

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: M.TECH/PRE-PHD  
BRANCH: EEE**

**SEMESTER : II/NA  
SESSION : SP/19**

**SUBJECT: EE563 ADVANCED POWER SYSTEM PROTECTION**

**TIME: 3.00 Hrs.**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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Q.1(a) Based on attributes prescribed by IEEE Standard Dictionary for a relay, analyze the advantages of computer relays over electromagnetic and static relays. [5]

Q.1(b) Compare the superior design philosophy of computer relay using its functional block diagram to meet stringent power system requirements such as speed of operation, reliability and adaptability. [5]

Q.2(a) Derive the expression for fundamental voltage phasor using discrete Fourier Transform technique for developing a numerical relay. Assume the voltage waveforms are not pure sinusoidal waveforms. [5]

Q.2(b) Using discrete Fourier transform algorithm, extract the fundamental voltage phasor component from the given samples where sampling frequency is 200 Hz and operating frequency is 50Hz. [5]

Samples	1	2	3	4
v(t) in Volts	0	224.9999	0.3902	-224.999

Q.3(a) Design of protection system for large synchronous generators based on the IEEE C37.102 standards includes the protection against inter-turn fault. Analyse its effectiveness using a block diagram representation of the relay. [5]

Q.3(b) A 400 kV transmission line from Kolaghat to Jeerat is 130 km long and the adjoining 400 kV line from Jeerat to Subhasgram is 80 km long. Design the 3 zone protection scheme for the entire length of transmission. The transmission line has resistance of 0.0297  $\Omega$ /km and reactance of 0.332  $\Omega$ /km. [5]

Q.4(a) Based on block diagram for architecture for WAMS, compare and contrast the unique advantages of phasor measurement unit assisted WAMS based protection over conventional protection. [5]

Q.4(b) Derive the non-recursive algorithm for phasor calculation for PMU using N samples for cycle. [5]

Q.5(a) Design philosophy of system integrity protection (SIPS) has different models and architectures. Compare them in terms their functioning. [5]

Q.5(b) Design SIPS for local BIT Mesra distribution system with 11kV ring main unit (RMU) with suitable block diagram and explain its functioning. [5]

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