

2023

M. Sc.

4th Semester Examination

PHYSICS

PAPER : PHS-404A & 404B.1/404B.2

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks.

*Candidates are required to give their answers
in their own words as far as practicable.*

Illustrate the answers wherever necessary.

SECTION—I

(SOLID STATE SPECIAL)

PHS-404A

1. Answer *any four* questions from the following : 2×4=8
- (a) What is meant by quenching of orbital angular momentum?
- (b) Find Hund's ground state for Mn^{2+} having $3d^5$ electron configuration.

(2)

- (c) What is meant by energy gap in a superconductor?
- (d) Give an example of a ferrite and also explain why ferrites are technically important.
- (e) Show the nature of transition when a superconductor becomes normal under influence of magnetic field.
- (f) Determine the frequency of the electromagnetic waves radiated by a Josephson junction across which a DC voltage of 0.5 mV is applied.

2. Answer *any four* questions from the following :

4×4=16

- (a) Explain the current-voltage characteristics when a thin layer of insulator is placed between metal and a superconductor.
- (b) Explain in detail, the principle of ESR and find the resonance condition.
- (c) What is a Bloch wall? Calculate the thickness of the domain wall.
- (d) What is meant by coherence length? Find an expression of it.

- (e) What do you mean by Cooper pair? Explain the formulation of Cooper pairs.
- (f) What is meant by Heisenberg exchange energy? How do you classify ferromagnetic and non-ferromagnetic solid on this basis?

3. Answer **any two** questions from the following :
8×2=16

- (a) Explain Pauli's spin paramagnetism and find an expression of susceptibility at $T = 0\text{K}$. 2+6
- (b) What is the origin of spin wave? Consider a linear chain of atom having only the spin motion. Find the dispersion relation for a spin wave excited on the chain. 2+6
- (c) What is meant by flux quantization in a superconducting ring? Derive an expression of fluxoid in this connection. What is 123 superconductor? 1+6+1=8
- (d) What is Josephson tunneling? Explain DC Josephson effect. Show that supercurrent of superconducting pairs across the junction depends on the phase difference. 2+6

2. Answer *any two* questions from the following :

4×2=8

- (a) Explain the construction details and operation of a Trinitron type colour picture tube with necessary diagrams.
- (b) (i) Instead of transmitting individual colour signals, colour difference signals are transmitted in colour TV transmission system. Why?
- (ii) Which colour difference signal is not transmitted in colour TV signal transmission and why?
- (c) (i) What do you mean by vestigial side band modulation and why is it used in TV picture signal modulation?
- (ii) What is the frame reception rate used in Indian TV transmission system and why is it not set at 24 as in Motion Pictures?
- (d) Explain the detailed operation of ramp type digital voltmeter with proper block diagram.

(4)

SECTION—II

(APPLIED ELECTRONICS SPECIAL : ANALOG
ELECTRONICS)

Answer from **both** the Units as directed.

UNIT—I

PHS 404B.1

1. Answer *any two* questions from the following :

2×2=4

- (a) What is the normal channel width allotted for transmission of both picture and sound signals in Indian television system? What is the maximum frequency deviation used for frequency modulated sound signal transmission?
- (b) What is intermediate frequency (IF) and why are they generated in a TV receiver?
- (c) Find the picture carrier frequency, sound carrier frequency and colour subcarrier frequency for channel number 9 of Indian television transmission system.
- (d) Explain how colour differential signals disappear at the output of the signal combining matrix on white and grey shades.

3. Answer *any one* question from the following :

8×1=8

(a) (i) Draw the detailed block diagram of a black and white TV receiver and explain the operation of its different blocks for reception and reproduction of picture and sound signals.

(ii) What do you mean by interlaced scanning and why is it used in TV transmission system? 5+3

(b) (i) Explain in detail, the operation of Videocon type TV camera with a neat diagram.

(ii) Draw the block diagram of a colour TV camera showing generation of colour difference signals and luminescence signal. 5+3

UNIT—II

PHS 404B.2

1. Answer *any two* questions from the following :

2×2=4

(a) What are the basic differences between 8085 and 8086 microprocessors?

(b) If in a 'differential phase shift keying' modulation system the digital data set is 10111100, then what will be the binary signal that has to be transmitted by the carrier wave?

- (c) In a TDM-PAM system 9, signals are to be transmitted using a 5kHz sampling frequency with 5 sync bits per frame. If the word length is 5 bits, then find out the data transmission speed on that transmission line.
- (d) Explain different conditional jump statements in 8085 μ P.

2. Answer *any two* questions from the following :

4×2=8

- (a) Write down a program in the memory location 2000 onwards to find out the minimum number from an array of fifteen (15) numbers stored in memory location 3000 onwards. 4
- (b) Give the modulation technique of FSK. 4
- (c) What is Pulse Width Modulation? Describe the process of getting PWM. Is it good for communication technique? 1+2+1
- (d) (i) If a signal $Y = A_1 \cos 5000\pi t + A_2 \cos 8000\pi t + A_3 \cos 12000\pi t$ has to be sampled by band pass approach, then what will be sampling frequency?
- (ii) For the signal-quantization, if the voltage width of each section is 24 mV, then what will be the quantization error?

2+2

(8)

3. Answer *any one* question from the following :

8×1=8

(a) With proper block diagram give the idea of Delta modulation.

(b) Mention advantage and disadvantage of it. Why is adaptive delta modulation required?

4+4

4. (a) Give the meaning of the instructions and explain the outcome of the following program :

SUB A/MVI C 03/INR A/RAL C/XRA C/HLT

(b) What do you mean by Bus Interface Unit and Execution Unit of 8086 microprocessor?

4+4

★ ★ ★

2023

M.Sc.

4th Semester Examination

ZOOLOGY

PAPER : ZOO-401.1 & 401.2

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks.

*Candidates are required to give their answers
in their own words as far as practicable.*

Illustrate the answers wherever necessary.

SECTION—I

(ZOO-401.1)

(ENVIRONMENTAL POLLUTION & MANAGEMENT)

1. Answer any two questions from the following :

2×2=4

(a) Differentiate sewage from sludge.

- (b) Differentiate formal text book knowledge from the traditional knowledge.
- (c) Differentiate pollutants from contaminants.
- (d) Differentiate man-made pollution from natural pollution.

2. Answer *any two* questions from the following :

$4 \times 2 = 8$

(a) What is acid rain? Briefly highlight the roles of meteorological parameters in the formation of acid rain. $1+3=4$

(b) What is bio-invasion? Briefly elaborate the ecological consequences on the introduction of invasive species in coastal ecosystem. $1+3=4$

(c) Briefly discuss on the multifarious impacts of chemical fertilizers on environment. 4

(d) What is 'Green Movement'? Mention different steps for achieving the targets of venture. $1+3=4$

3. Answer *any one* question from the following :

$8 \times 1 = 8$

(a) Define eutrophication. Schematically highlight different ecological consequences due to this process. Add a note on 'Sacred Groves'. $2+4+2=8$

(b) What is sustainable development? Mention its different types. What are the different steps involved in environmental management? $2+2+4=8$

(3)
SECTION—II

(ZOO-401.2)

(BIostatistics)

4. Answer *any two* questions from the following :
2×2=4

(a) In a quantitative analysis, median is a better option than mean of that variable - justify.
2

(b) Write a short note on types of data scales of measurement.
2

(c) How do you differentiate one tailed test from two tailed test?
2

(d) Differentiate between Rank and Pearson's Correlation analysis.
2

5. Answer *any two* questions from the following :
4×2=8

(a) An IQ test was administered to 5 persons before and after they were trained. The results are given below :

IQ before training	110	120	123	132	125
IQ after training	120	118	125	136	121

(4)

Test whether there is any change in IQ after the training program. 4

$$\text{Critical } t_{0.05(4)} = 2.776$$

$$t_{0.05(8)} = 2.306$$

$$t_{0.05(9)} = 2.262$$

$$t_{0.05(5)} = 3.365$$

(b) Find a suitable measure of skewness for the following distribution : 4

Marks	0-10	11-20	21-30	30-40	40-50
Frequency	3	7	10	12	18

(c) The product moment r scores (r_{12}) between gill weight (x_1 gm) and trunk length (x_2 cm) was found to be +0.55 in a sample of 43 carps, the r scores (r_{13}) between their gill weight (x_1 gm) and body weight (x_3 gm) amounted to +0.3; while r scores (r_{23}) between their trunk lengths (x_2 cm) body weight (x_3 gm) was found to be +0.28. Find whether or not there is a significant multiple linear correlation between the combination of variables.

$$\{ \text{critical } t_{0.05(40)} = 2.704 \}$$

4

(d) What is binomial distribution? Draw a normal distribution curve where standard deviation is equal to mean value. 2+2=4

6. Answer *any one* question from the following :

8×1=8

(a) (i) You are given that the variance of x is 9. The regression equations are $8x - 10y + 66 = 0$ and $40x - 18y = 214$. Find the average values of x and y and correlation coefficient.

(ii) Differentiate the sample mean and population mean. 6+2=8

(b) The impact of four medicine(M) on the reduction of the serum creatinine level on kidney patients. The creatinine level was measured for replicates. Carry out appropriate statistical test on the effects of medicine on creatinine levels. 8

Critical $F_{0.05(3, 14)} = 3.34$

$$F_{0.05(4, 14)} = 3.11$$

$$F_{0.05(3, 13)} = 3.41$$

$$F_{0.05(3, 12)} = 3.49$$

M1	4.9	4.3	4.7	4.5
M2	3.6	3.8	4.8	4.9
M3	4.2	4.5	4.5	4.6
M4	4.1	4.9	4.8	5.1

