

4TH SEM./ ELECTRICAL/ 2022(S)

TH-1 Energy Conversion-I

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. What is the number of parallel paths in lap winding and wave winding in DC machines?
 - b. What is the role of back emf in DC motor running?
 - c. Why breather is used in transformer?
 - d. What are the factors which affect the torque of DC motor?
 - e. State the two methods of improving commutation in DC Generator.
 - f. What do you mean by burden in instrument transformers?
 - g. State any two cooling methods of transformer.
 - h. What is 'all day efficiency' in distribution transformers?
 - i. Why the C.T. secondary should not be kept open?
 - j. Write any two applications of Auto transformer.

2. Answer Any **Six** Questions 6 x 5
 - a. Describe the armature control method in speed control of DC shunt Motors.
 - b. Write the differences between core type transformer and shell type transformer.
 - c. Explain the role of compensating windings in DC generator.
 - d. A 4-pole, lap wound DC shunt generator has a useful flux per pole of 0.07 Wb. The armature winding consists of 220 turns each of 0.004Ω resistance. Calculate the terminal voltage when running at 900 RPM if the armature current is 50 A.
 - e. Explain the operation of ON Load Tap changer in transformer using resistor transition.
 - f. Write a short note on potential transformer (PT).
 - g. A 25 kVA transformer has 500 turns on the primary and 50 turns on the secondary winding. The primary is connected to 3000V, 50Hz supply. Find the full load primary and secondary currents, the secondary e.m.f and the maximum flux in the core. Neglect leakage drops and no load primary current.

- 3 Explain the saving of copper in auto transformer as compared to ordinary two winding transformer. 10
- 4 The armature winding of a 4-pole, 250V DC shunt motor is lap connected. There are 120 slots in each slot containing 8 conductors. The flux per pole is 20 mWb and current taken by the motor is 25A. The resistances of armature and field circuit are 0.1Ω and 125Ω respectively if the rotational losses amount to be 810W. Find (i) Gross torque
(ii) Useful torque and
(iii) Efficiency. 10
- 5 Describe the process of commutation in DC Generator along with sketch diagram in details. 10
- 6 Explain about the care and the maintenance of transformer on daily, monthly and yearly basis. 10
- 7 A 25 kW, 250V, DC shunt generator has armature and field resistances of 0.06 ohm and 100 ohm respectively. Determine the total armature power developed when working (i) as a generator delivering 25 kW output and (ii) as a motor taking 25 kW. 10

Th2 ANALOG ELECTRONICS AND OPAMP

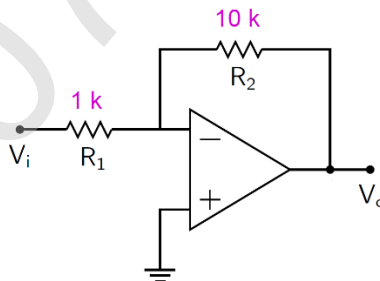
Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions. 2 x 10

- a. Define knee voltage of a PN junction diode. Write the values of cut in voltage for Si and Ge diode.
- b. What is the role of intrinsic (I) layer in a PIN diode?
- c. Define ripple factor and mention its values for Half Wave and Full Wave rectifier.
- d. Draw the transistor configurations for CB, CE.
- e. What are the needs for transistor biasing?
- f. Write the advantages of negative feedback in amplifier.
- g. Differentiate between BJT and FET.
- h. Define CMRR and Slew Rate of an OPAMP.
- i. If $V_i = -10V$, then find V_o .



- j. Draw the simplified circuit diagram of a series clipper. Plot its output waveform for an input $v_i(t) = 5 \sin \omega t$

2. Answer **Any Six** Questions 6 x 5

- a. Explain the working of Zener diode as voltage regulator.
- b. Define a filter circuit? Draw the circuit diagram of pi (π) filter and explain its working.
- c. Draw the circuit diagram for voltage divider bias configuration. Determine its operating point and stability factor.
- d. Differentiate between voltage and power amplifier.
- e. Design a subtractor using OPAMP.

- f. Find the h parameters of CE configuration and draw the simplified diagram.
 - g. Find the expressions for voltage gain of inverting and non-inverting OPAMP.
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- | | | |
|---|--|----|
| 3 | With neat circuit diagram explain the working of RC coupled amplifier with its frequency response curve. | 10 |
| 4 | With neat circuit diagram explain the working of Class – B push pull amplifier. | 10 |
| 5 | Define Barkhausen Criterion for oscillation. Draw the circuit diagrams of Colpitts and Hartley oscillator using BJT. Also specify their frequency of oscillation. | 10 |
| 6 | Design an integrator and a differentiator using OPAMP. | 10 |
| 7 | Explain the working of full wave bridge rectifier. Derive the expressions for DC and RMS values of rectifier output. Calculate its rectification efficiency and ripple factor. | 10 |

TH-3 Electrical Measurement & Instrumentation

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define accuracy and sensitivity.
 - b. State the types of measuring instruments.
 - c. What are the three essential features of indicating instruments?
 - d. State the classification of moving coil instruments.
 - e. State the types of errors in dynamometer wattmeters.
 - f. Define creeping and what is its cause?
 - g. Write down two advantages of bridge circuits.
 - h. Define transducer.
 - i. State two uses of capacitive transducers.
 - j. What is a CRO?
2. Answer **Any Six** Questions 6 x 5
 - a. Write down the advantages of moving iron instruments.
 - b. Give a comparison between analog and digital multi meter.
 - c. What is a megger? Explain its construction with working principle.
 - d. Define Hall effect. Write some applications of Hall effect transducers.
 - e. State the operating principle of induction type wattmeter. Write down the advantages and disadvantages of it.
 - f. State the applications of CRO.
 - g. What is a thermistor? Write down the applications.
3. Explain Deflecting, controlling and damping arrangements in indicating type of instruments. 10
4. Describe Construction and principle of working of Dynamometer type wattmeter. 10
5. Explain the principle of operation and working of dynamometer type single phase power factor meter. 10
6. Explain the construction and working principle of LVDT with a neat diagram. 10
7. With a neat diagram, explain briefly the main parts of a cathode ray tube. 10

Th4 Generation, Transmission and Distribution

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2

Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
- What is photovoltaic effect?
 - Why transmission of electric power by high voltage DC is superior to that of high voltage AC system?
 - State Kelvin's law.
 - What are the factors affecting sag in an overhead line?
 - Write the methods of reducing corona effect?
 - What is a booster transformer?
 - Write the characteristics of Tariff.
 - Define diversity factor.
 - What do you mean by Ferranti effect?
 - Define voltage regulation.
2. Answer **ANY SIX** questions 6 x 5
- Describe the working of Nuclear power plant with proper sketch.
 - Differentiate between EHVAC and HVDC system.
 - Explain different connection schemes of distribution system.
 - A two wire distribution AD is 225m long. The various loads and their positions are given below
- | At point | Distance from A in meters | Concentrated load in A |
|----------|---------------------------|------------------------|
| B | 75 | 12 |
| C | 175 | 15 |
| D | 225 | 20 |
- The cross sectional area of each conductor is 0.27 cm^2 . The end A is supplied with 250 V. Resistivity of the wire is $1.78 \mu\Omega \text{ cm}$. Calculate the current in each section of the conductor, the two core resistance of each section and the voltage at each tapping point.
- Describe Murray loop test for localization of earth fault in underground cables.
 - Explain different types of insulator.

- g A generating station has following data
 Installed capacity= 300 MW, capacity factor= 50%, Annual load factor=60%, Annual cost of fuel, oil, etc= Rs. 9×10^7 , capital cost= Rs. 10^9 , annual interest & depreciation= 10%. Calculate minimum reserve capacity of the station and the cost per kWh generated?
- 3 a. Define Sag. 02
 b. A transmission line has a span of 250m between supports, the supports being at same level. The conductor has a cross-sectional area of 1.29 cm^2 . The ultimate strength is 4220 kg/cm^2 and factor of safety is 2. The wind pressure is 40 kg/cm^2 . Calculate the height of the conductor above ground level at which it should be supported if a minimum clearance of 7m is to be kept between the ground and the conductor. 08
- 4 A 3 phase, 50 Hz overhead transmission line has following constants 10
 Resistance/phase=9.6 ohm, Inductance/phase= 0.097mH,
 Capacitance/phase=0.765 μ F
 If the line is supplying a balanced load of 24000 KVA 0.8 p.f lagging at 66 KV, using nominal π method Calculate
 i. Sending end current
 ii. Line value of sending end voltage
 iii. Sending end power factor
 iv. Percentage regulation
 v. Transmission efficiency.
- 5 A three phase ring main ABCD fed at A at 11 KV supplies balanced loads of 10
 50A at 0.8 p.f lagging at B, 120A at unity p.f at C and 70A at 0.866p.f lagging at D, the load currents being referred to the supply voltage at A. The impedances of the various sections are:
 Section AB= $(1+j0.6)\Omega$; Section BC= $(1.2+j0.9)\Omega$; Section CD= $(0.8+j0.5)\Omega$;
 Section DA= $(3+j2)\Omega$. Calculate the currents in various sections and station bus-bar voltages at B, C & D.
- 6 a. State different type of Bus-bar arrangements in substation. 03
 b. Draw the layout of 66/11 KV substation. 07
- 7 Write short notes on 5 $\times$ 2
 a. Necessity of EHVAC Transmission.
 b. Laying of Underground cables.