

**Examination Control Division**  
2073 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject: - Instrumentation I (EE552)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) What is an instrumentation system? Explain its different components with the help of a block diagram. [6]
- b) What is random error? Which method do you think is the most appropriate to find its distribution among a given set of data, make a complete analysis and hence define probable error. [6]
- c) The output of an LVDT is connected to a 5V voltmeter through an amplifier whose amplification factor is 250. An output of 2 m V appears across the terminals of LVDT when core moves through a distance of 0.5 mm. calculate the sensitivity of LVDT and that of whole set-up. The milli-voltmeter scale has 100 divisions. The scale can be reads to 1/5 of divisions. Calculate the resolution of the instrument in mm. [4]
2. a) Explain the principle of operation of an inductive transducer used for the measurement of linear displacement. Why differential arrangement of such a transducer is required? [8]
- b) "Maxwell's bridge is not suitable for the measurement of high Q-coils", verify the statement and draw and explain the modified bridge which can measure the inductance of high Q-coils. [8]
3. a) Explain the construction and working of a megger used for the measurement of high resistance. [4]
- b) Describe how digital to analog conversion is achieved by using the R-2R ladder network. How this DAC over comes the limitations of WRN type of DAC? [8]
- c) An analog to digital converter having an input of (0-8)V is able to distinguish a change of 10.3 mv in its input signal, calculate: [4]
  - i) The number of bits
  - ii) What voltage change does each LSB represent
  - iii) What voltage does IMSB represent
4. a) Explain the working principle of dy-nanometer type, wattmeter and also prove that the deflection torque is directly proportion to power consumed by the load in both a.c. and d.c. circuit. [8]
- b) What do you understand by a Data Acquisition system? Explain with a neat sketch, the role of multiplexer in a DAS. [8]
5. a) What do you understand by sample and hold circuit. Explain its functioning with the help of circuit diagram. [6]
- b) Explain the working and application of OP-amp as [6]
  - i) an integrator
  - ii) a differentiator and
  - iii) a substractor
- c) A piezoelectric pressure transducer having unknown charge sensitivity is connected to a charge amplifier, the gain being set to 5 mv/PC. The amplifier output is connected to an ultraviolet chart recorder, whose sensitivity is set to 25 mm/volt. Determine the sensitivity of the piezoelectric transducer if deflection of chart recorder is 100 mm due to a pressure of 300 N. [4]



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**Subject: - Microprocessor (EX551)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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1. Differentiate between Microprocessor and Microcontrollers. Explain how the microprocessor is organized in microprocessor based systems. [4+4]
2. What is flag? Discuss about 8085 associated flags. Along with suitable example show how these flags are affected by arithmetic and logical group of instructions. [1+2+5]
3. Write an assembly language program for 8085 to find the square of ten 8-bit numbers which are  $\leq 0FH$ , stored from memory location C090H. Store the result from the end of the source table. [8]
4. Discuss and differentiate between Bus Interface Unit (BIU) and Execution Unit (EU) of 8086 Microprocessor. List out the operators used in 8086 Assembly Language Programming. [4+4]
5. Two tables contain ten 16-bit data each. Write an assembly language program to generate the 3<sup>rd</sup> table which contains 1FFFh if the corresponding data in the 1<sup>st</sup> table is less than that of 2<sup>nd</sup> table, else store 0000h. [8]
6. Draw and explain the timing diagram of LXI D, 2465 H. Calculate the time required to execute this instruction if the crystal frequency is 6MHZ. [6+2]
7. With a neat diagram explain the interfacing circuit using a 3:8 decoder (74LS138) needed to connect the following memory units to the 8085 microprocessor consecutively starting from memory location A000H. [8]
  - 2K×8 ROM chip
  - 2K×8 RAM chip
  - 4K×8 EPROM chip
8. Explain the purpose of the EI, DI, SIM and RIM instructions of the 8085 processor while using interrupts. Describe how the 8085 obtains the starting address of the interrupt service routine for each of the hardware interrupts. [8]
9. Discuss about Flynn's Classification. What are the key features having with a typical Operating system? [4+4]
10. Write short notes on: [4×2]
  - i) RS232
  - ii) PPI



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**Subject:** - Electrical Machine (EE551)

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1. a) Define coercitivity and retaintivity with the help of BH curve. [6]  
 b) A magnetic circuit consists of a circular iron core having mean length of 10 cm and cross sectional area of 100 square mm. The air gap is 2 mm and the core has 600 turns of winding. Calculate the magnitude of current to be passed through the winding to produce air gap flux of 1 tesla (permeability of iron = 4000) [10]
2. a) Explain working principle of an auto-transformer. Derive an expression for Cu saving in an auto-transformer. [8]  
 b) A 4-kVA, 200/400V single phase transformer has following test results: [8]
 

O.C Test: 200V	0.8A	70W
S.C Test: 20V	10A	60W

Obtain equivalent circuit parameters of the transformer refer to L.V side.
3. a) Make a detail comparison of dc shunt generator and dc series generator with their diagrams, equations and characteristics curve. [8]  
 b) A dc shunt motor is supplied by a source of 200 V. It draws a current of 20 A and runs at speed of 1500 rpm. The armature and field winding resistance are 0.08 Ω and 110 Ω respectively. A resistance of 0.02 Ω is added in series with armature and load torque is increased by 30%, calculate new speed. [8]
4. a) How does induction motor and synchronous motor adjust the current according to the change in load? Explain briefly using mathematical expression. [4+4]  
 b) A 4 pole, 50 Hz, 3-phase slip ring induction motor has star connected stator and rotor windings. The rotor winding has impedance of  $(1+j4)\Omega$  per phase at stand still. The stator to rotor turn ratio is 2. Given that emf induced in rotor circuit is 400 V between two slip rings at stand still. Calculate starting current and running current at 1400 rpm. [8]
5. a) A 1200 KVA, 6000 V, 3 phase star connected stator of a synchronous generator has a armature resistance of 0.4 ohms/phase and synchronous reactance of 6 ohm/phase. The generator delivers full load current at pf 0.8 lagging at normal rated voltage. Calculate the terminal voltage for the same excitation and load current at 0.8 pf leading. [8]  
 b) Why single phase induction motors are not self-starting? Explain any two starting methods for single phase induction motor. [8]



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**Subject:** - Power System (EE553)

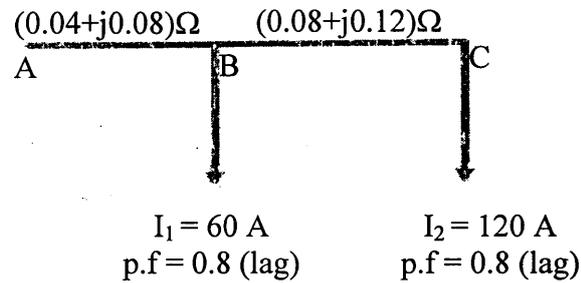
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1. a) What are the advantages of adopting high voltage for transmission of ac electric power? Explain with mathematical expression. [6]
- b) Two towers support an overhead transmission line at a river crossing at a height of 40 m and 80 m respectively above the water level with a span of 250 m. The working tension is 1800 kg and the weight of conductor is 1.16 kg/m. Find the clearance between the conductor and the water level midway between the towers. [8]
2. a) How does the electric stress varies in an insulated power cable? [4]
- b) What is skin effect? Derive the expression of capacitance of a single phase overhead line. [6]
- c) A 3-phase overhead transmission line has 2 sub conductors per phase separated by 45 cm. The phases are horizontally spaced with center to center distance between adjacent phases equaling 7.5 m and that of between extreme end phases equaling 15 m. The radius of each sub conductor is 16 mm. Calculate the inductance per phase per km of the line. [6]
3. a) A 50 Hz, 3-phase, 132 kV overhead transmission line is supplying a load of 30 MW at 0.9 p.f lagging. The line has a series impedance of  $15+j50 \Omega$ /phase and shunt admittance of  $j2.5 \times 10^{-4}$  S/phase. Calculate the line efficiency and reactive power loss. [6]
- b) How does a transmission line behave as source and sink of reactive power? Why reactive power compensation is required in power system? [6]
- c) A 3-phase transmission line has the following parameters: [4]
  - $A = 0.985 \angle 0.6^\circ$
  - $B = 50 \angle 78.5^\circ \Omega$
  - $V_S = 135.6 \angle 15.6^\circ \text{ kV}$
  - $V_R = 132 \angle 0^\circ \text{ kV}$

Determine the sending end real power.



4. a) What are interconnected grid system? Explain its advantages. Briefly describe why and how frequency of the power system should be maintained constant. [8]
- b) For the following two-wire feeder system, the voltage at the far end C is to be maintained at 400V. Determine the voltage at point A and B. [6]



5. a) What is a load centre? How do rural and urban distribution system differ? [6]
- b) Why do we need to carry out fault analysis in a power system? What are the basic principles of a power system protection scheme? [8]
- c) Draw a neat sketch of transformer protection scheme and briefly explain its operation. [6]

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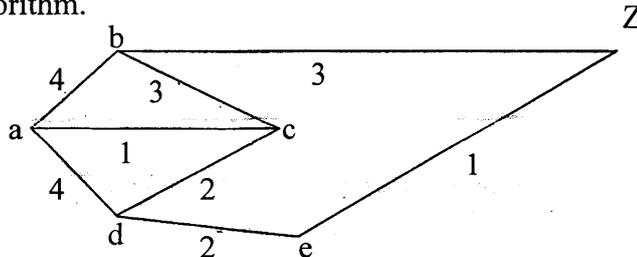


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**Subject: - Discrete Structure (CT551)**

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1. Hypothesis: "If today is Sunday then I will have a test in MFC and IT. If my IT teacher is sick then I will not have a test in IT. Today is Sunday and my IT teacher is sick." Conclusion: "I will have a test in MFC." Use rule of inference to prove it. [8]
2. What do you mean by weak principle of mathematical induction? Prove that  $5^n - 1$  is divisible by 4 for all  $n \geq 1$  using Induction method. [3+5]
3. What are the central ideas of formal and informal proofs? Prove that  $\sqrt{2}$  is irrational. [4+4]
4. Define Non-Deterministic Finite State Automata. Design a finite-state automation that accepts only those set of strings over  $\{a,b\}$  which ends with  $aba$ . Precisely, only those strings which end with  $aba$  should accepted and other strings over  $\{a,b\}$  should be rejected. Your design should include the proper definition of the finite-state automation, transition table and the transition diagram. [2+6]
5. Consider the regular grammar  $G = (N, T, P, \sigma)$  where  $N$  =set of non-terminal symbols =  $\{\sigma, C\}$ ,  $T$  = set of terminal symbols =  $\{a, b\}$ ,  $P$  is the set of production rules =  $\{a \rightarrow b\sigma, \sigma \rightarrow aC, C \rightarrow bC, C \rightarrow b\}$  and  $\sigma$  being the starting symbol. Construct a non-deterministic finite state automaton equivalent to the given regular grammar. Use this non-deterministic finite state automaton to generate equivalent deterministic finite state automaton. [4+4]
6. What do you understand by recurrence relation? Explain in brief. Setup a recurrence relation for the sequence representing the number of moves needed to solves Hanoi Tower puzzle. [3+5]
7. Draw neat and clean graphs of:  $W_6$  (a wheel with 6 peripheral vertices),  $K_6$  (a complete graph with 6 vertices),  $Q_3$  (a 3 dimensional hypercube) and  $K_{2,5}$  (complete bipartite graph). Use graph coloring technique to color each of these graphs and state their respective chromatic numbers. [4+4]
8. Find the shortest path from vertex a to vertex Z Highlight the shortest paths in the graph using Dijkstra's Algorithm. [6+2]



9. Explain the Euler circuit and Hamilton circuit with example. State the necessary and the sufficient conditions for them. [2+2+2+2]
10. Write short notes on: [4+4]
  - i) Spanning Trees
  - ii) Max-flow min-cut theorem

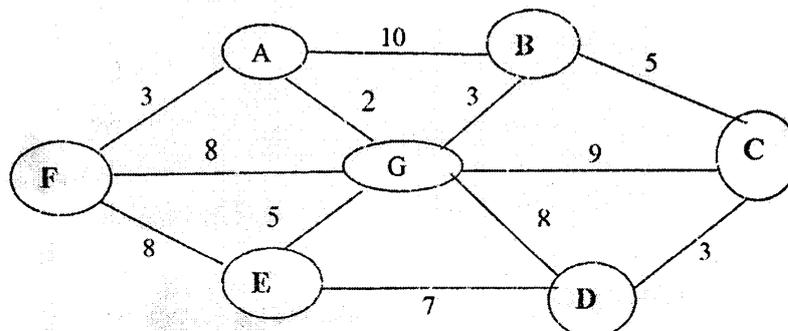


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**Subject: - Data Structure and Algorithm (CT552)**

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1. Describe value definition and operator definition of ADT and apply it to describe STACK. [4]
2. What is a stack data structure? Is stack a linear or non linear data structure. [3+2]
3. When do you get error message "Queue overflow and Queue underflow"? Explain with example. [2+3]
4. How do you implement array to represent queue as list? [6]
5. In a linked list data cannot be accessed randomly, Justify with suitable example. Write complete algorithm to implement circular queue linked list. [2+8]
6. Explain a Tower of Hanoi for '3' disks and also generate recursion tree. Explain the basic principle of recursion with example. [6+2]
7. Write an algorithm to implement a Binary Search Tree using doubly linked list. [6]
8. Describe an AVL tree. Construction AVL tree for following sequence of elements 3, 2, 1, 4, 5, 6, 7, 16, 15, 14, 13, 12 [2+4]
9. Explain Radix sort and sort the numbers 345, 654, 924, 123, 56, 72, 555, 808, 911 and 57. [8]
10. Write down the algorithm for binary search with suitable example. [8]
11. Explain about Big-oh notation with its significance and limitation. [4]
12. Explain Kruskal algorithm for finding minimum spanning tree in a graph. [10]



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