

2019

(January)

Time : 3 hours

Full Marks : 80

Answer any **one** Group according to your specialisations

*The figures in the right-hand margin indicate marks*

*Candidates are required to answer in their own words  
as far as practicable*

GROUP – I

(ELECTRONICS)

SECTION – A

1. Answer any *four* of the following : 4 × 4  
(a) Explain the frequency response of linear amplifier.

( 2 )

- (b) Explain the effect of negative feedback in amplifiers.
- (c) Explain feedback criteria for oscillation.
- (d) Derive an expression for CMRR taking the example of differential amplifier.
- (e) Explain how operational amplifier working as a differentiator.
- (f) State and explain Thevenin's and Boolean theorems.

*Or*

2. Answer *all* questions from the following : 2 × 8

- (a) Explain how Transistor used as a switch.
- (b) Explain the Boot-strapping the FET.
- (c) Define Nyquist criteria.
- (d) Explain the phase shift in phase shift oscillator.
- (e) Explain the properties of operational amplifier.

( 3 )

- (f) Write down the two application of operational amplifier.
- (g) Explain AND and OR gates with truth tables.
- (h) State Thevenin's theorem in digital circuits.

SECTION – B

Answer all questions : 16 × 4

3. (a) Describe the principle and working of RC and Transformer coupled amplifiers with neat circuit diagrams.

*Or*

- (b) Distinguish between FET and MOSFET and explain the operation of MOSFET with a neat circuit diagram.
4. (a) Draw the circuit diagram of phase shift oscillator and explain its working and obtain an expression for frequency.

( 4 )

*Or*

- (b) Describe the principle and working of Wien bridge oscillator with a neat circuit diagram and explain how it generates a large range of frequencies.
5. (a) Give a detailed account on the dc characteristics of operational amplifier and obtain the expression for input and output impedances.

*Or*

- (b) Describe the working of summing and integrating amplifier using operational amplifier with a circuit diagram.
6. (a) Distinguish between RS and JK-Flip-flop and explain the working of JK flip-flop with a circuit diagram.

*Or*

- (b) Explain the two methods of A/D conversion and describe the working of D/A converter.

( 5 )

GROUP - II

( GENERAL THEORY OF RELATIVITY )

SECTION - A

1. Answer any *four* of the following : 4 × 4
- (a) Explain the symmetric and antisymmetric tensors.
- (b) Explain the Lagrangian of a relativistic particle.
- (c) State and explain the equivalence principle.
- (d) Write a note on covariant derivatives.
- (e) Explain the Solar Red Shift.
- (f) Explain the Algebraic properties of the curvature tensor.

*Or*

2. Answer *all* questions from the following : 2 × 8
- (a) Define Tensor and Ricci Tensor.
- (b) Explain the significance of 4-vectors.

- (c) State equivalence principle.
- (d) Define covariant derivatives.
- (e) Define Red shift.
- (f) What do you mean by gravitational field? Explain.
- (g) Define curvature tensor.
- (h) What is elastic scattering? Explain.

## SECTION – B

Answer all questions :  $16 \times 4$

3. (a) Obtain Lorentz transformation and explain the transformation properties.

*Or*

- (b) Define Four-momentum and Four-force and obtain the covariant equations of motion.
4. (a) Define weak and strong principle of equivalence and obtain the equation of motion in presence of Gravitational forces.

*Or*

- (b) What are affine connection and metric tensor? Obtain the relation between Metrics tensor and Affine connection.
5. (a) Define Newtonian limit and Newtonian potential and obtain the relation between Newtonian limit and Newtonian potential.

*Or*

- (b) Discuss the Time dilation in a gravitational Field and explain the Red shift of spectral lines.
6. (a) Write a detailed note on Ricci and Bianchi identities.

*Or*

- (b) Obtain Einstein's field equations for energy and momentum.