NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Even Semester Mid-term Examination 2022-23

Course Code: EEC 401 Full Marks: 25

Course Name: Power System-I Time: 90 Mins

Question Paper No.: NITDGP/EEC 401/1 Date of Exam:20.02.2023

Instructions: (i) Figures in the margin indicate full marks.
(ii) Answer any **three** questions from **Part-I** and **two** from **Part-II**; (iii) Assume any data if needed.

PART-I			
			Mapped CO
1(a).	What are the different standardized voltages used in transmission and distribution systems in India?	2	CO 1
(b).	Show that the expression of the most economical voltage of transmission for a specific power (P) and a particular length (L) of a line is $\sqrt{\frac{EPL}{(BP+DL)}}$ where B, D, and E are constants.	3	
2.	A 600m long, direct current two wire distributor is fed at both ends A and B at 400V. It has a concentrated load of 150A at a distance of 150m from the feeding point A and a uniformly distributed lighting load of 1A/m for a distance of 200m from end B. The go and return resistance of the distributor is 10^{-4} ohm/m. Calculate (i) the point of minimum potential in the system and (ii) the consumer voltage at point of minimum potential.	5	CO 1
3.	The daily load cycle of a 3φ, 33kV, 50Hz, 10km long line is as follows: 20MW at 0.8 power factor for 6 hours, 15MW at 0.85 power factor for 8 hours and 10MW at 0.9 power factor for 10 hours. The cost of the line per km including erection is ₹ (5a + 5), where 'a' is the cross sectional area of each conductor in cm^2. The rate of interest and depreciation is 8% of the capital cost. The cost of energy is ₹ 5 per kWh. The line is in use for whole of the year. The resistance per km of each conductor is 0.18/a Ω. Determine the most economical cross sectional area of the conductor.	5	CO 1
4.	A single span of a transmission line is 300m long, the supporting structures being level. The conductor radius is 10mm and weighs 2.0 kg/m in length. Find the sag which must be allowed if the wind pressure is 35kg/m^2 of the projected area and 10 mm radial ice coating over the conductor's surface. Tension in the conductor is not to exceed one-fourth of the ultimate strength of 4200kg/cm^2 and the weight of ice is 910 kg/m^3.	5	CO 2
PART-II			
5.	What is the difference between flashover voltage and puncture voltage of a line insulator. "Creepage path is an important parameter to calculate flash over voltage of a line insulator", justify the statement. Where do we require to use post type insulator? Why the upper surface of disc insulators always have some slope w.r.t horizontal plane.	1+2+1 +1	CO 4
6.	Design a 33 kV suspension Insulator string with string efficiency of 95 %. What can be the possible solution if it's string efficiency needs to be improved to 97 %?	4+1	CO 4
7.	What are the advantages of XLPE cables over other types of insulated cables? What do you mean by radial and tangential stresses of insulated cables? Explain it with suitable sketck. Why does effective insulation resistance of cables reduce due formation of air pockets?	2+2+1	CO 5

Course Outcomes:

On completion of the course, the students will be able to:

- CO1: find out economical voltage, minimum consumer voltage for different kinds of loads for transmission of electrical energy, and suggest remedies to improve the voltage if needed.
- CO2: evaluate different parameters associated with electrical design and mechanical design of transmission lines, including the presence of neighbouring communication lines.
- CO3: analyze the performance of short, medium, and long-distance transmission lines.
- CO4: apply the knowledge to find out different important parameters of insulators and know different methods to improve the performance parameters of the insulators.
- CO5: select the appropriate type of power cables for different applications and determine operating voltage, charging current, charging kVAR, insulation resistance, and dielectric power loss of power cables.
- CO6: mitigate different adverse situations that may arise due to corona.

Q. No. EEC - 402 0105 ND/B.Tech./Even

Reg/2022-23

2022-23

ELECTRICAL MACHINES-I

EEC - 402

Full Marks : 25 Time : Ninety Minutes

The figures in the margin indicate full marks.

Answer any *five* questions.

1. Draw and explain the different parts of dc machines. Also distinguish the self and separately excited dc machines. 3+2 [CO1 & CO2]

2. Draw the lap-winding diagram in the developed form for a 4-pole, 12-slot armature with two coil-sides/slot. Assume single-turn coils. Indicate the number and position of brushes on the commutator. What is the number of parallel paths? 5 [CO2]

3. A dc shunt generator fails to build up voltage when it is run at rated speed. What must be the possible reasons for this? Explain. 5 [CO4]

4. A 150 kW, 250V, 6 pole lap wound generator has 600 conductors on its armature. Due to armature. Due to armature reaction if the MNA are shifted by 18° electrical, determine (i) demagnetising ampere-turns (ii) cross-magnetising ampereturns (iii) series turns required to balance the demagnetising component neglecting magnetic leakage. 5 [CO3 & CO4]

P.T.O.

5. In a 110V compound generator, the resistance of armature, shunt and series field winding are 0.06Ω, 25Ω and 0.04Ω respectively. The load consists of 100 lamps, each rated as 55W at 110V. Find the total electromotive force and armature current when the machine is connected as (i) long shunt and (ii) short shunt. 5 [CO3 & CO4]

6. The following figures give the open-circuit characteristics of a dc shunt generator at 300 rpm:

I_f (A)	0	0.2	0.3	0.4	0.5	0.6	0.7
V_{oc} (V)	7.5	93	135	165	186	202	215

The field resistance of the machine is adjusted to 354.5 ohm and the speed is 300 rpm. (i) Determine graphically the no-load voltage. (ii) Determine the critical field resistance. (iii) Determine the critical speed for the given field resistance. (iv) What additional resistance must be inserted in the field circuit to reduce the no-load voltage to 175V. 5 [CO4]

Course Outcomes :

- CO1 : Able to understand the fundamental principles and classification of electromagnetic machines.
- CO2 : Ability to design and armature winding.
- CO3 : Able to learn about the constructional details and principle of operation of dc machines.

- CO4 : Acquire knowledge about the working of dc machines as generators and motors.
- CO5 : Acquire knowledge about the constructional details, principle of operation of transformers.
- CO6 : Acquire knowledge about testing and applications of dc machines & transformers.

Q. No. EEC - 403 0106 ND/B.Tech./Even

Reg/2022-23

2022-23

DIGITAL ELECTRONICS

EEC - 403

Full Marks : 25 Time : Ninety Minutes

The figures in the margin indicate full marks.

Answer to the **Qusestion 1** (compulsory) and **any two (2)** questions from **Part-A** and **any three (3)** questions from **Part-B**

Part - A

1. Using the battery powered lamp circuits, explain NOT, AND, OR, NAND and NOR logics. 5 [CO1]

2. With a net diagram of a practical digital HIGH signal explain the terms: signal amplitude, signal width, rise time and fall time. 4 [CO1]

3. Using a –9 Volt DC power supply, design an electronic circuit (analog/digital) to generate digital data/signal representing a binary sequence of 10101. 4 [CO2]

4. With a net schematic diagram show the gate realization circuit for a NOT gate using a 7404 IC. 4 [CO2]

5. Perform the following binary operation:

$(01011110_2 + 000111_2) \times (111010101_2 - 1010101_2)$

4 [CO2]

P.T.O.

Part - B

6. Illustrate the method of 1 bit error detection and correction using 7 bit Hamming code during transmission of 4 bit data.

4 [CO1]

7. Represent the unsigned decimal numbers 791 and 658 in BCD, and then show the steps necessary to form their sum.

4 [CO1]

8. Convert each of the following to the other canonical form:

(a) $F(x,y,z)=\sum(1,3,5)$

(b) $F(A,B,C,D)=\prod(3,5,8,11)$ 4 [CO2]

9. Reduce the following Boolean expressions to the indicated number of literals

(a) $A'C' + ABC + AC'$ to three literals

(b) $A'B(D' + C'D) + B(A + A'CD)$ to one literal. 4 [CO2]

10. Reduce the Boolean function $f=\sum(1,5,6,7,8,9,10,14)$.

4[CO2]

Course Outcomes :

- CO1 : Acquire an idea about digital electronics and its applications.
- CO2 : To learn the fundamentals of different numbers systems and codes and code conversion techniques.
- CO3 : To study about the Boolean algebra and basic logic gates along with their digital design procedure using elementary logic gates.
- CO4 : To learn about the different sequential and combinational logic circuits and their use in digital electronics applications.
- CO5 : Learn about the Analog to Digital Converter (ADC), Digital to Analog Converter (DAC), and data conversion and acquisition techniques.
- CO6 : To study the different types of Codes (Gray code, Excess-3 code, BCD Code etc.) and Code converters.

Q. No. EEC - 431 101 ND/B.Tech./Even

Reg/2022-23

2022-23

CONTROL SYSTEM

EEC - 431

Full Marks : 25 Time : Ninety Minutes

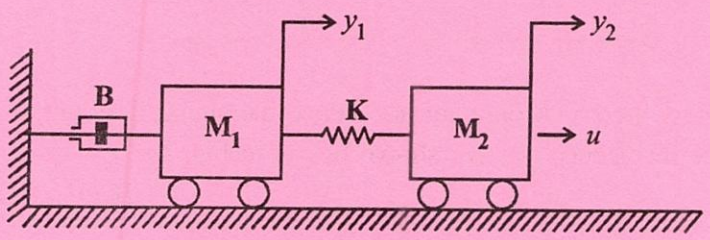
The figures in the margin indicate full marks.

Answer any *five* the questions.

Group - A

1. Obtain the transfer function **Y1(s)/U(s)** for the mechanical system given in **Fig. 1** and draw the force current analogy.

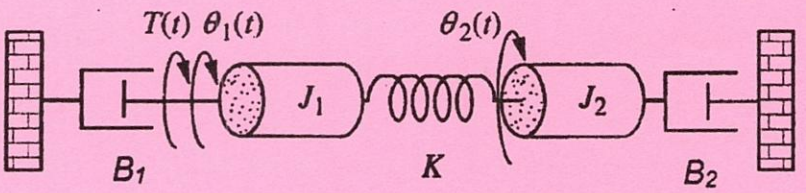
5 [CO1, CO2]



P.T.O.

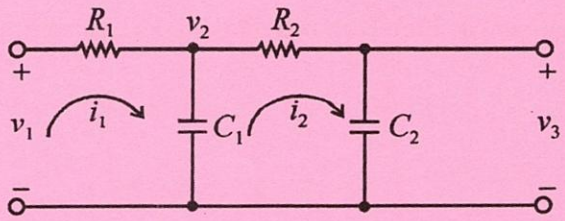
2. Obtain the state space model for the mechanical system given in Fig. 2 and draw the torque voltage analogy.

5 [CO1, CO2]



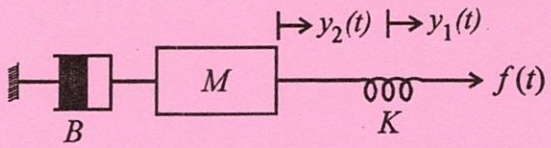
3. Draw the block diagram and hence the signal flow graph of the circuit given below in Fig. 3 The initial condition of node voltages are 0.

5 [CO1, CO2]



4. Draw the block diagram and hence the signal flow graph for the mechanical system shown below in Fig. 4.

5 [CO1, CO2]



5. Reduce the system given in Fig. 5 in a single transfer function C(s)/R(s)

5 [CO2]

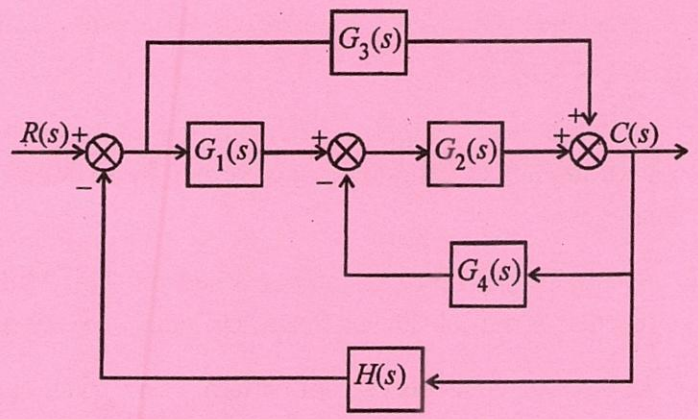
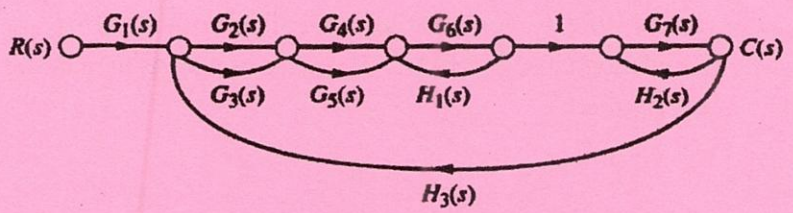


Fig. 5

6. Using the Mason's gain formula find the transfer function **C(s)/R(s)** for the signal flow graph given by Fig. 6.

5 [CO2]



7. Write the advantages of open loop and closed loop system. Draw a schematic diagram of a closed loop control system mentioning the significant components. 1+2+2 [CO1]

P.T.O.

Course Outcomes :

CO1 : To get the knowledge of basic objectives of control system design

CO2 : To derive input-output relationship of systems based on their mathematical modeling governed by basic laws of physics

CO3 : To justify stability of systems based on their transfer functions, time domain and frequency domain specifications

CO4 : To develop concepts on root pattern with variable gains and comment on the stability

CO5 : To determine the stability of closed-loop system based on open loop frequency response

CO6 : To be able to design controllers so as to meet design specifications both in time as well as frequency domain

CO7 : To be able to realize the controller both in software simulation through MATLAB coding as well as in realtime environment.

Q. No. EEC - 432 197 ND/B.Tech./Even

Reg/2022-23

2022-23

ELECTRICAL MACHINES

EEC - 432

Full Marks : 25 Time : Ninety Minutes

The figures in the margin indicate full marks.

Answer any *five* questions.

1. Draw and explain the different parts of dc machines. Also derive the e.m.f. equation of dc generator.
3+2 [CO1 & CO2]

2. Explain the process of voltage build-up of dc shunt generator. Mention the condition and importance of voltage build up.
2.5+2.5 [CO1 & CO3]

3. Draw and illustrate all the characteristics of dc shunt motor.
5 [CO1 & CO3]

4. A load of 7.5 kW at 230V is supplied by a short-shunt cumulatively compound DC generator. If the armature, series, and shunt field resistances are 0.4, 0.3 and 100 ohms respectively. Calculate the induced emf and the load resistance.

5. A dc shunt motor rated 10 kW connected to 250V supply is loaded a draw 35A armature current running at a speed

P.T.O.

of 1250 rpm. Given Ra = 0.5 ohm, (a) Determine the load torque if the rotational loss is 500W. (b) Determine the motor efficiency if the shunt field resistance is 250 ohms. 5 [CO5]

6. A dc shunt motor runs at 1200 rpm on no-load drawing 5 A from 220V mains. Its armature and field resistances are 0.25 ohm and 110 ohms respectively. When loaded, the motor draws 62A from the mains. What would be its speed? Assume that the armature reaction demagnetizes the field to the extent of 5%. Also calculate the internal torque developed at no-load and on load. What is the motor shaft troque at load. 5 [CO5]

Course Outcomes :

- CO1 : Theory of electromechanical energy conversion, the concepts of voltage generation and fundamental torque equation.
- CO2 : Basic understanding of the principles of operation and construction of direct and alternating current machines and transformers.
- CO3 : A study of theory and concept of Electric Machines (AC & DC)
- CO4 : Deriving equivalent circuit of electrical machines.
- CO5 : Studying the performance and characteristics of Electrical machines (AC & DC)

Q. No. EEC 601/ 107

B.TECH/EVEN
REG/(22-23)

Even Semester Mid-term Examination, 2022-23

ADVANCED POWER SYSTEMS

EEC 601

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

All parts of any questions should be answered at one place.

Materials to be supplied: NIL

Only neat & clean Sketches will be eligible for marks

GROUP A

Answer *all* the questions.

Question No.	Body of the Question	Marks	Mapped CO

1. Design the 'High Voltage Zone' for a Generating and Two Receiving substation's with the individual rating of High Voltage Line materials such as Bus bar, transformer, Isolators, CBs, CTs, PTs & LAs with neat sketch. The substations and transmission line should satisfy the following parameters: 9 CO1

   Generation Voltage =3.3kV

   Generation Power = 180 MW

   Transmission Voltage= 132kV

Outgoing Voltage & Power of Receiving Substation 1= 33kV,l20MVA

Outgoing Voltage & Power of Receiving Substation 2=11 kV, 60 MVA Service

Voltage = 230 V

** Assume any relevant parameters for the design if required.

2. Describe 'Classification of different Class of Solid Insulation with Temperature characteristics' with neat sketch. 3 CO1 & CO2

3. Describe any four parameters which influences the dielectric strength' of air as insulation in brief with neat sketch. 6 CO2

Or

Describe any four properties of insulation in brief with neat sketch.

GROUP-B

(Answer any *one* question)

4. Develop an expression for the maximum steady state power which can be transmitted over the line if the voltage at each end is maintained constant. Neglect the effect of capacitance of the line. Show that if the reactance X of the line could be varied , the resistance remaining constant, the maximum steady state power that could be transmitted over the line would be greatest, when $X=\sqrt{3}\,R$ 7 CO6 & CO7

5. The ABCD constants of a nominal $\prod$ network representing a three-phase transmission line are, $A=D= 0.97\angle 0.6°$, $B=60\angle 70°$, $C= 0.001\angle 91°$

Find the steady state stability limit, if both the sending end and receiving end voltage are held at constant at 132 KV,

(a) with the ABCD constants as given

(b) with the shunt admittance neglected and

(c) with both the series resistance and shunt admittance neglected. 7 CO6 & CO7

COURSE OUTCOMES

CO1: To understand basics of High Voltage Engineering & power system stability

CO2: To design the insulation system and load management module

CO3: To design the High Voltage test system and Laboratory

CO4: To learn about the testing of High Voltage power apparatus

CO5 To understand on line monitoring and conditioned monitoring

CO6: Given specification of stability analysis leads to modeling of power system equipment's like

transmission line, generator and design system to obtain operating limits to satisfy the reliability criteria.

CO7: Given specification leads to knowledge of regulation of active, reactive power and frequency of any system and its application in optimal load How and scheduling

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Q. No. EEC 602/ 123

B.TECH/EVEN
REG/(22-23)

Even Semester Mid-term Examination, 2022-23

MICROPROCESSOR AND MICROCONTROLLER

EEC 602

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

Answer *all* the questions.

Question No.	Body of the Question	Marks	Mapped CO

1. (a) Explain the operations of following pins of 8085:

   (i) HOLD

   (ii) TRAP

   b) Explain about the following instructions of 8085:

   (i) SHLD D100H

   (ii) DAD D

   (iii) XTHL 2×5 CO1, CO2

2 (a) Draw the Functional Block Diagram of 8085 microprocessor and explain each block in brief.

   (b) Show the 8085-timing diagram for the execution of IN O1H instruction. 5+5 CO2, CO2

3. Design a system that utilizes an 8085 microprocessor and has a total memory space of 16 kilobytes. This

system should implement one 8 kilobyte EPROM and one 8 kilobyte RAM. The circuit diagram should clearly depict the connections between the microprocessor and the memory units, including the Address, Data, Read, Write, and Chip Select lines.

5 CO1, CO2, CO3, CO4

COURSE OUTCOMES

CO1:

CO2:

CO3:
