4) a) Attempt any one:

- i) Explain standard and unipolar limb lead system used for recording the electrocardiogram. [8]
 - ii) Give the difference between shortwave diathermy and microwave diathermy. [8]
- b) Attempt any one:
- i) Give the essential features of instruments. [2]
 - ii) Explain the basic principle of resistive transducer. [2]

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SEAT No. :

P703

[5115]-504

[Total No. of Pages : 3

T.Y.B.Sc.

STATISTICS (Principal)

ST - 331 : Distribution Theory - I

(2008 Pattern) (Semester - III) (Theory Paper - I)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of scientific calculator and statistical tables is allowed.*
- 4) *Symbols and abbreviations have their usual meaning.*

Q1) Attempt each of the following:

[1each]

A) Choose the correct alternative in each of the following:

- a) Following is the probability density function of _____ distribution.

$$f(x) = 2xe^{-x^2} \quad \text{if } x \geq 0$$

- | | |
|-------------------------------|----------------------------|
| i) Exponential (2λ) | ii) Gamma ($\lambda, 3$) |
| iii) Chisquare ($2, 1$) | iv) Weibull ($1, 2$) |

- b) If X follows beta distribution of second kind with parameters (3,5) then its arithmetic mean is _____.

- | | |
|------------|-----------|
| i) $3/4$ | ii) $4/3$ |
| iii) $3/8$ | iv) $5/8$ |

- c) If $X_1, X_2, \dots, X_n$ is a random sample from continuous uniform (0, θ) then the distribution of $X_{(n)}/\theta$ is _____.

- | | |
|----------------------|-----------------------------|
| i) U (0,1) | ii) Exponential(θ) |
| iii) $\beta_1(1, n)$ | iv) $\beta_1(n, 1)$ |

P.T.O.

d) If $(X_1, X_2, X_3) \sim \text{MD}(10, 0.4, 0.3, 0.3)$ then $X_2 + X_3$ follows.

i) $\text{MD}(10, 0.5, 0.3)$

ii) $b(10, 0.5)$

iii) $b(10, 0.4)$

iv) $b(10, 0.6)$

B) State whether each of the following statements is true or false: **[1 each]**

a) Weibull distribution is symmetric around the mean.

b) Uniform distribution on $(0, 1)$ is $\beta_1(1, 1)$ distribution.

C) Define the following: **[1 each]**

a) Weibull distribution.

b) Order statistics.

D) Attempt each of the following: **[1 each]**

a) Show that $\beta_1(m, m)$ distribution is symmetric around $\frac{1}{2}$.

b) If $X \sim \beta_1(m, m)$ state $E[(1-X)/X]$.

Q2) Attempt any TWO of the following: **[5 each]**

a) If $(X_1, X_2, \dots, X_k) \sim \text{MD}(n, p_1, p_2, \dots, p_k)$ then find its moment generating function. Hence find the marginal distribution of X_i , mean and variance of X_i .

b) State and prove the relation between beta distribution of first kind and beta distribution of second kind.

c) State and prove the central limit theorem for independent and identically distributed random variables.

Q3) Attempt any TWO of the following: **[5 each]**

a) Derive the mean and variance of Weibull distribution with parameters (α, β) .

b) Derive the probability density function of $X_{(i)}$ the i^{th} order statistic corresponding to a random sample of size n from a continuous distribution.

- c) If X and Y are independent gamma variables with parameters (α, λ_1) and (α, λ_2) respectively then find the probability distribution of $\frac{x}{x+y}$.

Q4) Attempt any ONE of the following:

- a) i) State and prove Chebychev's inequality for continuous random variable.
- ii) Suppose a random variable X has mean 3 and the variance 4, find k such that **[6+4]**
- $$P\{|X-3| \leq k\} \geq 0.99$$
- b) i) State and prove weak law of large numbers for independent identically distributed random variables.
- ii) If $(X_1, X_2, X_3) \sim MD(n, p_1, p_2, p_3)$ then find the multiple correlation coefficient $R_{1.23}$. **[5+5]**

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SEAT No. :

P704

[5115]-505

[Total No. of Pages : 3

T.Y.B.Sc.

STATISTICS (Principal)

**ST - 333 : Statistical Process Control (Online Methods)
(2008 Pattern) (Semester - III) (Paper - III) (Theory)**

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Use of scientific calculator and statistical tables is allowed.*
- 4) Symbols and abbreviations have their usual meaning.*

Q1) Attempt each of the following:

A) Choose the correct alternative in each of the following: **[1each]**

a) X-MR charts are used when n is

- | | |
|----------|-----------|
| i) Large | ii) Small |
| iii) 1 | iv) 2 |

b) Natural tolerance band is always

- | | |
|---------------|---------------|
| i) 3σ | ii) 6σ |
| iii) σ | iv) 4σ |

c) If $\bar{c}=4$, then the control limits of c-charts are

- | | |
|--------------|---------------|
| i) $(-2,16)$ | ii) $(-2,10)$ |
| iii) $(0,8)$ | iv) $(0,10)$ |

d) Process spread in a production process can be studied by using

- | | |
|--------------------|-------------|
| i) $\bar{X}$ chart | ii) R chart |
| iii) P chart | iv) C chart |

P.T.O.

- B) In each of the following, state whether the given statement is true or false: **[1 each]**
- i) The assignable causes in the process can be discovered & corrected.
 - ii) Cause and effect diagram is a simple bar diagram of causes.
- C) Define the following terms: **[1 each]**
- i) Modern definition of quality.
 - ii) Probability limits.
- D) i) State any four dimensions of the quality. **[1]**
- ii) Explain how shifts are identified in control chart. **[1]**

Q2) Attempt any TWO of the following: **[5each]**

- a) Explain the construction of C chart when standards are not given.
- b) Write note on Pareto diagram.
- c) For 25 samples of size $\bar{\bar{X}} = 0.45$ and $\bar{R} = 0.01$ obtain 3σ control limits. If the process average shifts to 0.455, calculate the probability of catching the shift on the second sample after the shift.

Q3) Attempt any TWO of the following: **[5 each]**

- a) Give justification for the use of 3σ limits on control charts.
- b) Define C_p index for a stable process. Also interpret the following:
 - i) $C_{pk} = 0$
 - ii) $C_{pk} = C_p$
 - iii) $C_{pk} < C_p$
- c) Write a short note on ISO.

Q4) Attempt any ONE of the following:

- a)
 - i) Explain the factors to be considered in determining size of subgroups and frequency of subgroups in the construction of control charts for attributes.
 - ii) Explain the control chart for fraction defectives (p) using stabilized control limits. State the assumptions if any. **[5+5]**
- b)
 - i) Explain the concept of confirming run length chart (CRL). Also state its interpretation. What is the distinction between CRL and P-chart.
 - ii) State the purpose of Statistical Process Control (SPC). **[7+3]**

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Total No. of Questions : 4]

SEAT No. :

P705

[5115]-506

[Total No. of Pages : 7

T.Y.B.Sc.

STATISTICS (Principal)

ST - 336 (A) : Operations Management

(2008 Pattern) (Semester - III) (Paper - VI) (Elective - I)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of statistical tables and calculator is allowed.*
- 4) *Symbols and abbreviations have their usual meaning.*

Q1) Attempt each of the following:

- a) Choose the correct alternative in each of the following: **[1 each]**
- i) The problem of replacement is not concerned about the
 - A) items that deteriorate graphically
 - B) items that fail suddenly
 - C) determination of optimum replacement interval
 - D) maintenance of an item to work out profitability
 - ii) Coefficient of optimism (α) is always
 - A) Less than -1
 - B) More than 2
 - C) Between 0 and 1
 - D) Any constant value
 - iii) Which of the following is not an assumption underlying the fundamental problem of EOQ?
 - A) Demand is known and uniform
 - B) Lead time is not zero
 - C) Holding cost per unit per time period is constant
 - D) Shortages are not permitted

P.T.O.

- iv) Which of the following is not correct?
- A) The critical path of a project network represents the minimum time needed to complete the project.
 - B) Critical path is the longest path in a project network.
 - C) A delay in the completion of critical activities need not cause a delay in the completion of the whole project.
 - D) The sum of the variances of the critical activity times gives the variance of the overall project completion time.
- b) In each of the following cases state whether the given statement is true or false: **[1 each]**
- i) The time gap between placing of an order and its actual arrival in the inventory is the lead time.
 - ii) In PERT analysis, a Beta distribution is assumed because it is multi-modal, has non-negative end points and is approximately symmetric.
- c) Explain the following terms: **[1 each]**
- i) Economic order quantity (EOQ).
 - ii) Float.
- d) i) Explain payoff table, used in decision theory. **[1]**
- ii) What is project cost in PERT? **[1]**

Q2) Attempt any TWO of the following: **[5 each]**

- a) From the following information find the critical path and the duration of the project:

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	-	-	A	B	C,D	C,D	E	E	F,G	H,I
Duration (days)	4	6	9	7	5	4	3	6	9	4

- b) Explain in brief Laplace criterion and savage minimax regret criterion for the decision under uncertainty.

- c) A firm is considering replacement of a machine, whose cost price is Rs. 12,200/- and the scrap value Rs. 200. The running (maintenance and operating) cost in rupees are found from experience to be as follows:

Year	1	2	3	4	5	6	7	8
Running cost	200	500	800	1200	1800	2500	3200	4000

When should the machine be replaced? Justify your answer.

Q3) Attempt any TWO of the following: **[5 each]**

- a) Derive an expression for the economic lot size model with uniform rate of demand, finite replenishment rate and no shortage.
- b) A manager has a choice between
- A risky contract promising Rs.7 lakhs with probability 0.6 and Rs. 4 lakhs with probability 0.4 and
 - A diversified portfolio consisting of two contracts with independent outcomes each promising Rs. 3.5 lakhs with probability 0.6 and Rs. 2 lakhs with probability 0.4. Construct a decision tree for using EMV criteria. Can you arrive at the decision using EMV criteria?
- c) The following table relates to a network

Activity	10-20	10-30	10-40	20-50	30-40	30-70	40-50	40-60	50-60	50-70	60-70
Duration (Days)	20	23	8	19	16	24	0	18	0	4	10

Calculate earliest and latest event times and hence determine the critical path.

Q4) Attempt any ONE of the following:

- a) i) Write a note on ABC analysis. **[5]**
- ii) The following matrix gives the pay off of different strategies (alternatives) S_1, S_2, S_3 against conditions N_1, N_2, N_3 and N_4 .

	N_1	N_2	N_3	N_4
S_1	4000	-100	6000	18000
S_2	20000	5000	400	0
S_3	20000	15000	-2000	1000

Determining the optimal strategy using

- 1) Maximax
 - 2) Regret criterion. [5]
- b) i) Explain the following terms related cost benefit analysis: [3]
- 1) Normal time
 - 2) Crash cost
 - 3) Cost slope
- ii) A small project consists of seven activities, the details of which are given below:

Activity	Most likely time	Optimistic time	Pessimistic time	Immediate predecessor
A	3	1	7	-
B	6	2	14	A
C	3	3	3	A
D	10	4	22	B,C
E	7	3	15	B
F	5	2	14	D,E
G	4	4	4	D

- 1) Draw the network, number the nodes and hence find the critical path, the expected project completion time.
- 2) What project duration will have 95% confidence of completion? [7]

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Total No. of Questions : 4]

P705

[5115]-506

T.Y.B.Sc.

STATISTICS (Principal)

ST - 336 (C) : Time Series Analysis

(2008 Pattern) (Semester - III) (Paper - VI) (Elective - I)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Use of scientific calculator and statistical tables is allowed.*
- 4) Symbols and abbreviations have their usual meanings.*

Q1) Attempt each of the following:

- a) In each of the following cases, choose the correct alternative from the given alternatives: **[1 each]**
 - i) The data of time series should have time in
 - A) Weeks
 - B) Months
 - C) Years
 - D) Any unit of time
 - ii) Method of moving average is used for measurement of
 - A) Trend
 - B) Seasonal Variations
 - C) Cyclical Variations
 - D) Irregular Variations
 - iii) Durbin - Watson test is used to
 - A) Test, the mean of time series
 - B) Test, the variance of time series
 - C) Test the serial correlation of time series
 - D) Test the coefficient as variation of time series

- iv) The multiplicative model of time series is
- A) $T-S+C-I = Y_t$
 - B) $T+S.C.+I = Y_t$
 - C) $\log Y_t = \log T + \log S + \log C + \log I$
 - D) $Y_t = T+S.C.I$
- b) In each of the following cases state whether the given statement is true or false: **[1 each]**
- i) Time series is same as regression analysis with the regression X replaced by time t .
 - ii) Monthly price index series is not a time series.
- c) Define each of the following: **[1 each]**
- i) Stationary Time Series.
 - ii) State AR (1) model.
- d) i) Define component irregular variation used in time series analysis. **[1]**
- ii) State Box-Cox transformation. **[1]**

Q2) Attempt any TWO of the following: **[5 each]**

- a) Describe two different methods of removing the trend from a time series and compare their merits and demerits.
- b) What is seasonal differencing? Explain with the help of an example.
- c) Find Auto covariance function for MA(1) model.

Q3) Attempt any TWO of the following: **[5 each]**

- a) Explain in brief any one non-parametric test in analysis of time series.
- b) Write Note on Double Exponential Smoothing.
- c) Write short note on Box-Jenkins time series modeling.

Q4) Attempt any ONE of the following:

- a) i) Estimate the trend using 10% smoothing constant for the following time series. [5]

t	1	2	3	4	5	6	7	8	9	10
Y_t	31	37	39	41	41	39	33	29	27	29

- ii) Discuss Detrending of time series. [5]
- b) i) State use of Auto Correlation Function. [5]
- ii) Explain in brief Durbin-Watson test. [5]

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