Signature and Name of Invigilator

1. (Signature) _____

   (Name) _____

2. (Signature) _____

   (Name) _____

Roll No. | | | | | | | |

(In figures as per admission card)

Roll No. _____

(In words)

Test Booklet No.

D–8808

PAPER – III

Time : 2½ hours] **ELECTRONIC SCIENCE** **[Maximum Marks : 200**

Number of Pages in this Booklet : **32** Number of Questions in this Booklet : **26**

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. Answers to short answer/essay type questions are to be given in the space provided below each question or after the questions in the Test Booklet itself.

   No Additional Sheets are to be used.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :

   (i) To have access to the Test Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.

   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the question booklet will be replaced nor any extra time will be given.**
4. Read instructions given inside carefully.
5. One page is attached for Rough Work at the end of the booklet before the Evaluation Sheet.
6. If you write your name or put any mark on any part of the Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
7. You have to return the Test booklet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall.
8. **Use only Blue/Black Ball point pen.**
9. **Use of any calculator or log table etc. is prohibited.**
10. **There is NO negative marking.**

परीक्षार्थियों के लिए निर्देश

1. पहले पृष्ठ के ऊपर नियत स्थान पर अपना रोल नम्बर लिखिए।
2. लघु प्रश्न तथा निबंध प्रकार के प्रश्नों के उत्तर, प्रत्येक प्रश्न के नीचे या प्रश्नों के बाद में दिये हुये रिक्त स्थान पर ही लिखिये।

   इसके लिए कोई अतिरिक्त कागज का उपयोग नहीं करना है।
3. परीक्षा प्रारम्भ होने पर, प्रश्न-पुस्तिका आपको दे दी जायेगी। पहले पाँच मिनट आपको प्रश्न-पुस्तिका खोलने तथा उसकी निम्नलिखित जाँच के लिए दिये जायेंगे जिसकी जाँच आपको अवश्य करनी है :

   (i) प्रश्न-पुस्तिका खोलने के लिए उसके कवर पेज पर लगी सील को फाड़ लें। खुली हुई या बिना स्टीकर-सील की पुस्तिका स्वीकार न करें।

   (ii) **कवर पृष्ठ पर छपे निर्देशानुसार प्रश्न-पुस्तिका के पृष्ठ तथा प्रश्नों की संख्या को अच्छी तरह चैक कर लें कि ये पूरे हैं। दोषपूर्ण पुस्तिका जिनमें पृष्ठ / प्रश्न कम हों या दुबारा आ गये हों या सीरियल में न हों अर्थात किसी भी प्रकार की त्रुटिपूर्ण पुस्तिका स्वीकार न करें तथा उसी समय उसे लौटाकर उसके स्थान पर दूसरी सही प्रश्न-पुस्तिका ले लें। इसके लिए आपको पाँच मिनट दिये जायेंगे। उसके बाद न तो आपकी प्रश्न-पुस्तिका वापस ली जायेगी और न ही आपको अतिरिक्त समय दिया जायेगा।**
4. अन्दर दिये गये निर्देशों को ध्यानपूर्वक पढ़ें।
5. उत्तर-पुस्तिका के अन्त में कच्चा काम (Rough Work) करने के लिए मूल्यांकन शीट से पहले एक पृष्ठ दिया हुआ है।
6. यदि आप उत्तर-पुस्तिका पर अपना नाम या ऐसा कोई भी निशान जिससे आपकी पहचान हो सके, किसी भी भाग पर दर्शाते या अंकित करते हैं तो परीक्षा के लिये अयोग्य घोषित कर दिये जायेंगे।
7. आपको परीक्षा समाप्त होने पर उत्तर-पुस्तिका निरीक्षक महोदय को लौटाना आवश्यक है और इसे परीक्षा समाप्ति के बाद अपने साथ परीक्षा भवन से बाहर न लेकर जायें।
8. **केवल नीले / काले बाल प्वाईंट पैन का ही इस्तेमाल करें।**
9. **किसी भी प्रकार का संगणक (कैलकुलेटर) या लाग टेबल आदि का प्रयोग वर्जित है।**
10. **गलत उत्तर के लिए अंक नहीं काटे जायेंगे।**

ELECTRONIC SCIENCE

PAPER – III

NOTE: **This paper is of two hundred (200) marks containing four (4) sections. Candidates are required to attempt the questions contained in these sections according to the detailed instructions given therein.**

SECTION - I

Note : This section contains **five (5)** questions based on the following paragraph. Each question should be answered in about **thirty (30)** words and each carries **five (5)** marks.

(5x5=25 marks)

Modern communication systems essentially involve transmission of information available in the form of an electrical signal to a receiver located at another location. Most message signals are low frequency ($\lesssim$ 20 kHz) and cannot be transmitted long distances and have to be loaded on a high frequency carrier wave by modulation. The physical medium can be space, as in ionospheric propagation and satellite communication, or a guided channel, like copper cables (with loss ~ 20 dB /km) at low to RF frequency and optical fiber (with loss ~ 0.2 dB/km) for optical communication. The bandwidth at a high carrier frequency is roughly 10% of the carrier frequency and a typical audio and video signal requires a band of 8 kHz and 4.5 MHz respectively.

1. Define Amplitude Modulation and Frequency Modulation.

2. Why is it difficult to transmit a low frequency signal over long distance as compared to a high frequency signal ?

3. What is ionosphere propagation and what is the typical frequency range in which it is possible ?

4. If 1 mW of power is launched into a copper cable and an optical fiber, estimate the power received after a propagation distance of 50 km in each case.

5. Consider optical communication at $\lambda = 1.5$ μm. How many (i) audio and (ii) video channels can be accomodated on a single channel ?

SECTION - II

Note : This section contains **fifteen (15)** questions each to be answered in about **thirty (30)** words. Each question carries **five (5)** marks.

(5x15=75 marks)

6. For a CE tranistor in active region show that

$$I_C = \beta I_B + (\beta + 1) I_{CO}$$

where all symbols have conventional meanings.

7. State and prove the Superposition Theorem.

8. What is an ideal OP - AMP ? Compare the properties of a 741 IC to those of an ideal OP - AMP.

9. What are Flags in a microprocessor ? Name *four* commonly used Flags.

10. Realise a digital circuit for the logic equation

$y = \overline{A}.B + A.\overline{B}$.

11. What is the race round condition in a Flip Flop ?

12. What is a 'pointer' in C language and how is it related to the address operator and indirection operator ?

13. Define Directive Gain and Directivity of an Antenna.

14. What modulation index would produce the lowest bandwidth FM signal according to Bessel Functions ?

15. What is Responsity 'R' of a *p-i-n* photodectector ? How is it related to quantum efficiency η ?

16. Distinguish between spontaneous emission and stimulated emission.

17. Explain how bunching takes place in a Reflex Klystron.

18. Draw the schematic symbols used for a *n-channel* and *p-channel* enhancement mode MOSFET.

19. What is measured by a Venturi Tube ? What is the principle of operation ?

20. What is the Routh - Hurwitz criterion for stability ?

SECTION - III

Note : This section contains **five (5)** questions. Each question carries **twelve (12)** marks and is to be answered in about **two hundred (200)** words.

(12x5=60 marks)

21. (a) Explain with necessary diagrams the characteristics of bipolar junction transistors.

(b) What is the differnce between Avalanche and Zener breakdown.

22. (a) What is the working principle of a phase-shift oscillator ?

(b) Use De Morgan's Theorem to prove that a NOR gate with inverted inputs is equivalent to an AND gate.

23. (a) What is an interrupt ? Discuss the various hardware interrupts of the 8085 miscroprocessor.

(b) Explain briefly the 8051 miscrocontroller.

24 (a) What is the relationship between Strain and Stress ? Why are strain measurement s of importance ?

(b) Explain with necessary diagram the working principle of any one strain gauge.

25. (a) Write down Maxwell's Equations in a nonconducting medium and show that $\vec{H}$ and $\vec{E}$ satisfy the wave equation.

(b) The electric field of a plane wave in a dielectric medium with $< S > = 3.77\ W/m^2$ is given by

$\vec{E} = \hat{y}\ E_o \exp [\ j\ (at - bx - dz\ )\ ]\ V/m.$

with $a = 6\pi \times 10^{14}\ s^{-1}$, $b = 2\sqrt{3}\ \pi \times 10^6\ m^{-1}$ and $d = 2\pi \times 10^6\ m^{-1}$.

Obtain the following :

(i) frequency and wavelength of the wave.

(ii) dielectric constant of the medium.

(iii) direction of propagation and polarization of the wave.

(iv) the corresponding $\vec{H}$.

SECTION - IV

Note : This section consists of one essay type question of **forty (40)** marks to be answered in about **one thousand (1000)** words, [each part carries **ten (10)** marks].

(40x1=40 marks)

26. (a) What is a shift register ? What are the differences between parallel loading and serial loading in shift registers ?

(b) What are different types of address modes available in the 8085 microprocessor ? Explain with examples.

(c) What is a thyristor ? Draw and explain the *v-i* characteristics of a thyristor.

(d) Explain with simple ray theory light guidance in a multimode step index fiber. Obtain the expression for time delay between the fastest and slowest ray and explain how this effects the transmission data rate.

OR

(a) With a suitable sketch describe the construction of a microwave pin diode. Breifly explain its operation for microwave detection.

(b) Draw the block diagram of a Ripple Counter. Sketch the waveforms at the output of each FLIP FLOP for a three stage counter.

(c) Explain amplitude, frequency and phase modulation. What is the modulation index in each case ?

(d) Explain the use of an UJT as a relaxation oscillator. What is the term "intrinsic stand-off ratio" ?

FOR OFFICE USE ONLY							
Marks Obtained							
Question Number	Marks Obtained	Question Number	Marks Obtained	Question Number	Marks Obtained	Question Number	Marks Obtained
1		26		51		76	
2		27		52		77	
3		28		53		78	
4		29		54		79	
5		30		55		80	
6		31		56		81	
7		32		57		82	
8		33		58		83	
9		34		59		84	
10		35		60		85	
11		36		61		86	
12		37		62		87	
13		38		63		88	
14		39		64		89	
15		40		65		90	
16		41		66		91	
17		42		67		92	
18		43		68		93	
19		44		69		94	
20		45		70		95	
21		46		71		96	
22		47		72		97	
23		48		73		98	
24		49		74		99	
25		50		75		100	

Total Marks Obtained (in words) .....

(in figures) .....

Signature & Name of the Coordinator .....

(Evaluation) Date .....