

6TH SEM./EME/ ELECTRICAL / 2022(S)

TH1 ELECTRICAL INSTALLATION AND ESTIMATING

Full Marks: 80

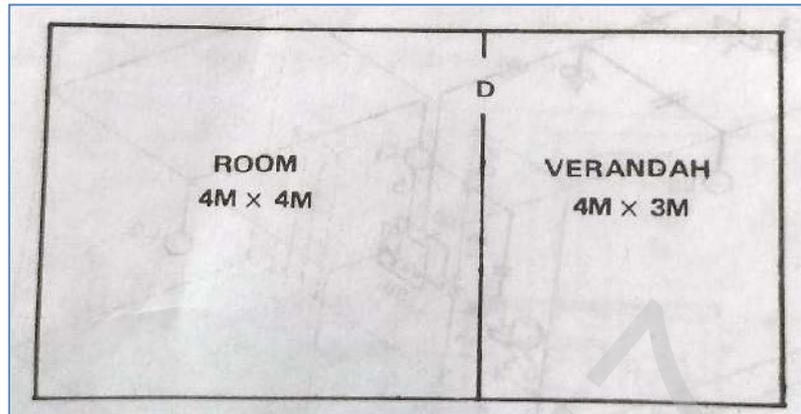
Time- 3 Hrs

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. Name any two types of methods of earthing.
 - b. Write any two important properties of ACSR conductors used in transmission lines.
 - c. State the Rule 31 of Cut-out premises in general safety precautions of Indian Electricity Rules.
 - d. How Britannia straight joint is made between two bare wires?
 - e. State any two accessories of conduit wiring system.
 - f. Define (i) Depreciation factor (ii) Luminous flux in illumination.
 - g. Name the material of filament and gas used in halogen lamp.
 - h. Expand the abbreviation of ACSR, TPIC, TRS, and MCCB used in electrical estimation.
 - i. What is the declared voltage and frequency of supply to consumer as per IE rules?
 - j. Define(i)Black conduit (ii) Bird Guards

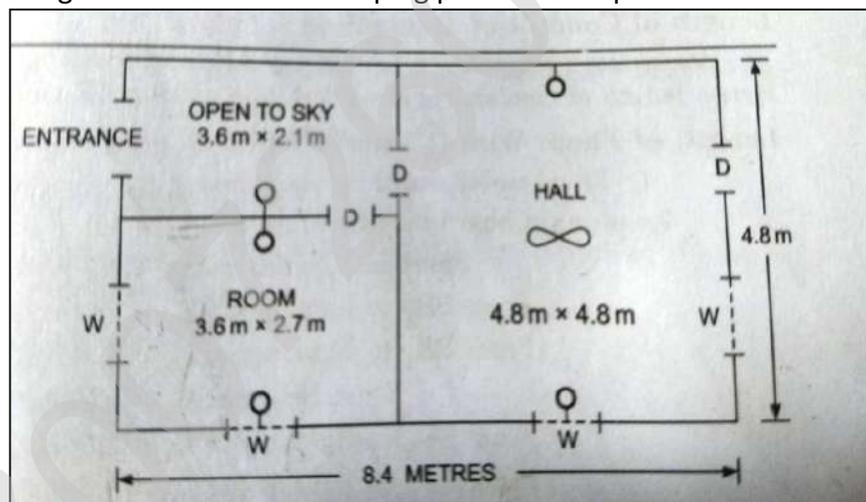
2. Answer **Any Six** Questions 6 x 5
 - a. Explain about the installation of service line for low roof or single storeyed building briefly.
 - b. Draw a neat labelled sketch diagram of plate earthing.
 - c. Explain the construction and working of RCCB briefly.
 - d. Explain about the High Pressure Mercury discharge lamp briefly with a neat diagram.
 - e. Describe the qualities and applications of PVC insulated wires.
 - f. Write a short note on Steel towers used for supporting transmission lines.
 - g. What are the differences between concealed conduit wiring and TRS wiring?

3. A room and a verandah, the plan of which is given below is required to be provided with electrical wiring. Mark the location of energy meter, main switch and switch board and electrical points suitably and draw the installation plan showing supply path to each point and wiring diagram. Calculate the total length of wire required for wiring the room and verandah in batten system of wiring. Assume: Total height of ceiling= 3.5 mts. Height of HR from floor=3.0 mts, Height of SB from floor=1.5 mt. Location of energy meter and main switch board =0.5 mt. inside verandah on room wall. 10



4 Explain the sequences to be followed in carrying out the estimate of domestic electrical installations (from drawing installation plan to preparing material table) in details. 10

5 Draw the electrical circuit and calculate the length of PVC Casing-Capping, phase & neutral wire for the wiring used in a house, the plan of which is given below. Assume the height of ceiling as 3.6 meters and one plug point is to be provided in each room. 10



6 In a city locality, an overhead distribution line of 400 volts, 3 phase, 50 cycles/sec is to be erected along a straight route on steel tubular poles. The length of the line is 500 meters and the line terminates at the end. Make a neat sketch of a tubular pole with 3-phase wires, earth wire, neutral wire and street light conductor, shackle insulators, reel insulator cable box, stay wire etc. and estimate the quantity of material required for installing the distribution line with full specification of each item. Size of ACSR conductors, for all types of wires, is 6/1x2.11 (squirrel conductor), Weight of ACSR conductor=85kg/km, Earth wire Galvanized steel is of 8 SWG, Weight of earth wire=10mts/kg, Line Sag=2% 10

7 There are four light/power sub circuits in an installation of a house wiring as follows: 10

- No. 1 Sub-Circuit: Light points-2nos., Fans-2 nos., 5A Socket-4 nos.
- No. 2 Sub-Circuit: Light points-5nos., Fans-2 nos., 5A Socket-2 nos.
- No. 3 Sub-Circuit: Light points-2nos., Fans-3 nos., 5A Socket-3 nos.
- No.4 Sub-Circuit: 15A Socket-1 no (1000W).

Assuming each fan is of 70W, each light is of 40W, each 5A socket is of 60W and supply voltage is 230V. Calculate the Total load in amperes assuming unity power factor. Also draw the single line diagram showing cut-out, energy meter, main switch board, and main distribution board.

6th Sem. /ELECT./EEE/ ELECT(I & C)/EME / 2022(S)
TH-2 Switchgear and Protective Devices

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(i) TSM(ii) Symmetrical fault
 - b. State any two important faults that occur on an alternator.
 - c. What is the use of distance relay?
 - d. What are the factors on which RRRV (rate of rise of restriking voltage) in circuit breaker depends?
 - e. What are the desirable characteristics of fuse element?
 - f. State any two advantages of static relay.
 - g. A fuse wire of circular cross-section has a radius of 0.8 mm. The wire blows off at a current of 8A. Calculate the radius of the wire that will blow off at a current of 1A.
 - h. What is the function of surge absorber?
 - i. Define(i) Short circuit kVA (ii) Recovery voltage
 - j. Write any two advantages of valve type lightning arrester.

2. Answer **Any Six** Questions 6 x 5
 - a. What steps to be taken for the maintenance of oil circuit breakers?
 - b. Write a short note on High voltage fuses.
 - c. A 3-phase, 20 MVA, 10 kV alternator has internal reactance of 5% and negligible resistance. Find the external reactance per phase to be connected in series with the alternator so that steady current on short-circuit does not exceed 8 times the full load current.
 - d. Explain the protection of switchgear against lightning using overhead ground wires briefly.
 - e. Write a brief note on plain break oil circuit breaker with a neat diagram.

- f. How time-graded protection of a radial feeder can be achieved using definite time relays and inverse time relays?
- g Describe about the Earth fault or Leakage protection of 3 phase transformer.

- 3 Explain about the construction and operation of Buchholz relay in transformer with neat diagram. 10
- 4 With the help of neat diagram, describe the construction, working of Vacuum circuit breakers and also write its advantages. 10
- 5 Write a brief note on i) Horn-gap arrester ii) Percentage differential relay. 10
- 6 Explain about the construction and operation of Induction type Directional power relay with a neat diagram 10
- 7 Describe the differential protection of Alternators using Merz-Price circulating scheme in details. 10

6TH SEM./ ELECTRICAL/2022(S)

TH-3 Control System Engineering

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 signal flow graph?
 - b. Define phase margin. Is it positive or negative for stable feedback systems?
 - c. What do you mean by velocity error constant?
 - d. Define (i) Gain cross over frequency (ii) Resonant frequency, in frequency domain analysis.
 - e. What is the time response to unit ramp input in first order system?
 - f. What is corner frequency in Bode plot?
 - g. Define (i) Impulse signal (ii) Transfer function.
 - h. What are the open loop poles of $G(s).H(s) = \frac{12(s+1)}{s(s+4)(s+5)}$?
 - i. What do you mean by all pass system?
 - j. What are the advantages of polar plot?

2. Answer **Any Six** Questions 6 x 5
 - a. Explain the effects of feedback in a closed loop control system.
 - b. What are the basic properties of signal flow graph?
 - c. Derive the damped natural frequency from the time response of second-order system to the unit step signal.
 - d. Describe about the PI controller using Block Diagram briefly.
 - e. Write a brief note on Constant-M circles with the help of polar plot.
 - f. An unity feedback control system has an open loop transfer function:
 $G(s) = \frac{K}{s(s^2+4s+13)}$. Find the (i) Centroid of asymptotes (ii) Breakaway point.
 - g. Explain the effect of addition of poles and zeros to $G(S).H(S)$ on the shape of Nyquist plot.

3. Explain all the rules for reduction of Block diagram, used in control systems in details. 10
4. Explain about the Nicholas Chart used in frequency response analysis briefly. 10
5. Describe about the construction and working of AC servomotors in details with the help of a neat diagram. 10
6. Describe the properties, advantages, disadvantages of transfer function in details. 10
7. Derive the expression for rise time, peak time, peak overshoot for second order systems 10

6th Sem./ Electrical / 2022(S)

Th4 Renewable Energy

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 zenith angle?
 - b. Write at least two basic differences between Induction generator and synchronous generator.
 - c. What are the difference between Renewable energy and Non-Renewable energy?
 - d. Why is solar power not widely used?
 - e. Define solar constant?
 - f. Can wind energy make effective use of transmission lines? Justify.
 - g. What are the factors that determine the output from a wind energy converter?
 - h. What are the types of biogas digester?
 - i. What are the environmental impacts of using geothermal energy?
 - j. What is fermentation?
2. Answer **Any Six** Questions 6 x 5
 - a. Describe the operating principle of Solar photovoltaic system?
 - b. Explain principle of wind energy conversion. Define tip speed ratio?
 - c. What is Biomass and enlist various methods for obtaining energy from biomass.
 - d. Describe with neat sketch of different types of vertical axis wind turbine.
 - e. Describe with neat sketch Microhydel-PV system.
 - f. Explain briefly the process of Pyrolysis.
 - g. What are the limitations of Renewable energy sources?
3. Explain briefly Ocean Thermal Energy Conversion (OTEC) system with neat sketch. 10
4. Explain briefly induction generator used in wind power plant with neat diagram. 10
5. Describe single and double output system in wind power station. 10
6. Explain different types of solar collectors with neat sketch. 10
7. Write short on 5+5
 - (a) Wood gassifier
 - (b) MPPT System

6TH SEM ./ ELECTRICAL/ELE & MECH / 2023(S)

TH1 ELECTRICAL INSTALLATION AND ESTIMATING

Full Marks: 80

Time- 3 Hrs

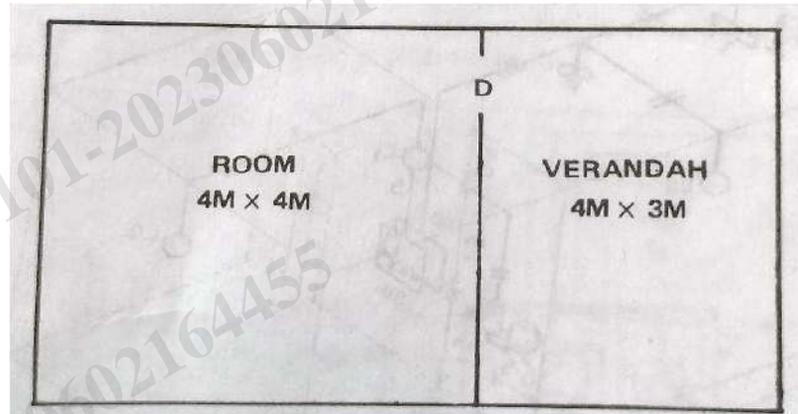
Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define (i) Open Sparking (ii) Concentric Cable.
 - b. Write any two important properties of Glass Insulators used in transmission lines.
 - c. State the Rule 34 of Accessibility of bare conductor of Indian Electricity Rules.
 - d. How Pig tail joint is made between two solid conductors?
 - e. State any two advantages of PVC casing and capping wiring system.
 - f. Name any two types of methods of earthing.
 - g. What are the factors governing height of poles?
 - h. Expand the abbreviation of GI, TPIC, TRS, and RCCB used in electrical estimation.
 - i. What is the declared voltage and frequency of supply to consumer as per IE rules?
 - j. Define (i) Wire splicing (ii) Bird Guards

2. Answer **Any Six** Questions 6 x 5
 - a. Explain briefly about the different schemes of lightening.
 - b. Describe briefly about pipe earthing with a neat diagram.
 - c. Explain the construction and working of ELCB briefly.
 - d. Explain about the Sodium Vapour lamp briefly with a neat diagram.
 - e. Explain about the installation of service line for low roof or single storeyed building briefly.
 - f. Write a short note on shackle insulators in overhead lines with a neat diagram.
 - g. Describe about voltage grading and general specification of cables.

3. A room and a verandah, the plan of which is given below is required to be provided with electrical wiring. Mark the location of energy meter, main switch and switch board and electrical points suitably and draw the installation plan showing supply path to each point and wiring diagram. Calculate the total length of wire required for wiring the room and verandah in batten system of wiring. Assume: Total height of ceiling= 3.5 mts. Height of HR from floor=3.0 mts, Height of SB from floor=1.5 mt. 10

Location of energy meter and main switch board =0.5 mt. inside verandah on room wall.



- 4 Describe about all types of lighting schemes with their advantages and applications in details. 10
- 5 Draw a labelled sketch diagram of pole mounted substation of capacity 50kva transformer of rating 11/0.4 KV, showing disc insulators, TPMS, fuse set, danger plate, stay wire, earthing clearly. 10
- 6 An overhead distribution line of 415volts,3phase,50Hz is to be erected along straight route.The length of the line is 300 meters and the end supports are terminal structures. 10
The span between adjacent poles is 50 meters.Draw a neat sketch of the terminal pole showing all the 3 phases, neutral, earth wire, street light wire. Phase wire-hard drawn bare copper wire no. 4 SWG. Neutral and street light wire- hard drawn bare copper wire no. 8 SWG. Earth wire-GS wire no. 8 SWG. Estimate the quantity of material required for the line.
- 7 There are four light/power sub circuits in an installation of a house wiring as follows: 10
No. 1 Sub-Circuit: Light points-2nos., Fans-2 nos., 5A Socket-4 nos.
No. 2 Sub-Circuit: Light points-5nos., Fans-2 nos., 5A Socket-2 nos.
No. 3 Sub-Circuit: Light points-2nos., Fans-3 nos., 5A Socket-2 nos.
No.4 Sub-Circuit: 15A Socket-2 no (1000W).
Assuming each fan is of 80W, each light is of 40W,each 5A socket is of 60W and supply voltage is 230V.Calculate the Total load in amperes assuming unity power factor. Also draw the single line diagram showing cut-out, energy meter, main switch board, and main distribution board.

TH-2 Switchgear & Protective Device

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 are the types of bus-bar arrangements?
 - b. What is symmetrical fault?
 - c. What are factors in which arc resistance depend?
 - d. What is fusing current and fusing factor?
 - e. What is inverse-time relay?
 - f. What is Merz-price circulating current scheme?
 - g. What is surge absorber?
 - h. What is Instantaneous over current relay?
 - i. What are the important relays and system used for transformer protection?
 - j. What is short-circuit KVA ?

2. Answer **Any Six** Questions 6 x 5
 - a. If the percentage reactance of an element is 20% and full load current is 50 A, then find the short circuit current.
 - b. Explain different method of arc extinction?
 - c. Explain semi-enclosed rewirable fuse and also write its limitation?
 - d. Explain the operation of induction type directional power relay.
 - e. Explain with neat diagram the Balanced earth fault protection of alternator.
 - f. Define and explain the mechanism of lightning discharge.
 - g. Explain the principle of IDMT relay.

- 3 A 3-phase transmission line operating at 10 kV and having a resistance of 1Ω and reactance of 4Ω is connected to generating station bus bars through 5 MVA step up transformer having reactance 5%. The bus-bars are supplied by 10 MVA alternator having 10% reactance. Calculate the short circuit KVA fed to symmetrical fault at the load end of transmission line and at the high voltage terminals of transformer. 10
- 4 Explain the operation of Sulphur Hexa-fluoride (SF_6) circuit breaker with diagram and write the advantages and limitations of SF_6 circuit breaker. 10
- 5 Explain with the help of neat diagram the construction and working of Differential relay. 10
- 6 Explain the operation of Buchholz relay with neat diagram and also write its advantages and disadvantages. 10
- 7 Write short notes on: 10
- (a) Horn-gap lightning arrester
 - (b) Rod-gap lightning arrester

6TH SEM ./ELECTRICAL / 2023(S)
TH-3 Control System Engineering(CSE)

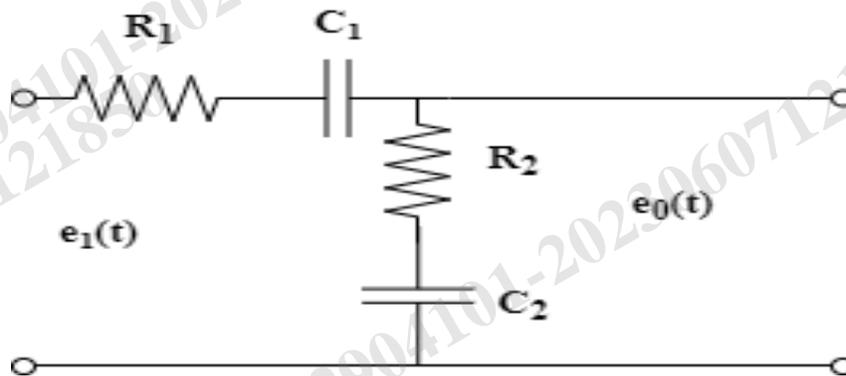
Full Marks: 80

Time- 3 Hrs

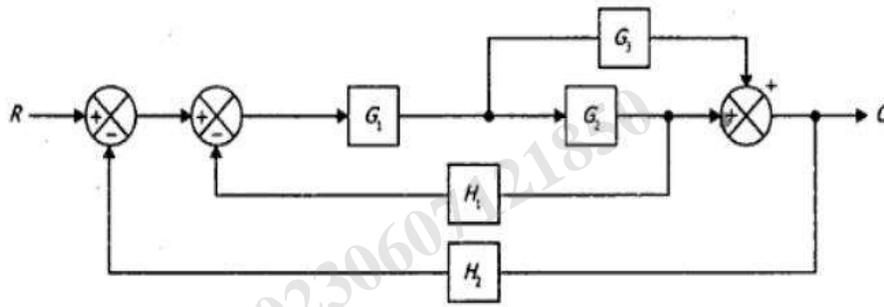
Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks& Use Calculator

1. Answer **All** questions 2 x 10
 - a. How do you define Transfer Function?
 - b. Define Signal Flow Graph (SFG) & write two properties of SFG.
 - c. Write the effect of Negative feedback in control system.
 - d. How do you mean by **Order** and **Type** of a system?
 - e. Define unit impulse function.
 - f. What is the main objective of Root-Locus analysis Technique?
 - g. How do you define relative stability?
 - h. Write the effect of adding poles to closed loop control system.
 - i. Give two disadvantages of closed loop control over open loop control system.
 - j. Define Peak Time.

2. Answer **Any Six** Questions 6 x 5
 - a. Derive the expression for peak time and setting time for the under damped second order system with unit step input.
 - b. Obtain the Transfer Function for the given electrical system

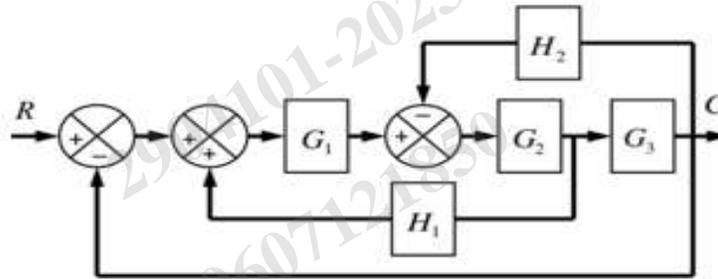


- c. Explain details of PID controller used in control system.
- d. Obtain the Transfer Function of a given system using Block Diagram Reduction Technique.



- e. Explain details of Nicholas Chart used in control system.
- f. State difference between open loop and closed loop control system.
- g. Write short note on Constant M and N circle in brief.

- 3 Describe construction and working principle of Synchros and also explain how it is used in servo application. 10
- 4 Draw the signal flow graph for the given system block diagram and obtain the closed loop transfer function of the system $C(S)/R(S)$ using Masson's gain formula 10



- 5 Sketch the Root-Locus of the system whose transfer function is given by 10

$$G(s)H(s) = \frac{K}{s(s+2)(s+4)}$$

- 6 Describe with neat block diagram the working of armature controlled DC motor as a control system. 10

- 7 The open loop transfer function of the plant is 10

$$G(s)H(s) = \frac{80(s+5)}{s^2(s+50)}$$

Use Bode Plot, Find the Gain Margin and Phase Margin.

6TH SEM. / ELECTRICAL / 2023(S)

TH4 Renewable Energy

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 (i) Solar PV Array (ii) Non-renewable energy
 - b. What are the applications of biodiesel?
 - c. How the speed of wind turbines is controlled by Yaw control mechanism?
 - d. What are the importance of renewable sources of energy.
 - e. Write an example of (i) Line focus (ii) Point focus solar collectors?
 - f. Define solar irradiance and state its SI unit.
 - g. Name any two types of biogas digester.
 - h. What are the characteristics of wind power plant?(any two)
 - i. What do you mean by Hybrid Energy system? Give an example.
 - j. What is wood gasifier?

2. Answer **Any Six** Questions 6 x 5
 - a. Describe about the Maximum Power Point Tracker (MPPT) briefly with a neat diagram.
 - b. Explain the characteristics of induction generator making it suitable for use in wind turbines.
 - c. Describe the thermo-chemical process of pyrolysis briefly.
 - d. What are the advantages of anaerobic digestion?
 - e. Explain about the barrage tidal power systems briefly.
 - f. Write a short note on sustainable design and development.
 - g. Explain the double output system associated with wind turbines with a neat diagram.

3. Write a short note on (i) Combustion And Fermentation (ii) Liquid flat –plate solar collector 10

4. Describe the method of Ocean Thermal Energy Conversion (OTEC) and its types with a neat diagram. 10

5. Write a short note on (i) Solar Charger (ii) Vertical Axis Wind Turbine 10

6. Explain the pitch angle control and Stall (α) control mechanisms of wind turbine control systems in details. 10

7. Explain the present scenario of conventional and renewable sources of energy in India and World. 10