22101

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answer with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Answer any <u>FIVE</u> of the following questions in three to four sentences. **10**

a) State any four qualities of Shiva that inspired you.

b) Describe the initial struggle of Ronaldo before becoming a star football player.

c) Explain the term 'comfort zone' which hinder our career growth.

d) Mention any four diversified areas in which Tata group entered in the last half of 20 century.

e) Describe the role of Gurmeet Singh at Lawaris ward in the Patna hospital.

f) Suggest any two solutions to minimize the pollution caused by improper disposal of e-waste.

g) State the importance of situational intelligence.

Marks

2. Attempt any THREE of the following questions in four to six sentences. **12**

a) Narrate the difficulties faced by Arunima Sinha during Mount Everest expedition.

b) State the importance of wearing helmet while riding two-wheeler.

c) Summarize the contribution of Gurmeet Singh as a philanthropist.

d) Describe the initial struggle of Walter Edward Dandy, an American neurosurgeon.

3. Attempt any THREE of the following: **12**

a) Develop a dialogue amongst students about their final examination.

b) Develop a dialogue between a father and a daughter about the purchase of new Laptop required for the online class.

c) Develop a paragraph based on the topic – My family time during lockdown.

d) Develop a paragraph based on the topic – Internet has changed our lives.

4. Attempt any THREE of the following: **12**

a) Make sentences using the following collocations:

i) Fully aware

ii) Take off

iii) Give a presentation

iv) Vaguely remember.

b) Replace the underlined words with correct words and rewrite the sentences :–

i) The whether looks unpredictable today.

ii) Someone has decided to steel the car.

iii) If you cell drugs, you will be arrested.

iv) Your injuries will heel over time.

Marks

c) State the meaning of the following idioms and make sentences using the idioms.

i) Blessings in disguise

ii) Cross the bridge when you come to it.

d) Choose the correctly spelt word from the following:–

i) (1) Fourty

(2) Forty

(3) Fortee

ii) (1) Definition

(2) Defination

(3) Definiation

iii) (1) Pronunciasion

(2) Pronounciation

(3) Pronunciation

iv) (1) Schedule

(2) Shedule

(3) Schedual

e) Change the voice :–

i) The forest fire destroyed the whole suburb :

ii) He reads a book in a week.

iii) She will clean her bedroom on Sunday.

iv) Harry has donated money to the homeless shelter.

5. a) Attempt any <u>TWO</u> of the following: **8**

i) Draft a farewell speech as a service engineer has completed the project and going back to his company.

ii) Draft a speech to introduce a life trainer who has been invited to conduct a workshop for your employees.

iii) Prepare a welcome speech on the occasion of opening ceremony of new branch of your company.

Marks

b) Change into indirect speech any TWO of the following: **4**

i) He said, "I bought a new car yesterday."

ii) Roy said, "I was waiting for a long time."

iii) She asked "Are you enjoying the party?"

6. Attempt any TWO of the following: **12**

a) **Do as directed –**

i) Shortly, hence their marriage they moved into Colorado. (Use correct preposition)

ii) I try very hard in the competitive examination and I am not receiving good grades. (Use correct conjunction)

iii) She is a architect and he is an doctor. (Rewrite the sentence using the correct articles in the place of underlined articles.)

b) **Do as directed:**

i) They ..... (reach) Mumbai yesterday and they ..... (take) rest at a hotel now. (Use correct form of verb and rewrite the sentence.)

ii) Vinay always comes on time for the lecture. (Make it negative.)

iii) What a lovely bouquet of flowers. (Make it assertive.)

c) **Read the following extract and answer the questions given below:–**

Meet Zhou Qunfei, the world's richest self-made woman. She is the founder of Lens Technology and counts a $ 27 million estate in Hong Kong among her acquisitions. But she is most at home on the floor of her factory, dipping her hands in a tray of water to ensure it is of the right temperature, or taking the place of one of her technicians for a while. If you meet her, you would instantly notice her neatness of appearance her round owl-like glasses and her cherubic face.

The youngest of three children, Qunfei was born in a tiny village in China. She lost her mother when she was five. Her father was a skilled craftsman. He lost his eyesight and a

Marks

finger in an accident. Young Quinfei helped her family raised pigs and ducks for their livelihood.

Despite being a brilliant student, Qunfei dropped out of school at the age of 16. She landed a job that required her to work from 8 am to 10 pm polishing glass. The hours were long and the work monotonous. After three months, she decided to quit. She wrote her letter of resignation to her boss, in which she complained of the long hours and the boredom. But she also said that she was grateful for the job and was willing to learn more. Her boss was impressed with the letter. He asked her to stay on and promoted her.

Questions:

i) Name the company started by Zhou Qunfei.

ii) State the reason of taking place of one of technicians by Zhou Qunfei on the floor of her factory.

iii) Describe the childhood days of Qunfei.

iv) Mention the reason behind leaving school by Qunfei.

v) Explain the reason behind the promotion of Qunfei at the glass polishing factory.

vi) State the reason of leaving glass polishing factory by Qunfei.

22101

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) State any four qualities of Shiva that have inspired you.

(b) Express your views on Christiano Ronaldo.

(c) Name the scientists and lawyers who flourished under the leadership of JRD Tata.

(d) State any three adjectives to describe the condition of patients in the abandoned ward in Patna.

(e) State any three health hazards of improper disposal of e-waste.

(f) Express in two sentences about the importance of scoring marks for your career.

(g) Name the peaks climbed by Arunima Sinha.

2. Attempt any THREE of the following : **12**

(a) Describe the change in the author's life after his son's accident.

(b) State the four qualities of Mr. Lal that have inspired you.

(c) Describe the role and responsibilities of the society in controlling e-waste hazards.

(d) Summarise the struggle of Shiva.

3. Attempt any THREE of the following : **12**

(a) Develop a dialogue between a teacher and student who is apologising for using mobile phone in the class. (8-10 dialogues).

(b) Develop a dialogue between Arjun and Amit discussing about the ways to improve their spoken English. (8-10 dialogues)

(c) Write a paragraph on "an online class compared to a traditional face-to face class". (75 words)

(d) Write a paragraph on "Wi-Fi Technology". (75 words)

4. Attempt any THREE of the following : **12**

(a) Make sentences using the following collocations :

(i) Do your best

(ii) Break a record

(iii) Take an exam

(iv) Save electricity

(b) Replace the underlined words with correct word and rewrite the sentences.

(i) Amit's father is very <u>industrial</u>.

(ii) A <u>hoard</u> of dacoits looted the village.

(iii) The goods train is <u>stationery.</u>

(iv) Raju is very <u>week</u>.

(c) Write the meanings of the following idioms and make sentences of your own :

(i) Blessing in disguise

(ii) Crocodile tears

(d) Choose the correctly spelt word from the following :

(i) unique, unic, unque

(ii) counsellor, counselar, counselor

(iii) angrily, angryly, angrilly

(iv) Keys, Keyes, Keies

(e) Change the voice :

(i) Let the window be shut.

(ii) He will be forgiven by the teacher.

(iii) Will your brother pay your fees today ?

(iv) The robber has been caught by the police.

5. (A) Attempt any TWO of the following : **8**

(a) Draft a welcome speech for Dr. Khare, an industrialist from your region who is invited at your institute for a talk on "Expectations of the industry from the diploma holders"

(b) Draft a speech to introduce the chief guest for the first year induction program organised by the institute.

(c) Prepare a vote of thanks for the annual gathering of your institute.

(B) Attempt any TWO : **4**

Change into indirect speech

(a) The monitor said, " Sir, some students were making noise yesterday".

(b) The Prime Minister said, "India became independent in 1947".

(c) "Sit down." She told him.

6. Attempt any TWO of the following : **12**

(a) Do as directed :

(i) Not everyone gets <u>the</u> opportunity to become <u>an</u> famous person. (Rewrite the sentence using correct article in place of the underlined article.)

(ii) Either the police officers or the military personnel were present there. (Rewrite the sentence using correct conjunctions in place of underlined conjunction).

(iii) Mr. Verma received a parcel to his son who had been staying in Mysore from many years. (Rewrite the sentence using the correct prepositions in place of underlined preposition.)

(b) Read the following passage and answer the given questions :

Our forests are important source of natural wealth covering one fifth of the country's land area. They supply the timber for the railways, house building and furniture making. They also supply the fuel for cooking and bamboo for paper making. Medicinal herbs also come from the forests.

In the olden days our wise men and philosophers had their "Ashrams' in the forests. These Ashrams were centers of knowledge and learning. Unfortunately forests were ruthlessly cut down in the past few years. While the forests are disappearing the demand for timber is growing. We must therefore, protect and develop our forests. "Vana Mahotsava" is a most important step in this direction. It is observed for a week in July every year. During this week lakhs of saplings are planted throughout the country. This is being done to restore our fast disappearing forests.

Questions :

(i) What do forests supply for paper making ? **(1)**

(ii) What was the purpose of Ashrams ? **(1)**

(iii) Why is Vana Mahotsava observed ? How is it observed ? **(2)**

(iv) What would you do to restore forests ? **(2)**

(c) Do as directed :

(i) Yesterday evening the phone (ring) three times while we (have) dinner. (Rewrite the sentence using the correct form of the verbs in the brackets).

(ii) While I (do) the language course, I (meet) lots of people from all over the world.

(Rewrite the sentence using the correct forms of the verbs in the brackets).

(iii) What a wonderful painting this is ! (Change into Assertive)

22101

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Explain the term comfort zone.

b) Name the entrepreneurs developed under the guidance of JRD Tata.

c) State any two positive points of Gurmeet Singh's personality that has appealed to you.

d) State the additional tips for proper recycling of e-waste.

e) State the full form of EQ, IQ and SQ.

f) Name the awards won by Arunima Sinha.

g) Explain the term : Doer and Mentor.

2. Attempt any THREE of the following: **12**

a) Describe the help given by Krishna Vedavyasa.

b) Write about your career dreams.

c) Express your views / ideas on JRD Tata.

d) State the qualities of Arunima that touched your heart.

P.T.O.

Marks

3. Attempt any THREE of the following: **12**

a) Develop a dialogue between two students about the timetable of final exam. (8 - 10) dialogues.

b) Develop a dialogue between the doctor and the patient about the improvement in the patient's health. (8 - 10) dialogues.

c) Write a paragraph on 'My Sweet Memories'.

d) Write a paragraph on 'Mobile telephone'. (75 words).

4. Attempt any THREE of the following: **12**

a) Make sentences using the following collocations :

i) Save money

ii) Pay attention

iii) Do business

iv) Take a seat

b) Replace the underlined words with correct word and rewrite the sentences.

i) Ram is very week.

ii) The goods train is stationery.

iii) We salute our army personal.

iv) The principle of the college was present for the meeting.

c) Write the meanings of following idioms and make sentences of your own :

i) At the eleventh hour

ii) In black and white

d) Choose the correctly spelt word from the following :

i) mesege ii) message iii) messege.

ii) miting ii) meeting iii) metting.

iii) keys, keyes, keies.

iv) leafs, leaffs, leaves.

Marks

e) Change the voice

i) Grammar is taught to us by Prakash.

ii) By whom was she taught French?

iii) Let the door be shut.

iv) I sent the report yesterday.

5. a) Attempt any TWO of the following: **08**

i) A senior faculty of your department is retiring from the job. As an H.O.D., draft a farewell speech for the faculty.

ii) Draft a speech to introduce the chief guest for the first year induction program organised by your institute.

iii) Prepare vote of thanks for the Annual Gathering of your institute.

b) Change into Indirect speech: **04**

i) Sachin said to Janu, "Will you give me a pen?"

ii) Geeta said, "I do yoga daily."

6. **Attempt any TWO of the following:** **12**

a) Do as directed:

i) Ganesh was an only teacher in a village. (Rewrite the sentence using the correct article in place of the underlined article).

ii) Dr. Janhavi was though a lecturer and author of many famous books. (Rewrite the sentence using the correct conjunctions in place of underlined conjunctions).

iii) Mr. Prakash received a letter to his daughter who had been living in Chennai from many years. (Rewrite the sentence using the correct prepositions in place of the underlined prepositions).

Marks

b) Read the following passage and answer the given questions :

The word victory generally reminds us of wars and conquerers like Alexander, Caesar and Napoleon. Or we may think of the Allied victories in the two world wars but these victories were associated with so much destruction and devastation. Thousands of people were killed and hundreds of towns and cities destroyed, but there is another type of victory which is creative and constructive. In this category we may include the achievements of scientists and scholars, statemen and social reformers, workers in the field and factory and all who contribute to the progress of the human race. The victories of peace are more lasting and useful to humanity than the so called victories of war.

Questions :

i) How many things are associated with the word victory in this passage. (01 mark)

ii) Name two constructive victories. (01 mark)

iii) Why the victory of peace is useful. (02 mark)

iv) Give the synonym for the word (02 mark)

1) Category

2) Achievement

c) Do as directed :

i) We (go) shopping last weekend. There (be) a great crowd at the shopping centre. (Rewrite the sentence using the correct form of the verbs in the bracket).

ii) What a wonderful idea it is! (Change into Assertive)

iii) As soon as I (hear) the noise, I immediately (go) there. (Rewrite the sentence using the correct form of the verbs in the bracket).

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22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Figures to the right indicate full marks.

(4) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Write any two points of JRD Tata's personality that impressed you most.

(b) Describe how Shiva prepared for IIM exam.

(c) Explain what Mohammad Ali thinks about 'success'.

(d) State any two health hazards of improper disposal of e-waste.

(e) Write any two qualities of emotionally stable people.

(f) State the various stages in Mr. Lal's life.

(g) Write any two achievements of Arunima Sinha.

2. Attempt any THREE of the following : **12**

(a) 'He (Gurmeet Singh) is like God.' Justify the statement.

(b) Write the success story of Christiano Ronaldo.

(c) State the consequences of not wearing helmets.

(d) Summarize the suggestions given by the author to make one's life remarkable.

3. Attempt any THREE of the following : **12**

(a) Develop a dialogue between a subject teacher and a student asking for permission to leave early due to illness.

(b) Develop a dialogue between two friends about Campus interviews for the final year students.

(c) Write a paragraph on 'My idea of satisfying career'.

(d) Write a paragraph on 'An Accident'.

4. Attempt any THREE of the following : **12**

(a) Make sentences using the following collocations :

(i) Make a mess

(ii) Break the ice

(iii) Take an exam

(iv) Come to the point

(b) Replace the underlined words with correct words and rewrite the sentences.

(i) The Soldiers show a lot of <u>metal</u> during wars.

(ii) Vrunda's handwriting is <u>eligible</u>.

(iii) No <u>deserts</u> were served after the dinner.

(iv) They had <u>morning</u> in their house at the death of their mother.

(c) Write the meanings of the following idioms and make sentences of your own :

(i) Piece of Cake

(ii) By all means

(d) Chosse the correctly spelt word from the following :

(1) (i) greatful (ii) gratefull (iii) grateful

(2) (i) beautyful (ii) beautiful (iii) beautifull

(3) (i) ninth (ii) nineth (iii) nintth

(4) (i) leafs (ii) leaffs (iii) leaves

(e) Change the voice of the following sentences :

(i) By whom was she taught French ?

(ii) Let this post be advertised.

(iii) The two ministers are signing the treaty.

(iv) I sent the report yesterday.

5. (A) Attempt any TWO of the following : **8**

(a) Your institute has organized a Guest Lecture on 'Expectations of the Industry from the Diploma holders'. Draft a speech for introducing the guest speaker to the audience.

(b) Propose a vote of thanks for the Annual Gathering of your college.

(c) A senior faculty of your department is retiring from the job. As an HOD, draft a Farewell speech for the faculty.

(B) Change into indirect speech (any TWO) **4**

(a) She said to him, "I don't believe you".

(b) "Don't play on the grass, boys." She said.

(c) She said to me, "What do you want now ?".

6. Attempt any TWO of the following : **12**

(a) Do as directed.

(i) Though Sanskrit is an difficult language, my friend is a M.A. in this subject. (Rewrite the sentence using correct article in the place of underlined articles.)

(ii) He always drives in a tremendous speed because he is always at a hurry. (Rewrite the sentence using the correct prepositions in place of underlined words.)

(iii) The car is though economical and easy to drive. (Rewrite the sentence using correct conjunctions in place of the underlined conjuctions.)

P.T.O.

(b) Read the following passage and answer the given questions :

Education is not an end, but a means to an end. In other word, we do not educate children only for the purposes of educating them. Our purpose is to fit them for life. As soon as we realize this fact, we will understand that it is important to choose a system of education which will really prepare children for life. It is not enough just to choose the first system of education one finds; or to continue with one's old system of education without examining it to see whether it is in fact suitable or not.

In fact, when we say that all of us must be educated, we mean that all of us must be educated in such a way that, firstly, each of us can do whatever job is suited to our brain and ability, and secondly, that we can realize that all jobs are necessary to society, and that it is very bad to be ashamed of one's work, or to scorn someone else's.

Questions :

(i) What is the passage about ? **1**

(ii) What is the real purpose of education ? **1**

(iii) What does it mean when one says, 'all of us must be educated' ? **2**

(iv) What is your opinion about education ? **2**

(c) Do as directed :

(i) When I _____ (visit) the Taj Mahal last time, there _____ (be) lots of tourists from all over the world. (Rewrite the sentence using the correct form of verbs given in the brackets)

(ii) Please be quiet in the library. (Change into assertive)

(iii) He will never learn manners. (Change into interrogative)

_____

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Find value of $\ddot{x}$ if $\frac{\log x}{\log 4} = \frac{\log 64}{\log 16}$.

(b) Find the area of triangle whose vertices are (0, 0), (3, 6) and (–8, –2) using determinant method.

(c) Without using calculator find value of 'sin 15°'.

(d) Calculate the surface area of the cube having length of one side as 5.3 cm.

(e) If the volume of a room is 792 m^3 and the area of the floor is 132 m^3, find the height of the room.

(f) Find range and co-efficient of range of the following data 50, 90, 120, 9, 13, 11, 5.

(g) If the mean of data is 12 and co-efficient of the data is 45%, then find the standard deviation of the data.

2. Attempt any THREE of the following : **12**

(a) If $A = \begin{bmatrix} 2 & -3 \\ 1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 & 2 \\ 1 & 0 & 1 \end{bmatrix}$, then verify that $(AB)^T = B^T \cdot A^T$.

(b) Resolve into partial fractions,

$$\frac{x^2 + 1}{x(x^2 - 1)}.$$

(c) Calculate variance for the data :

x_i	10	20	30	40	50
f_i	12	15	17	11	9

(d) Following equations are obtained as a result of an experiment

$\alpha I_1 - I_2 + I_3 = 0$, $4I_1 - I_3 = 2$, $2I_2 + I_3 = 2$, find I_1, I_2, I_3 using Cramer's rule.

3. Attempt any THREE of the following : **12**

(a) Prove that $\tan\left(\frac{\pi}{4} + A\right) \cdot \tan\left(\frac{\pi}{4} - A\right) = 1$.

(b) If $\tan A = \frac{1}{3}$, $\tan B = \frac{1}{4}$ where $0 < A < \frac{\pi}{2}$, $\pi < B < \frac{3\pi}{2}$, find $\sin(A + B)$.

(c) Simplify $\frac{\sec^2(135°)}{\cos(-240°) - 2\sin(930°)}$.

(d) Prove that $\frac{\sin 4\theta + \sin 2\theta}{1 + \cos 2\theta + \cos 4\theta} = \tan 2\theta$.

4. Attempt any THREE of the following : **12**

(a) If $A = \begin{bmatrix} x & 2 & -5 \\ 3 & 1 & 2y \end{bmatrix}$, $B = \begin{bmatrix} 2y+5 & 6 & -15 \\ 9 & 3 & -6 \end{bmatrix}$ and if $3A = B$, find x and y.

(b) Resolve into partial fraction,

$$\frac{x^2 + 1}{x^3 + 1}.$$

(c) Show that $\cos 20° \cdot \cos 40° \cdot \cos 80° = \frac{1}{8}$.

(d) Prove that $\frac{\sin 7x + \sin x}{\cos 5x - \cos 3x} = \sin 2x - \cos 2x \cdot \cot x$.

(e) Prove that $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{2}{9}\right) = \cot^{-1}(2)$.

5. Attempt any TWO of the following : **12**

(A) Attempt the following :

(i) Find the equation of the straight line passing through (–3, 10) and sum of their intercept is 8.

(ii) Find the equation of straight line passing through the points (–4, 6) and (8, –3).

(B) Attempt the following :

(i) Find the equation of a straight line that passes through point (3, 4) and perpendicular to the line $3x + 2y + 5 = 0$.

(ii) Find acuate angle between line

$3x - 2y + 4 = 0$ and $2x - 3y - 7 = 0$

(C) Attempt the following :

(i) The area of a rectangular courtyard is 3000 sq.m. Its sides are in the ratio 6 : 5. Find the perimeter of the courtyard.

(ii) A swimming pool is 12 m long and 7.5 m broad. It is 2.5 m deep at its deep end and 1.4 m deep at its shallow end. Calculate its capacity in kilolitres.

6. Attempt any TWO of the following : **12**

(a) Solve the following equation by using matrix inversion method :

$x + 2y + 3z = 1$, $2x + 3y + 2z = 2$ & $3x + 2y + 4z = 1$

(b) Find the mean deviation from mean of the following data :

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
No. of Students	5	8	15	16	6

(c) Attempt the following :

(i) Find range and co-efficient of range of the following :

x_i	10	20	30	40	50
f_i	7	5	3	2	1

(ii) The runs scored by two batsmen A and B in 5 one day matches are given below :

A	48	50	39	46	37
B	50	52	60	55	53

Who is more consistent ?

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Prove that $\frac{1}{\log_3 6}+\frac{1}{\log_8 6}+\frac{1}{\log_9 6}=3.$

(b) Find x, if $\begin{vmatrix} 4 & 3 & 9 \\ 3 & -2 & 7 \\ 11 & 4 & x \end{vmatrix} = 0.$

(c) Without using calculator, find the value of cos(105°).

(d) The area of a rectangular garden is 3000 m^2. Its sides are in the ratio 6 : 5. Find the perimeter of the garden.

(e) Find the area of ring between two concentric circles whose circumferences are 75 cm and 55 cm.

(f) Find the range and coefficient of range 40, 52, 47, 28, 45, 36, 47, 50.

(g) The two sets of observations are given below :

Set I	**Set II**
$\bar{x} = 82.5$	$\bar{x} = 48.75$
$\sigma = 7.3$	$\sigma = 8.35$

Which of two sets is more consistent ?

2. Attempt any THREE of the following : **12**

(a) Solve the equations by Cramer's rule :

$x + y + z = 3, x - y + z = 1, x + y - 2z = 0$

(b) If $A = \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$, find $A^2 - 8A$.

(c) Resolve into partial fractions

$$\frac{3x+2}{(x+1)(x^2-1)}$$

(d) A metal strip having sides 17 × 7× 5 cm is melted down and minted into coins each of diameter 1.4 cm and thickness 0.08 cm. Assuming no wastage, how many coins can be minted ?

3. Attempt any THREE of the following : **12**

(a) Prove that

$\tan 70° - \tan 50° - \tan 20° = \tan 70° \tan 50° \tan 20°$.

(b) Prove that $\frac{1+\sin\theta-\cos\theta}{1+\sin\theta+\cos\theta} = \tan\left(\frac{\theta}{2}\right)$.

(c) Prove that $\frac{\cos 2A + 2\cos 4A + \cos 6A}{\cos A + 2\cos 3A + \cos 5A} = \cos A - \sin A \tan 3A$

(d) Prove that

$$\sin 20° \sin 40° \sin 60° \sin 80° = \frac{3}{16}$$

4. Attempt any THREE of the following : **12**

(a) Find the adjoint of matrix

$$A = \begin{bmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

(b) Resolve into partial fractions

$$\frac{x^4}{x^3+1}$$

(c) Prove that $\tan^{-1}(1) + \tan^{-1}(2) + \tan^{-1}(3) = \pi$.

(d) Prove that

$$\sin^{-1}\left(\frac{3}{5}\right) - \sin^{-1}\left(\frac{8}{17}\right) = \cos^{-1}\left(\frac{84}{85}\right)$$

(e) Without using calculator, prove that

$$\sin 420° \cos 390° + \cos(-300°) \sin(-330°) = 1$$

5. Attempt any TWO of the following : **12**

(a) Attempt the following :

(i) Find the acute angle between the lines $y = 5x + 6$ and $y = x$.

(ii) Find the equation of the line passing through the point (4,5) and perpendicular to the line $7x - 5y = 420$.

(b) Attempt the following :

(i) Find the length of perpendicular from the point (2,3) on the line $4x - 6y - 3 = 0$.

(ii) Find the equation of the line passing through (1,7) and having slope 2 units.

P.T.O.

(c) Attempt the following :

(i) A square grassy plot is of side 100 metres. It has a gravel path 10 meters wide all round it on the inside. Find the area of the path.

(ii) The volume of a sphere is $\frac{88}{21}$ cubic meters. Find its surface area.

6. Attempt any TWO of the following : **12**

(a) (i) Find the mean deviation from mean of the following distribution :

C.I.	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
f_i	5	8	15	16	6

(ii) Find range & coefficient of range for the following data :

C.I.	10 – 19	20 – 29	30 – 39	40 – 49	50 – 59
f	15	25	13	17	10

(b) Calculate standard deviation and coefficient of variance of the following table :

Marks below	5	10	15	20	25
No. of Students	6	16	28	38	46

(c) Solve the following equations by using matrix inversion method :

$x + y + z = 6,\ 3x - y + 3z = 10,\ 5x + 5y - 4z = 3$

22103

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Solve any FIVE of the following: **10**

a) Find value of $\log\left(\frac{2}{3}\right) + \log\left(\frac{4}{5}\right) - \log\left(\frac{8}{15}\right)$.

b) Show that the points (8, 1), (3, –4), (2, –5) are collinear.

c) Without using calculator find value of $\sin(105°)$.

d) Find area of Rhombus where diagonals are of length 6 cm and 9 cm.

e) Find surface area of cuboid whose dimensions are 8 cm × 11 cm × 15 cm.

f) If coefficient of variance is 5 and mean is 60. Find standard deviation.

g) Find range and coefficient of range for the data: 40, 52, 47, 28, 45, 36, 47, 50.

h) Find surface area of sphere whose volume is $\frac{4\pi}{3}$ cm^3.

Marks

2. Solve any THREE of the following: **12**

a) If $A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$ prove that $A^2 = I$.

b) Resolve following into partial fraction $\frac{x + 3}{(x - 1)(x + 1)(x + 5)}$

c) Following results are obtained as a result of experiment. Find V_1, V_2, V_3 by using Cramer's Rule.
$V_1 + V_2 + V_3 = 9$, $V_1 - V_2 + V_3 = 3$, $V_1 + V_2 - V_3 = 1$

d) Compute mean deviation for the mean of the data:
12, 6, 7, 3, 15, 10, 18, 5.

3. Solve any THREE of the following: **12**

a) Solve without using calculator,
$\sin(420°)\cos(390°) + \sin(-330°)\cos(-300°)$

b) Prove : $\frac{\sin 4\theta + \sin 2\theta}{1 + \cos 2\theta + \cos 4\theta} = \tan 2\theta$

c) Prove that : $\frac{\sin 4A + \sin 5A + \sin 6A}{\cos 4A + \cos 5A + \cos 6A} = \tan 5A$

d) Prove : $\tan^{-1}\left(\frac{1}{8}\right) + \tan^{-1}\left(\frac{1}{5}\right) = \tan^{-1}\left(\frac{1}{3}\right)$

4. Solve any THREE of the following: **12**

a) Find x and y if

$$\left\{4\begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 3 \end{bmatrix} - 2\begin{bmatrix} 1 & 3 & -1 \\ 2 & -3 & 4 \end{bmatrix}\right\}\begin{bmatrix} 2 \\ 0 \\ -1 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}$$

b) Resolve into partial fractions: $\frac{3x - 2}{(x + 2)(x^2 + 4)}$

c) Prove : $\cos 20°.\ \cos 40°.\ \cos 80° = \frac{1}{8}$

Marks

d) If $\tan(x + y) = \frac{3}{4}$ and $\tan(x - y) = \frac{1}{3}$. Find $\tan 2x$.

e) If $\sin A = \frac{1}{2}$. Find $\sin 3A$.

5. Solve any <u>TWO</u> of the following: **12**

a) Attempt the following:

i) Find equation of line passing through points $(6, -4)$ and $(-3, 8)$.

ii) Find distance between parallel lines $3x + 2y - 5 = 0$ and $3x + 2y - 6 = 0$.

b) Attempt the following:

i) Find equation of line passing through point $(2, 0)$ and perpendicular to $x + y + 3 = 0$.

ii) Find acute angle between the lines $3x - y + 4 = 0$ and $2x + y = 3$.

c) Attempt the following:

i) Find the area of ring between two concentric circles whose circumferences are 77 cm and 55 cm.

ii) The area of piece of land is in the form of a quadrilateral ABCD. The diagonal AC is 400 m long off-set to B is 220 m and off-set to D is 98 m. Find the area.

Marks

6. Solve any TWO of the following: **12**

a) Find the mean and standard deviation and coefficient of variance of the following data:

Class interval	0-10	10-20	20-30	30-40	40-50
Frequency	3	5	8	3	1

b) Attempt the following:

i) Find range and coefficient of range for following data:

Marks	10-19	20-29	30-39	40-49	50-59	60-69
No. of students	6	10	16	14	8	4

ii) The two sets of observations are given below:

Set I	Set II
$\bar{x}$ = 82.5 σ = S.D = 7.3	$\bar{x}$ = mean = 48.75 σ = S.D = 8.35

Which of two sets is more consistent?

c) Solve the following equations by matrix inversion method.
$x + y + z = 3$, $x + 2y + 3z = 4$, $x + 4y + 9z = 6$.

22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Solve : $\log(x + 3) + \log(x - 3) = 10916$.

(b) Using determinant find the area of a triangle whose vertices are :

(4, 5), (0, 7) and (–1, 1).

(c) Without using calculator find the value of tan (15°).

(d) Find the area of a plot in the form of a rhombus having diagonals 160 m and 210 m long.

(e) Find the area between two concentric circles of radius 4 m and 2 m.

(f) Following are the prices (in ₹) of shares of a company for six days of a week :

200, 210, 208, 100, 220, 250. Calculate the Range.

(g) The mean and S.D. of a particular distribution are 60 and 5 respectively. Find the co-efficient of variation.

2. Attempt any THREE of the following : **12**

(a) Resolve into partial fractions : $\frac{x^2 + 5x + 7}{(x-1)(x+2)(x+4)}$.

(b) If $P = \begin{bmatrix} 1 & 2 & -3 \\ 3 & -1 & 2 \\ -2 & 1 & 3 \end{bmatrix}$, $Q = \begin{bmatrix} 2 & 3 & 1 \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$ then find the matrix R such that P + Q + R = O.

(c) The sum of three numbers is 2. If twice the second number is added to the sum of first and third, we get 1. On adding the sum of second and third numbers to five times the first number, we get 6. Find the three numbers using Cramer's Rule.

(d) Find the mean deviation from mean for the following distribution :

xi :	20	18	16	14	12	10	8	6
fi :	2	4	9	18	27	25	14	1

3. Attempt any THREE of the following : **12**

(a) If $\tan x = -3/4$, $3\pi/2 < x < 2\pi$, then find (i) $\sin 2x$ (ii) $\cos 2x$

(b) Prove that : $\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 4\theta}}} = 2\cos(\theta/2)$

(c) Prove that : $\sin 20° \sin 40° \sin 60° \sin 80° = 3/16$

(d) Prove that : $\tan^{-1}(1) + \tan^{-1}(2) + \tan^{-1}(3) = \pi$

4. Attempt any THREE of the following : **12**

(a) If $A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$, show that $A^2 = I$.

(b) Resolve into partial fractions : $\frac{x^2 + 23x}{(x+3)(x^2+1)}$

(c) In a ΔABC, prove that :

$\tan A + \tan B + \tan C = \tan A \cdot \tan B \cdot \tan C$

(d) Prove that : $\sin 420° \cos 390° + \cos(-300°) \sin(-330°) = 1$.

(e) Prove that : $\frac{\sin 16\theta}{\sin \theta} = 16 \cos\theta \cdot \cos 2\theta \cdot \cos 4\theta \cdot \cos 8\theta$

5. Attempt any TWO of the following : **12**

(a) (i) If the slope of a line passing through the points (4, K) and (–2, –5) is 2, then find K.

(ii) Find the equation of a line making an angle of 120° with X-axis and passing through (2, 3).

(b) (i) Find the angle between the lines $x + 5y = 11$ and $5x - y = 11$.

(ii) Find the perpendicular distance of the point (–3, –4) from the line $4(x + 2) = 3(y - 4)$.

(c) (i) Find the area in hectare of the piece of land in the form of a quadrilateral ABCD. The diagonal AC is 400 m long and offset to B is 220 m and offset to D is 98 m.

(ii) A rectangular box 80 × 50 × 30 m is to be painted from outside at the rate of ₹ 1.25 per sq. m. Find the cost of painting it.

6. Attempt any TWO of the following : **12**

(a) Solve the following equations by matrix inversion method :

$x + 3y + 2z = 6$, $3x - 2y + 5z = 5$, $2x - 3y + 6z = 7$

(b) The score of two batsmen A and B in ten innings during a certain season are as under :

A : 32, 28, 47, 63, 71, 39, 10, 60, 96, 14

B : 19, 31, 48, 53, 67, 90, 10, 62, 40, 80

Find which of the two batsmen is more consistent using co-efficient of variation.

(c) Calculate the S.D., co-efficient of S.D., variance and co-efficient of variance of the following data :

Class :	0 – 30	30 – 60	60-90	90-120	120-150	150-180	180-210
Frequency :	9	17	43	82	81	44	24

22210

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Solve any FIVE of the following: **10**

a) If $f(x) = 2^x - \log_2 x$ then find $f(2)$.

b) Test whether the function is even or odd, if

$f(x) = 3x^4 - 2x^2 + \cos x$.

c) Find $\frac{dy}{dx}$ if $y = e^x \cdot \cot x$.

d) Evaluate $\int \frac{1}{3x-2}\, dx$.

e) Evaluate $\int \frac{2+3\sin x}{\cos^2 x}\, dx$.

f) Find the area bounded by the curve $y = 3x^2$, x-axis and the ordinates $x = 1$ and $x = 3$.

g) Express into polar form $z = \frac{1}{2} + \frac{\sqrt{3}}{2}i$.

P.T.O.

Marks

2. Solve any <u>THREE</u> of the following: **12**

a) If $x^2 + y^2 + xy - y = 0$ find $\frac{dy}{dx}$ at (1, 2).

b) Find $\frac{dy}{dx}$ if $y = \tan^{-1}\left[\frac{2x}{1 + 35x^2}\right]$.

c) Find the radius of curvature of the curve $y^2 = 4x$ at point $(2, \sqrt{2})$.

d) An electric cable cost ₹ C per kilometer and $C = \frac{100}{x} + 625\ x$ where x is the area of cross-section. Find the value of x for which cost is minimum. What is minimum cost?

3. Solve any <u>THREE</u> of the following: **12**

a) Find the equation of tangent to the circle. $x^2 + y^2 - 8x + 4y + 12 = 0$ at point (2, 0).

b) If $x = a\sin\theta$ and y = a $(1 + \cos\theta)$, find $\frac{dy}{dx}$.

c) If $e^x = x^y$, prove that $\frac{dy}{dx} = \frac{\log x - 1}{(\log x)^2}$.

d) Evaluate $\int \frac{1}{x\ [16 + (\log_e x)^2]}\ dx$.

Marks

4. Solve any <u>THREE</u> of the following: **12**

a) Evaluate $\int \frac{1}{2x^2 + 3x + 1}\, dx$.

b) Evaluate $\int \frac{1}{4 + 5\sin 2x}\, dx$.

c) Evaluate $\int x \cdot \log (1 + x)\, dx$.

d) Evaluate $\int \frac{e^x}{(e^x - 1)(e^x + 1)}\, dx$.

e) Evaluate $\int_1^3 \frac{\sqrt[3]{x+5}}{\sqrt[3]{x+5} + \sqrt[3]{9-x}}\, dx$.

5. Solve any <u>TWO</u> of the following: **12**

a) Find the area bounded by two parabolas $y^2 = 2x$ and $x^2 = 2y$.

b) i) Find order and degree of differential equation.

$$\frac{d^2y}{dx^2} = \left[y + \frac{dy}{dx}\right]^{3/2}$$

ii) Solve $\frac{dy}{dx} = e^x \cdot e^{-y} + x\, e^{-y}$

c) A resistance of 100 Ω and inductance of 0.1 henries are connected in series with a battery of 20 volts. Find the current in the circuit at any instant, if the relation between L, R, E is $L \frac{di}{dt} + Ri = E$.

Marks

6. Solve any TWO of the following: **12**

a) i) Express $\frac{(3-i)^2}{2-i}$ in 'x + iy' form.

ii) Find L $\{e^{-t} \cos 2t\}$

b) Find $L^{-1}\left\{\frac{4s + 5}{(s + 2)(s - 1)^2}\right\}$

c) Solve given differential equation by using Laplace transform.

$\frac{dy}{dt} + 3y = 2 + e^{-t}$, where $y(0) = 1$

22210

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) If $f(x) = 3x^2 - 5x + 7$, show that $f(-1) = 3f(1)$

b) State whether the function $f(x) = 3x^4 + x^2 + 5 - 3\cos x + 2\sin^2 x$ is even or odd.

c) Find $\frac{dy}{dx}$ if $y = e^x \cdot \sin^{-1} x$

d) Evaluate $e^{\int 2 \cdot \log x \, dx}$

e) Evaluate $\int \sin^2 x \, dx$

f) Find the area under the curve $y = x^2$ from $x = 0$ to $x = 3$ with x axis.

g) Express $z = 1 - i$ in Polar form.

P.T.O.

Marks

2. Attempt any THREE of the following: **12**

a) Find $\frac{dy}{dx}$ if $x^2 + y^2 = 4xy$

b) If $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$
find dy/dx at $\theta = \pi/2$

c) Find radius of curvature of the curve $\sqrt{x} + \sqrt{y} = 1$ at $\left(\frac{1}{4}, \frac{1}{4}\right)$

d) Find the maximum and minimum value of $x^3 - 9x^2 + 24y$

3. Attempt any THREE of the following: **12**

a) Find equation of tangent and normal to the curve
$2x^2 - xy + 3y^2 = 18$ at (3, 1)

b) Find $\frac{dy}{dx}$ if $y = x^x + (\sin x)^x$

c) If $y = e^{3\sec x + 4\tan x}$ find $\frac{dy}{dx}$

d) Evaluate $\int \frac{\sec^2 x}{(1 + \tan x)(3 + \tan x)}\, dx$

4. Attempt any THREE of the following: **12**

a) Evaluate $\int x \tan^{-1} x\, dx$

b) Evaluate $\int \frac{dx}{4 + 5\cos x}$

c) Evaluate $\int \frac{2x^2 + 5}{(x - 1)(x + 2)(x + 3)}\, dx$

d) Evaluate $\int \frac{dx}{\sqrt{16 - 6x - x^2}}$

e) Evaluate $\int_0^{\pi/2} \frac{dx}{1 + \cot x}$

Marks

5. Attempt any TWO of the following: **12**

a) Find the area between the curves $y = x$ and $y = x^2$

b) Attempt the following:

(i) Find the order and degree of the differential equation

$$\frac{d^2y}{dx^2} = \sqrt{1 + \frac{dy}{dx}}$$

(ii) Solve

$$\frac{dy}{dx} + y \cot x = \text{cosec } x$$

c) If L $\frac{di}{dt} = 30 \cdot \sin(10\pi t)$, find i in terms of t, given that L=2 and i=0 at t = 0

6. Attempt any TWO of the following: **12**

a) Attempt the following

(i) Expresss $\frac{2 - \sqrt{3}\,i}{1 + i}$ in x + iy form

(ii) Find $L\{e^{-4t}\ t^2\}$

b) Find $L^{-1}\left\{\frac{2s^2 - 4}{(s+1)(s-2)(s-3)}\right\}$

c) Solve using Laplace transform $\frac{dx}{dt} + 2x = e^{-t}$ given that $x(0) = 2$

———————

22210

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) If $f(x) = tan\ x$, show that

$$f(2x) = \frac{2f(x)}{1 - [f(x)]^2}$$

b) State whether the function $f(x) = \frac{e^x + e^{-x}}{2}$ is even or odd.

c) Find $\frac{dy}{dx}$ if $y = x.e^x$

d) Evaluate $\int tan^{-1}x\ dx$

e) Evaluate $\int \sqrt{1 + sin2x}\ dx$

f) Find the area bounded by the curve $y = sin\ x$ and the x-axis from $x = 0$ to $x = \pi$

g) Express in the form $a + ib$,
$Z = \frac{1+i}{2-i}$, where $a, b, \in$ IR. $i = \sqrt{-1}$

Marks

2. Attempt any THREE of the following: **12**

a) If $x = a(\theta - sin\theta)$, $y = a(1 - cos\ \theta)$
find $\frac{dy}{dx}$

b) If $x^2 + y^2 = xy$ find $\frac{dy}{dx}$

c) A metal wire 36 cm long is bent to form a rectangle. Find its dimensions when its area is maximum.

d) A beam is bent in the form of the curve $y = 2 \sin x - \sin 2x$. Find the radius of curvature of the beam at this point at $x = \frac{\pi}{2}$

3. Attempt any THREE of the following: **12**

a) Find the equation of the tangent and normal to the curve $4x^2 + 9y^2 = 40$ at (1,2)

b) Find $\frac{dy}{dx}$ if $y = x^{\sin x} + (\tan x)^x$

c) Find $\frac{dy}{dx}$ if $y = \log [x + \sqrt{x^2 + a^2}]$

d) Evaluate $\int \frac{dx}{4 + 5\cos x}$

4. Attempt any THREE of the following: **12**

a) Evaluate $\int \frac{(x-1)e^x}{x^2 . \sin^2\left(\frac{e^x}{x}\right)}\ dx$

b) Evaluate $\int \sin^3 x\ dx$

c) Evaluate $\int \frac{2x^2 + 5}{(x-1)(x+2)(x+3)}\ dx$

d) Evaluate $\int x^2 . e^{3x}\ dx$

e) Evalute $\int_o^5 \frac{\sqrt{5-x}}{\sqrt{x} + \sqrt{5-x}}\ dx$

Marks

5. Attempt any TWO of the following: **12**

a) Find the area of the circle $x^2 + y^2 = 36$ by using definite integration.

b) (i) Find the order and degree of D.E.

$$\sqrt{\frac{d^2y}{dx^2}} - \frac{dy}{dx} - xy^2 = 0$$

(ii) Solve D. E. $x \cdot \frac{dy}{dx} + y = x^3$

c) The velocity of a particle is given by $v = t^2 - 6t + 7$. Find distance covered in 3 seconds.

6. Attempt any TWO of the following: **12**

a) i) Express in polar form, $\not{Z} = 1 + i\sqrt{3}$

ii) Find $L\ \{sin\ 3t + cos\ 2t\}$

b) Find $L^{-1}\left\{\frac{2s+3}{(s+2)(s+6)}\right\}$

c) Solve the differential equation using Lap lace Transformation.

$$\frac{dy}{dt} - 3y = t.e^{-2t},\ y(0) = 0$$

22210

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Solve any FIVE of the following: **10**

a) Find 'a' if $f(x) = ax + 10$ and $f(1) = 13$.

b) State whether the function $f(x) = \frac{x\cos x}{1+\sin^2 x}$ is even or odd.

c) Find $\frac{dy}{dx}$ if $y = x^e + e^x + e^e + \sqrt{x}$.

d) Evaluate : $\int (e^x + x^e + e^e)\,dx$

e) Evaluate : $\int \frac{\cos(\log x)}{x}\,dx$

f) Find the area bounded by the curve $y = x^3$, x-axis and co-ordinates $x = 1$, $x = 3$.

g) Separate into real and immaginary polt for '$\frac{1+i}{2-i}$'.

P.T.O.

Marks

2. Solve any THREE of the following: **12**

a) Find maximum and minimum value of curve $x^3 - 9x^2 + 24x$.

b) Find $\frac{dy}{dx}$ if $x^3 + y^3 + xy = 0$.

c) If $x = \sec\theta + \tan\theta$ and $y = \sec\theta - \tan\theta$ then show that $\frac{dy}{dx} = \frac{-y}{x}$.

d) Find Radius of curvatures of curve $y = e^x$ at point [0, 1].

3. Solve any THREE of the following: **12**

a) Find the equation of tangent to the curve $y = x(x - 2)$ at the point (2, 0).

b) If $y = (\tan x)^x$ then find $\frac{dy}{dx}$.

c) Find $\frac{dy}{dx}$ it $y = \cos^{-1}[4x^3 - 3x]$.

d) Evaluate : $\int \frac{\cos\theta}{(2 + \sin\theta)(3 + 4\sin\theta)} d\theta$

4. Solve any THREE of the following: **12**

a) Evaluate : $\int \frac{dx}{4\cos^2 x + 9\sin^2 x}$

b) Evaluate : $\int \frac{dx}{5 + 4\cos x}$

c) Evaluate : $\int x \cdot \tan^{-1} x \, dx$

d) Evaluate : $\int \frac{dx}{\sqrt{13 - 6x - x^2}}$

e) Evaluate : $\int_0^{\frac{\pi}{2}} \frac{\tan x}{\tan x + \cot x} dx$

Marks

5. Solve any TWO of the following: **12**

a) i) Evaluate : $\int_{-1}^{1} \frac{1}{1+x^2}\,dx$

ii) Calculate the area enclosed by curve $y^2 = x$ and $y = x$.

b) i) Find the order and degree of differential equation $\frac{d^2y}{dx^2} = \sqrt[4]{1+\left(\frac{dy}{dx}\right)^2}$

ii) Find integrating factor of D.E. $x\frac{dy}{dx} - y = x^2$.

c) Solve the DE $L\frac{dI}{dt} + RI = E$, given I = 0 when t = 0 and L, E, R are constants.

6. Solve any TWO of the following: **12**

a) i) Express $z = \frac{-1}{2} + i\frac{\sqrt{3}}{2}$ in polar form.

ii) Find $L\{2 + e^{-3t} + \sin 2t\}$.

b) i) Find $\alpha^{-1}\left[\frac{6}{2S-3}\right]$

ii) Find $\alpha^{-1}\left[\frac{3S+2}{S^2+16}\right]$

c) Solve using Laplace transform.

$\frac{dy}{dt} + 3y = 1 + e^t$, given that $y(0) = -1$.

22210

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Solve any FIVE of the following: **10**

a) If $f(x) = x^2 + 6x + 10$, find $f(2) + f(-2)$.

b) State with proof whether the function $f(x) = \log\left(\frac{1-x}{1+x}\right)$ is even or odd.

c) Find $\frac{dy}{dx}$ if $y = e^x \cdot \tan x$.

d) Evaluate $\int e^{x \cdot \log_e a}\, dx$.

e) Evaluate $\int \sqrt{1+\cos 2x}\ dx$.

f) Find the area bounded by the curve $y = 4x^3$, X - axis and the ordinates $x = 1$, $x = 2$.

g) Find modulus and amplitude of $1 + i\sqrt{3}$.

P.T.O.

Marks

2. Solve any THREE of the following: **12**

a) If $x^2 + y^2 = 4xy$, find $\frac{dy}{dx}$ at (1, 2)

b) Find $\frac{dy}{dx}$, if $x = a\ (\cos t + t\ \sin t)$
$y = a\ (\sin t - t\ \cos t)$

c) A telegraph wire hangs in the form of curve $y = a \log \left\{\sec\left(\frac{x}{a}\right)\right\}$. Show that curvature at any point is $\frac{1}{a} \cos\left(\frac{x}{a}\right)$.

d) A metal wire 40 cm long is bent to form a rectangle. Find it's dimensions when it's area is maximum.

3. Solve any THREE of the following: **12**

a) Find the equations of tangents to the curve $y = x^2 - 2x - 3$ where it cuts x – axis.

b) If $x^y = e^{x-y}$, show that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$.

c) Find $\frac{dy}{dx}$ if $y = \log\left(\frac{\sin x}{1+\cos x}\right)$.

d) Evaluate $\int \frac{e^x (x+1)}{\cos^2 (x \cdot e^x)}\, dx$.

4. Solve any THREE of the following: **12**

a) Evaluate $\int \frac{dx}{x^2 + x + 1}$.

b) Evaluate $\int \frac{dx}{5 + 3\cos x}$.

c) Evaluate $\int \tan^{-1} x\ \ dx$.

d) Evaluate $\int \frac{dx}{\cos^2 x (1 - \tan x)\ (2 + \tan x)}$.

e) Evaluate $\int_0^{\frac{\pi}{2}} \frac{1}{1+\sqrt{\cot x}}\ \ dx$.

Marks

5. Solve any TWO of the following: **12**

a) Find the area bounded by parabolas $y^2 = 9x$ and $x^2 = 9y$.

b) i) Find order and degree of the differential equation

$$\sqrt{\frac{d^2y}{dx^2}} = \sqrt[3]{\frac{dy}{dx}}$$

ii) Solve : $\frac{dy}{dx} + y \tan x = \cos^2 x$.

c) Find the current as a function of time t using Kirchhoff's voltage law equation $L\frac{di}{dt} + Ri = E$, if resistance of 10 ohms and an inductance of 2 Henry are connected in series with a battery of 200 V.

6. Solve any TWO of the following: **12**

a) i) Express $\frac{(1+i)(2+i)}{3+i}$ in $x + iy$ form.

ii) Find $L\{\cos 5t \cdot \cos 3t\}$.

b) Find $L^{-1}\left\{\frac{s^2 + s - 2}{s(s-2)(s+3)}\right\}$.

c) Solve the differential equation using Laplace transform.

$\frac{dy}{dt} + y = t^2 \cdot e^{-t}$; $y(0) = 3$.

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23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Figures to the right indicate full marks.

(3) Assume suitable data, if necessary.

(4) Use of Non-programmable Electronic Pocket Calculator is permissible.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following :

(a) What is a match number in relation to De-Laval Nozzle ? **2**

(b) State the application of Nozzle. **2**

(c) Write down any four components of Domestic Refrigerator. **2**

(d) Define Wet steam and Dry steam. **2**

(e) Define Brake power and Brake thermal efficiency. **2**

(f) Enlist the part of Centrifugal pump. **2**

(g) Define dryness fraction and degree of super Heat. **2**

2. Attempt any THREE of the following :

(a) Describe the need of compounding in steam turbine. State the name of compounding method for reaction turbines. **4**

(b) Difference between Open cycle and Closed cycle gas turbine. **4**

(c) Turbine is operating on 150 m of water head, the discharge of water is 6.0 m^3/s find the power developed by the turbine neglecting the losses. Take density of water 9.8 kN/m^3. **4**

(d) Name the hazardous pollutants in a steam power plant with their effect on Human body. **4**

3. Attempt any THREE of the following :

(a) State the need of compounding of steam. **4**

(b) State any four applications of Gas turbine an power plant. **4**

(c) Mention the corrective action to reduce the electricity bill due to an air compressor. **4**

(d) Explain two methods to reduce power consumption of Air compressor with Justification. **4**

4. Attempt any THREE of the following :

(a) In diesel engine heat is supplied at a rate of 21.50 kW. Engine producers brake power at a rate of 5.2 kW. Estimate brake thermal efficiency. **4**

(b) List of four applications of compressor Air. **4**

(c) Explain working of open cycle gas turbine with neat sketch. **4**

(d) List of any two methods to reduce Sulphur Dioxide (So_2) emission from thermal power plants. **4**

5. Attempt any TWO questions of following :

(a) State the function of following component of refrigerator. **6**

(i) Thermostat

(ii) Defrost heater

(iii) OLP

(iv) HP and LP cut out

(b) Explain working of simple vapour compression system with neat sketch of its Layout. **6**

(c) Draw a neat sketch of Francis turbine in two views and show the following component on it : **6**

(i) Draft tube

(ii) Guide vanes or wicket gates

6. Attempt any TWO of the following :

(a) Explain the purpose of **6**

(i) Boiler mountings

(ii) Boiler accessories

(iii) Fussible plug

(b) Explain working of single acting reciprocating pump with sketches. **6**

(c) Explain with a neat sketch the vapour compression system used in domestic refrigerator. **6**

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the Clausius statement of second law of thermodynamics.

(b) Define :

(i) Dryness fraction of steam

(ii) Dry saturated steam

(c) Define I.C. Engine. Give it's applications.

(d) What is Mach number in relation to De Laval nozzle ?

(e) State the unit of Brake Power and define Brake Thermal Efficiency.

(f) State the meaning of HVAC.

(g) Define Ton of Refrigeration.

2. Attempt any THREE of the following : **12**

(a) Draw the schematic sketch of water tubes, headers, baffles and blow-off-cock as parts of Babcock and Wilcox boiler and label it.

(b) Sketch the labelled layout of steam power plant and describe the function of cooling tower.

(c) Describe the need of compounding in steam turbines. State the name of compounding method for reaction turbines.

(d) List any two methods to reduce sulfur dioxide (SO_2) emission from thermal power plants.

3. Attempt any THREE of the following : **12**

(a) A self start S.I. engine of a motorcycle fails to start. State any four reasons and remedies thereof.

(b) State any four applications of Gas turbine power plant.

(c) State two types of gas turbine power plants and compare them.

(d) The head over a Pelton wheel nozzle is 350 m of water of density 1000 kg/m^3. The spear valve is set to discharge 3.5 m^3/s. Find out the power of the turbine. Take g = 9.81 m/s^2.

4. Attempt any THREE of the following : **12**

(a) Describe the working of screw compressor with neat sketch.

(b) State any two methods to reduce power consumption of air compressors with justification.

(c) It is proposed to purchase compressor for furnace of smithy shop of workshop of polytechnic :

(i) State the most suitable type of compressor.

(ii) Justify your answer.

(d) A four stroke Diesel engine has Brake thermal efficiency of 25.6% while it delivers 6.5 kW of Brake power. Calculate the rate at which heat is supplied to engine.

(e) In order to determine efficiency of a centrifugal pump, the following observations were made :

Pressure gauge reading on suction side = 2.5 m of water

Pressure gauge reading on delivery side = 125 m of water

Total discharge of the pump = 0.25 m^3/s

Total input to the pump = 430 kW

Find efficiency of the pump.

5. Attempt any TWO of the following : **12**

(a) It is proposed to use window air-conditioner for air-conditioning of the room of 4m × 4m × 4m size. State the suggestions for energy saving with justification.

(b) State the functions of following components of refrigerator :

(i) Thermostat

(ii) Defrost heater

(iii) OLP

(iv) HP & LP cut out

(c) It is observed that when refrigerator is switched ON, the compressor starts but there is no cooling. Mention the possible causes with remedies.

6. Attempt any TWO of the following : **12**

(a) Draw a neat labelled schematic sketch of vapour compression cycle and state the function of :

(i) Compressor

(ii) Condenser

(iii) Expansion valve

(b) Explain the purpose of :

(i) Boiler mountings

(ii) Boiler accessories

(iii) Fusible plug

(c) Draw a neat sketch of Francis turbine in two views and show the following components on it :

(i) Draft tube

(ii) Guide vanes or wicket gates

22214

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define enthalpy and state its SI unit.

(b) State the application of Nozzle.

(c) Enlist the parts of centrifugal pump.

(d) If engine do not start in colder condition identify its causes.

(e) Define one ton of refrigeration.

(f) Identify the component of domestic refrigerator.

(g) Define pressure and state its SI units.

2. Attempt any THREE of the following: **12**

(a) Describe the functions of three parts of Babcock and Wilcox boiler using a sketch.

(b) Draw the sketch of Impulse steam turbine and do the following :

(i) Label the components

(ii) Describe the functions of any two major components.

(c) Describe the working of four stroke diesel engine with sketch ?

(d) Name the hazardous pollutants in a steam power plant with their effect on human.

3. Attempt any THREE of the following : **12**

(a) Suggest with justification the remedies in the following situations :

(i) High fuel consumption in IC engine

(ii) Overheating of IC engine

(b) State the working of gas turbine with sketch.

(c) Compare open and close cycle gas turbines with respect to components and working.

(d) Enlist the application of submersible pumps.

4. Attempt any THREE of the following : **12**

(a) Explain working principle of a screw compressor with sketches.

(b) List any four methods to reduce power consumption in air compressor with justification.

(c) In a diesel engine, heat is supplied at the rate of 19.50 kW. Engine Produces power at the rate of 4.2 kW. Estimate brake thermal efficiency.

(d) A turbine is operating on 130 m of water head-The discharge is 3.5 m^3/s. Find the power developed by the turbine neglecting the losses. Take density of water 9.81 kN/m^3.

(e) Enlist types of air compressors.

5. Attempt any TWO of the following : **12**

(a) State the types of Air conditioning system and explain with sketch any one air conditioning system.

(b) Suggest with justification, the type of air conditioner in the following situations :

(i) Computer Lab for 60 computere

(ii) A room of 5 metre × 5 metre

(iii) A city Bus of 45 people capacity

(c) It was observed that when refrigerator is switched on the compressor does not start. Method the possible causes with remedies.

6. Attempt any TWO of the following : **12**

(a) Describe the vapour compression cycle with neat sketch and state the function of any two component of it.

(b) State the requirement of boiler mountings and boiler accessories and name any three boiler mountings and three boiler accessories.

(c) Compare Reciprocating pump and Rotary pump and Draw the sketch of centrifugal pump.

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22214

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt ANY FIVE of the following : **10**

(a) Define enthalpy and state its unit.

(b) Define :

(i) Superheated steam

(ii) Wet steam

(c) State the use of piston in I.C. Engine.

(d) Define :

(i) Degree of superheat

(ii) Dryness fraction

(e) State the function of the turbine and list any two applications.

(f) What did you understand by the term "Ton of refrigeration." ?

(g) State the function of evaporator and condenser in refrigerator.

2. Attempt ANY THREE of the following : **12**

(a) Differentiate between boiler mountings and boiler accessories.

(b) State the necessity of compounding the steam turbine.

(c) Draw the neat sketch of Cochran boiler.

(d) Draw the layout of steam power plant and state the function of any two major components.

3. Attempt ANY THREE of the following : **12**

(a) Define the terms :

(i) Indicated power

(ii) Brake power

(iii) Brake thermal efficiency

(b) Explain the working of 4 stroke diesel engine with neat sketch.

(c) Mention any two faults and its remedies regarding. I.C. engine with its justifications.

(d) State the working principle of Pelton turbine giving two applications.

4. Attempt ANY THREE of the following : **12**

(a) Differentiate between centrifugal compressor and reciprocating compressor.

(b) List any four applications of compressed air.

(c) Draw the neat sketch of screw compressor and label it.

(d) Name the hazardous pollutants in a steam power plant with their effect on human body.

(e) Mention the corrective action to reduce the electricity bill due to air compressor.

5. Attempt ANY TWO of the following : **12**

(a) Explain centrifugal pump with its neat sketch and constructional features.

(b) Describe Francis Turbine with its neat sketch. Also mention any two applications of Francis Turbine.

(c) Explain window air conditioning system with neat sketch.

6. Attempt ANY TWO of the following : **$2 \times 6 = 12$**

(a) Add a short note on methods of energy savings in refrigeration and air conditioning system.

(b) Explain the working principle and state any two applications of the following :

(i) Reciprocating pump

(ii) Rotary pump

(c) Differentiate between impulse turbine and reaction turbine.

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22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the first law of thermodynamics.

(b) Define wet steam and superheated steam.

(c) Define boiler mountings with two examples.

(d) Enlist four important components of I.C. engines.

(e) 'Break power is always less than indicated power'. Justify.

(f) Define one ton of refrigeration.

(g) State the function of capillary tube in window air conditioner.

2. Attempt any THREE of the following : **12**

(a) List various boiler accessories and write functions of each of them.

(b) Draw neat sketch of Babcock & Wilcox boiler. Also label all important parts of it.

(c) State the need of compounding of steam turbine and give its types.

(d) The following observations are made of centrifugal pump :

The total manometric head = 130 m of water

Total discharge of the pump = 0.32 m^3/s

Total input to the pump = 600 kW

Find overall efficiency of the pump.

3. Attempt any THREE of the following : **12**

(a) A self-start S.I. engine of motorcycle fails to start. State any four reasons and remedies thereof.

(b) Compare open and closed gas turbines on the basis of components and working.

(c) List any four pollutants in exhaust gases of I.C. engine with their effects on human being.

(d) A diesel engine, produces break power at a rate of 5.5 kW. The break thermal efficiency of the engine observed as 48%. Calculate indicated power and friction power of the engine.

4. Attempt any THREE of the following : **12**

(a) State different applications of compressed air.

(b) Suggest the type of air compressor for the following applications :

(i) Domestic refrigerator

(ii) Spray painting

(iii) Domestic cooler

(iv) Air filling in tubes of vehicle

(c) Explain two methods to reduce power consumption of air compressor.

(d) A dam is constructed to provide a 50 m head of water

(i) Name the relevant turbine that is used to generate power

(ii) Sketch the turbine you recommended.

(e) Suggest the suitable type of pump for the following cases with justification :

(i) Transferring water from lakes to fields

(ii) Pumping lubricants in diesel engine

5. Attempt any TWO of the following : **12**

(a) Explain with neat sketch the working of simple vapour compression system. Show clearly the physical state of the refrigerant passing through the different components during cycle.

(b) It is observed that when refrigerator is switched ON, the compressor does not start. Give the possible causes with remedies.

(c) Suggest the remedial action to be taken when following faults occur in window air conditioner :

(i) A.C. unit is not running

(ii) A.C. making more noise

(iii) Not getting desirable cooling effect

6. Attempt any TWO of the following : **12**

(a) Sketch the labelled layout of steam power plant and explain the process of power generation.

(b) Explain centrifugal pump with its neat sketch and constructional features.

(c) Suggest with justification the type of air conditioning system for :

(i) Computer lab with 50 computers

(ii) A city bus with 45 passengers capacity

(iii) A bedroom of 5 m × 5 m

(iv) A bank ATM

22213

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Draw the symbol of –

i) Zener Diode

ii) Photo Diode

b) Define term Ripple factor for rectifier.

c) Draw the symbol of NPN and PNP transistor.

d) Define term load regulation.

e) List any two applications of Zener diode.

f) Name the IC voltage for fixed voltage +5V and –10V.

g) Draw the logic symbol and truth table for NAND gate.

P.T.O.

Marks

2. Attempt any THREE of the following: **12**

a) State the working principle of photo diode.

b) Explain half-wave rectifier with input-output waveform.

c) Describe the working of NPN transistor.

d) State the need of D.C. regulated power supply. Also give it's advantages. (any four)

3. Attempt any THREE of the following: **12**

a) Sketch the block diagram of D.C. regulated power supply. State function of each block.

b) List the application of LC and RC oscillators.

c) Draw input output characteristics of CE configuration.

d) Define filter. Give it's type and draw π type filter.

4. Attempt any THREE of the following: **12**

a) Compare positive and negative feedback system on the basis of –

i) Overall phase shift,

ii) Voltage gain,

iii) Stability,

iv) Application.

b) In full wave rectifier Vm = 50V, R_L = 10 kΩ, find Vdc, Idc and Ripple factor.

c) Describe transistor as switch with neat sketch.

d) Explain with diagram construction of LED.

e) Draw the circuit diagram of centertap rectifier with LC filter.

Marks

5. Attempt any TWO of the following: **12**

a) Sketch circuit diagram for common base configuration and explain it's input and output characteristics.

b) Sketch functional block diagram of IC 723 and explain each block in detail.

c) Sketch the implementation of OR gate and AND gate using NAND gate.

6. Attempt any TWO of the following: **12**

a) Define α, β and γ of transistor and give relation between α and β of transistor.

b) Convert :–

i) $(416)_{10} = (\quad)_2$

ii) $(140)_{10} = (\quad)_{16}$

iii) $(AFC)_{16} = (\quad)_8$

iv) $(248)_8 = (\quad)_{10}$

c) Sketch colpits oscillator and explain its working. Also state it's application.

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22213

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Draw symbol of:

(i) PN junction diode

(ii) LED

b) Name the different types of filter.

c) Define current gain of a transistor.

d) Define load and line regulation.

e) List any two applications of zener diode.

f) Draw pin configuration of IC 723.

g) Define Demorgans theorem first and write it's equation.

Marks

2. Attempt any THREE of the following: **12**

a) Describe the operating principle of Light Emitting Diode (LED) with neat diagram.

b) Draw the circuit diagram of full wave bridge rectifier and describe its working.

c) Describe the working of NPN transistor with a neat sketch.

d) Draw the block diagram of regulated power supply and state the function of each block.

3. Attempt any THREE of the following: **12**

a) Draw circuit diagram and describe the working of zener diode as voltage regulator.

b) Draw the circuit diagram of crystal oscillator. Give the basic principle of working of piezoelectric crystal and give the equivalent circuit diagram.

c) Draw the output characteristic of CE (Common Emitter) configuration and label various regions.

d) In full wave bridge rectifier Vm= 10 V RL = 10 kΩ. Find out V_{DC}, I_{DC}, ripple factor and P_{IV}.

4. Attempt any THREE of the following: **12**

a) Compare positive and negative feedback (any four points).

b) With the help of circuit diagram and waveform, describe the working of π type filter.

c) For a transistor $\alpha = 0.98$ and IC = 4 mA. Calculate IB and IE.

d) Draw labelled VI characteristic of PN junction diode and explain.

e) Draw the circuit diagram for the following input-output waveform of rectifier (Refer Fig. No. 1 and Fig. No. 2)

Marks

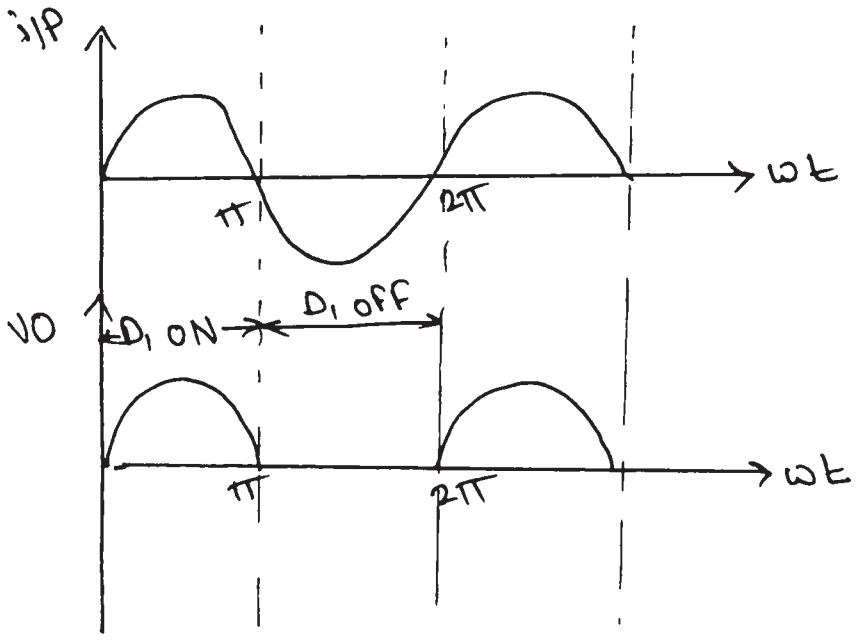

Fig. No. 1

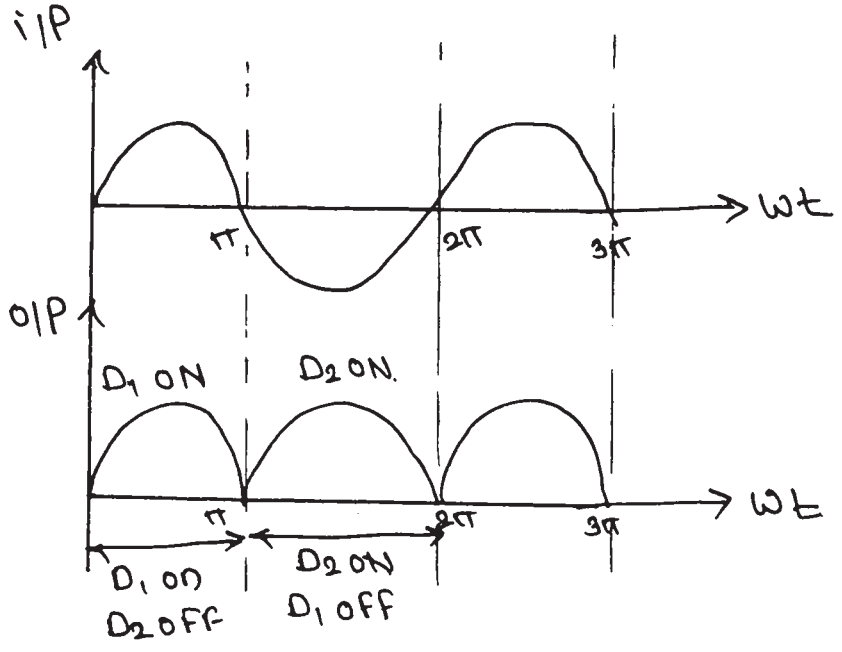

Fig. No. 2

Marks

5. Attempt any TWO of the following: **12**

a) Define α, β and γ of transistor and give the relation between α, β and γ of the transistor.

b) Construct a dual regulated power supply capable of giving ± 12 V using 78XX and 79XX IC's.

c) Define universal gate and implement NAND gate as a OR gate and EX-OR gate.

6. Attempt any TWO of the following: **12**

a) Draw RC phase shift oscillator and determine frequency of oscillation? How can the frequency of oscillator be changed.

b) Describe the working of transistor as a switch with a circuit diagram.

c) Convert:

(i) $(1101101)_2 = (\ ?\ )_8$

(ii) $(513)_{10} = (\ ?\ )_2$

(iii) $(125)_{10} = (\ ?\ )_{16}$

22213

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Draw symbols of zener diode and LED

b) List the types of filters.

c) Draw symbol of NPN and PNP transistor

d) Define the term line regulation and load regulation.

e) Suggest the diode material suitable to rectify 0.5V AC signal.

f) Draw circuit of zener diode as a voltage regulator.

g) Draw truth table for logic gates represented by following IC's:

(i) IC 7400

(ii) IC 7402

Marks

2. Attempt any THREE of the following: **12**

a) Draw and explain V-I characteristics of a PN Junction diode.

b) Explain shunt capacitor filter with the help of circuit diagram and waveform.

c) Compare CB, CE, CC configuration of BJT with respect to following points.

(i) Input Impedance

(ii) Output Impedance

(iii) Current gain

(iv) Voltage gain

d) Draw the functional block diagram of IC 723. State any two features of IC 723.

3. Attempt any THREE of the following: **12**

a) Draw block diagram of DC regulated power supply and explain function of each block with waveforms.

b) State and explain Barkhausen's criteria required for Oscillations.

c) State the need of biasing of BJT. List types of biasing.

d) A half wave rectifier is used to supply 50V DC to a resistive load of 1KΩ. The diode has a resistance of 10Ω. Calculate required input AC voltage.

4. Attempt any THREE of the following: **12**

a) Draw the circuit diagram of crystal oscillator and give the basic principle of piezoelectric crystal.

b) Compare half wave rectifier and full wave rectifier with respect to:

(i) PIV

(ii) Ripple Frequency

(iii) TUF

(iv) Efficiency

Marks

c) In a common base configuration, current amplification factor is 0.8. If emitter current is 2mA, determine the value of base current.

d) Describe the operating principle of LASER diode with constructional diagram.

e) List out advantages and disadvantages of bridge rectifier.

5. Attempt any TWO of the following: **12**

a) Draw frequency response of two stage RC coupled amplifier. Write procedure to calculate bandwidth and state any two methods to improve bandwidth.

b) State the need of regulator. Draw circuit diagram of DC regulated dual power supply for ±12V using IC's 78XX and 79XX

c) State race around condition. Draw the circuit diagram of master slave JK flipflop using NAND gates and explain it's operation.

6. Attempt any TWO of the following: **12**

a) List two applications of oscillator. Calculate the frequency of oscillation for RC phase shift oscillator for the components values R = 8·2KΩ, C = 0·01μF, R_1 = 1·2KΩ, R_F = 39KΩ.

b) Define transistor. Explain how transistor works as a switch with input and output waveforms.

c) Draw implementation of EX-OR and EX-NOR logic gate using NAND and NOR gate.

22213

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State the typical knee voltage values for Si and Ge diodes.

b) State the need of rectifiers. List the types of rectifiers.

c) Draw a symbol of PNP and NPN transistors.

d) State the output voltage of IC 7824 and IC 7906.

e) Suggest the suitable diode type for voltage regulator circuit.

f) Define the terms

i) Line Regulation

ii) Load Regulation

g) Draw the symbol and truth table of EX-OR gate.

Marks

2. Attempt any THREE of the following: **12**

a) Describe the V-I characteristics of a P-N junction diode with proper sketch and define

i) Break over voltage

ii) Reverse breakdown voltage

b) Describe the working of half wave rectifier with LC filter using neat circuit diagram

c) Explain transistor as a switch with neat sketch.

d) Sketch the block diagram of DC regulated power supply. State the function of each block.

3. Attempt any THREE of the following: **12**

a) Explain the functional block diagram of IC 723 with neat sketch.

b) Describe the working of crystal oscillator with neat diagram.

c) State the various transistor configurations. State any four applications of BJT.

d) Compare half-wave rectifier with full wave centre-tapped rectifier on the basis of Ripple factor, Rectifier efficiency, TUF and PIV.

4. Attempt any THREE of the following: **12**

a) State the Barkhausen criteria. Draw the circuit diagram of colpitt's oscillator.

b) Draw the circuit diagram of bridge rectifier with π filter. Draw it's input and output waveforms.

c) A transistor has $I_B = 110\,\mu A$, $I_C = 2\,mA$. Calculate α and β.

d) Describe the construction details of light emitting diode (LED) with neat sketch. State the application of LED.

Marks

e) Figure No. 01. shows the centre tapped full wave rectifier circuit. Assume both the diodes to be ideal. Determine

i) DC output voltage (Vdc) and

ii) Peak inverse voltage (PIV) of diode

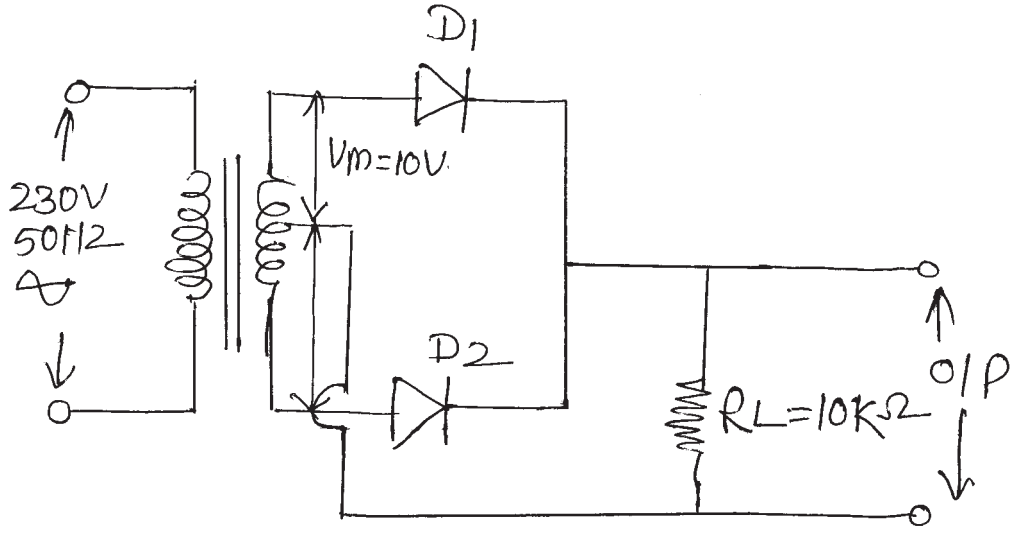

Figure No. 01.

5. Attempt any TWO of the following: **12**

a) A transistor has a typical $\beta = 100$. If the collector circuit is 40 mA. Determine the value of base current, emitter current and α.

b) For zener voltage regulator, if $I_{Zmin} = 2\,mA$, $I_{Zmax} = 20\,mA$, $V_Z = 4.7\,V$. Determine the range of input voltage over which output voltage remains constant. $R_L = 1\ k\Omega$, $R = 1\,\Omega$, $Z_Z = 0\,\Omega$. Refer Figure No. 02.

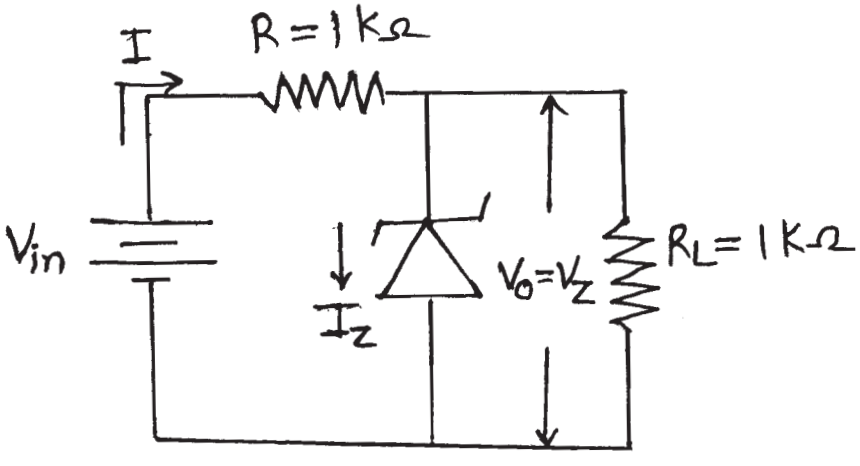

Figure No. 02.

P.T.O.

Marks

c) State the disadvantage of JK flip-flop. Explain the working of MS JK flip-flop with proper diagram.

6. Attempt any TWO of the following: **12**

a) Compare RC and LC oscillators. (six points)

b) Sketch common base configuration input characteristics for two different values of V_{CB} and O/P characteristics for two different values I_E. Write the formula for input resistance and output resistance.

c) Convert the following

i) $(208)_{10} = (\quad)_2$

ii) $(AgC)_{16} = (\quad)_8$

iii) $(247)_8 = (\quad)_{10}$

22213

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

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Marks

1. Attempt any FIVE of the following **10**

a) Draw the symbol of LED and PN junction diote.

b) Name the circuit to obtain D.C. signal from A.C. signal.

c) State relation between emitter current (IE) base current (IB) and collector current (IC) of BJT.

d) Draw pin configuration of IC723.

e) List any two applications of zener diode.

f) Write three terminal voltage regulator IC for obtaining :
   i) +5V
   ii) –12V

g) Draw symbol and write truth table of EX-OR gate.

Marks

2. Attempt any THREE of the following **12**

a) Draw and explain V-I characteristics of PN junction diode.

b) Explain center tapped full wave rectifier with the help of circuit diagram and draw input, output waveforms.

c) Compare CB, CE and CC configuration (Any four points)

d) Explain with circuit diagram operation of zener diode as a voltage regulator.

3. Attempt any THREE of the following **12**

a) Draw the block diagram of regulated DC power supply and explain the function of each block.

b) Sketch circuit diagram of Hartely oscillator. State expression for frequency of oscillation.

c) Describe transistor as a swithch with neat sketch.

d) In full wave bridge rectifier Vm = 10V, RL = 10KΩ. Find out V_{DC}, I_{DC}, ripple factor and PIV.

4. Attempt any THREE of the following **12**

a) Compare positive and negative feedback (Any four points).

b) Draw the circuit diagram of bridge rectifier with π filter. Draw its input and output waveform.

c) In a common base connection, current amplification factor (α) is 0.9. If the emitter current is IMA, determine the value of base current and collector current.

d) Describe the working principle of photodiode with proper diagram.

e) Name the type of rectifier for each of following feature:

i) Highest rectifier efficiency

ii) Highest form factor

iii) Two diode rectifier circuit

iv) PIV = 2Vm.

Marks

5. Attempt any TWO of the following **12**

a) Define α and β of transistor and derive the relation between them.

b) Construct a dual regulated power supply capable of giving ±12V using 78XX and 79XX IC'S.

c) Implement the fundamental logic gates 'OR' gate, 'AND' gate, 'NOT' gate using only NAND gates.

6. Attempt any TWO of the following **12**

a) Sketch circuit diagram of RC phase shift oscillator. If the value of capacitor. $C = C_1 = C_2 = C_3 = 5pf$ and frequency of oscillation is 800Hz, calculate value of resistor R_1 $(R = R_1 = R_2 = R_3)$.

b) Draw output characteristics of common emitter (CE) configuration and explain active, saturation and cut off regions in detail.

c) Convert the following numbers:

i) $(11010010)_2 = (?)_8$

ii) $(109)_{10} = (?)_2$

iii) $(6A)_{16} = (?)_{10}$

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define the term resistance and its unit.

(b) State the concept of internal voltage drop.

(c) Define breakdown voltage and dielectric strength of a capacitor.

(d) An iron ring of mean circumference 80 cm is uniformly wound with 500 turns of wire and carries 0.8A. Find the magnetic field strength.

(e) Define magnetic flux density. State its unit.

(f) State Faraday's law of electromagnetic induction.

(g) A coil of 500 turns is linked with a flux of 25 mWb, when carries a current of 12.5A. Calculate the value of self-inductance.

2. Attempt any THREE of the following : **12**

(a) The rating of electric geyser is 250 V, 3 kW. How much current does it take and what is its hot resistance ? Also calculate the energy consumed by it in one hour.

(b) Find the current through 1 Ω resistance of Figure No. 1 using Kirchhoff's laws.

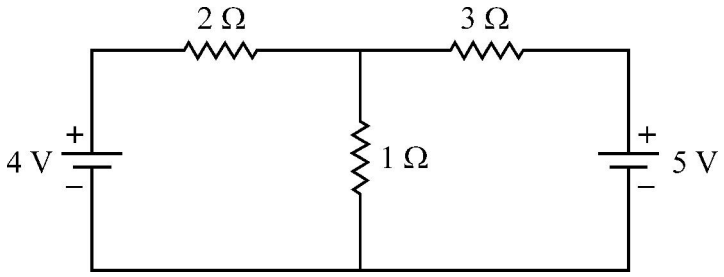

Fig. No. – 1

(c) Plot charging voltage and current curves of capacitor, also write expression for them.

(d) Distinguish between statically induced emf and dynamically induced emf.

3. Attempt any THREE of the following : **12**

(a) A device stores 500 J and releases in the form of current of 40 A in the duration of 15 msec. Find the terminal voltage.

(b) Define electric work and electric power. Give their S.I. units.

(c) State and explain Ohm's law.

(d) Derive the expression for energy stored in the capacitor with the help of neat diagram.

4. Attempt any THREE of the following : **12**

(a) Define ideal voltage source and practical voltage source. Draw the symbol for each.

(b) A resistance of 10 Ω is connected in parallel with 15 Ω. If current through the combination is 10 A, calculate current through each resistance.

(c) Calculate the equivalent resistance between points A and D in the Figure No. 2.

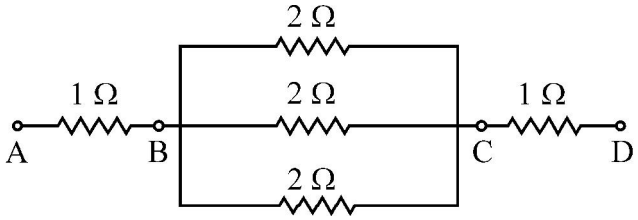

Fig. No. – 2

(d) Calculate the value of equivalent capacitance of the combination given in Figure No. 3.

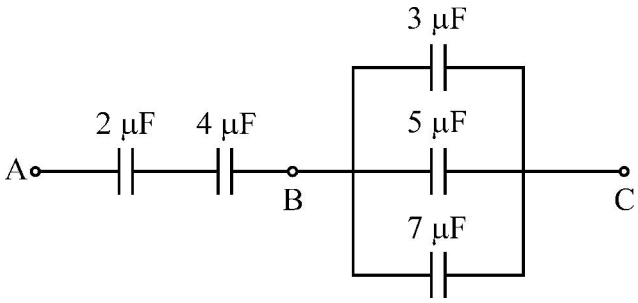

Fig. No. – 3

(e) List any four types of capacitor and their application.

5. Attempt any TWO of the following : **12**

(a) Compare electric circuit and magnetic circuit on any six points.

(b) Draw B-H curve for magnetic material and state its nature. State significance of hysteresis loop. Also draw the hysteresis loop for hard steel and soft steel.

(c) (i) State the various types of inductor.

(ii) Derive the expression for energy stored in magnetic field.

6. Attempt any TWO of the following : **12**

(a) An iron ring of mean circumference 0.8 m is uniformly wound with 400 turns of wire. It carries 1.6 A and produces a flux density of 1.1 T. Find permeability of the material.

(b) Define self-inductance and prove that $L = N^2/S$ where N = number of turns, S = reluctance.

(c) Two coils A of 1000 turns and B of 1200 turns are such that 60% of flux produced by A links with B. A current of 4A in coil A produces a flux of 0.05 wb and in coil B of 0.075 wb. Find

(i) L_1

(ii) L_2

(iii) M

(iv) K

22212

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define power and energy.

b) State the concept of internal voltage drop.

c) Define dielectric strength for a capacitor. And state its unit.

d) Define the term MMF and give it's unit.

e) A magnetic circuit has effective iron length of 100 cm and it is wound with 800 turns of wire carries 1 A. Find the magnetic filed strength.

f) State Lenz's law.

g) State Faraday's law of electromagnetic induction.

Marks

2. Attempt any THREE of the following: **12**

a) The rating of electric geyser is 250 V, 3 kW. How much current does it take and what is its hot resistance? Also calculate the energy consumed by it in one hour.

b) Compare series circuit and parallel circuit.

c) Draw a practical set-up to plot charging and discharging curves of capacitor through a resistor. Draw the curve.

d) State the term of co-efficient of self inductance and also prove that $L = \frac{N^2}{S}$, where N = Number of turns, S = reluctance.

3. Attempt any THREE of the following: **12**

a) The field coil of generator has 14.1 Ω at 25°C and 18.2 Ω at 32°C. Find the temperature coefficient of resistance at 0°C and resistance at 0°C.

b) Compare wire-wound resistor with carbon composition resistor on the basis of material, wattage, rating size and application.

c) Determine the current through 6 Ω resistors shown in Fig. No. 1 using KVL.

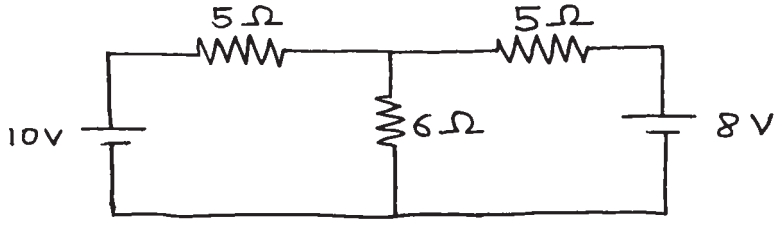

Fig. No. 1

d) Derive equation which is used for finding equivalent capacitances when three capacitances are connected in parallel.

Marks

4. Attempt any THREE of the following: **12**

a) State the laws of resistance and also the factors on which resistance of a material depends.

b) A resistance of 10 Ω is connected in parallel with 15 Ω. If current through the combination is 10 A, calculate current through each resistance.

c) Find resistance R_{AB} for the N/W shown in Fig. No. 2

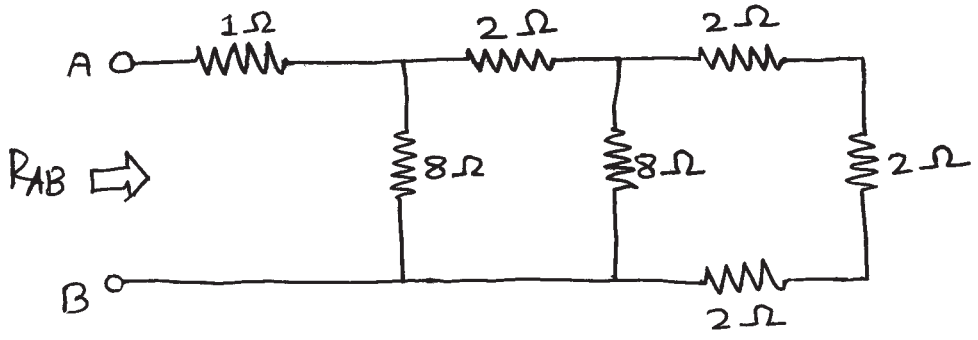

Fig. No. 2

d) Explain constant voltage charging method.

e) Derive the expression for energy stored in a capacitor with the help of neat diagram.

5. Attempt any TWO of the following: **12**

a) Compare electric circuit and magnetic circuit on any six points.

b) Draw a neat sketch of series magnetic circuit. State value of reluctance for both series and parallel magnetic circuit. Name each term used in them.

c) An air cored solenoid has a length of 60 cm and diameter of 2 cm. Calculate its inductance if it has 1000 turns and also find the energy stored in it if the current rises from zero to 6 AMP.

Marks

6. Attempt any TWO of the following: **12**

a) Draw hysteresis loop for following materials:

(i) permanent magnet

(ii) steel alloy

(iii) plastic

b) If a coil of 150 turns is linked with a flux of 0.01 wb when carrying a current of 10 A. Calculate the inductance of the coil. If this current is uniformly reversed in 0.01 seconds. Calculate the induced emf. If second coil of 100 turns is uniformly wound over first coil, find mutual inductance between the two coils.

c) (i) State the various types of inductor.

(ii) Derive the expression for the energy stored in magnetic field.

22212

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

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(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following **10**

a) Define the term resistance and state its unit.

b) State Krichhoff's current law and Krichhoff's voltage law.

c) Give two types of capacitor and give one example of each.

d) Define the following terms and state their units

(i) MMF

(ii) Reluctance.

e) Draw Hysteresis loop for hard steel and Silicon steel.

f) State the expression to determine energy stored in a magnetic field.

g) Name the factors affecting the inductance of a coil.

Marks

2. Attempt any THREE of the following: **12**

a) Draw the symbol and characteristics of ideal voltage source and practical voltage source.

b) Define the following terms as related to electric circuits

(i) Node

(ii) Branch

(iii) Loop and

(iv) Mesh

c) Plot charging voltage and current curves of capacitor, also write expression for them.

d) Compare statically induced emf with dynamically induced emf (any four points).

3. Attempt any THREE of the following: **12**

a) Define electric work and electric power. Give their SI units.

b) A coil consists of 2000 turns of copper wire having a cross-sectional area of 0.8 mm^2. The mean length per turn is 80 cm and the resistivity of copper wire is 0.02 micro-ohm-meter. Find the resistance of the coil and the power adsorbed by the coil when connected across 110 V D.C supply.

c) Derive an expression for equivalent resistance in parallel connection.

d) List four factors affecting the capacitance of a capacitor.

4. Attempt any THREE of the following: **12**

a) State the effect of temperature on resistance.

b) Find the current I supplied by 100 V source in the Figure No. (1).

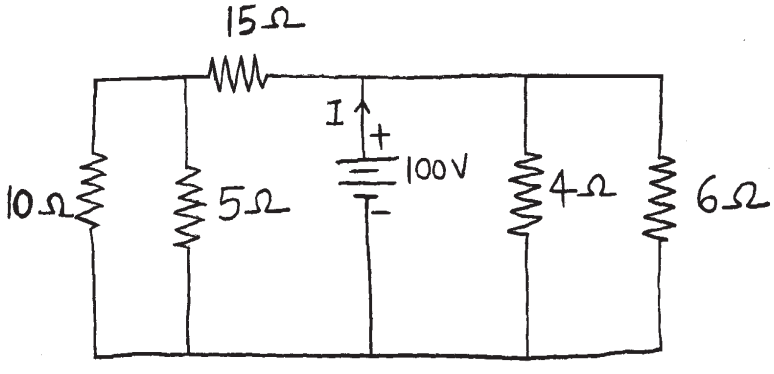

Fig. No. 1

Marks

c) By applying Kirchhoff's law find the current through 10Ω resistor Figure No. (2).

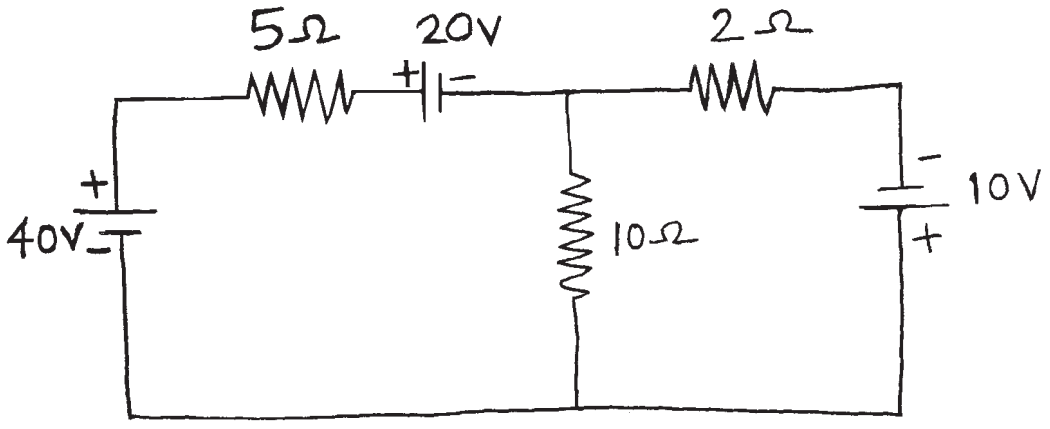

Fig. No. 2

d) Calculate the value of equivalent capacitance of the combination given in Figure No. 3.

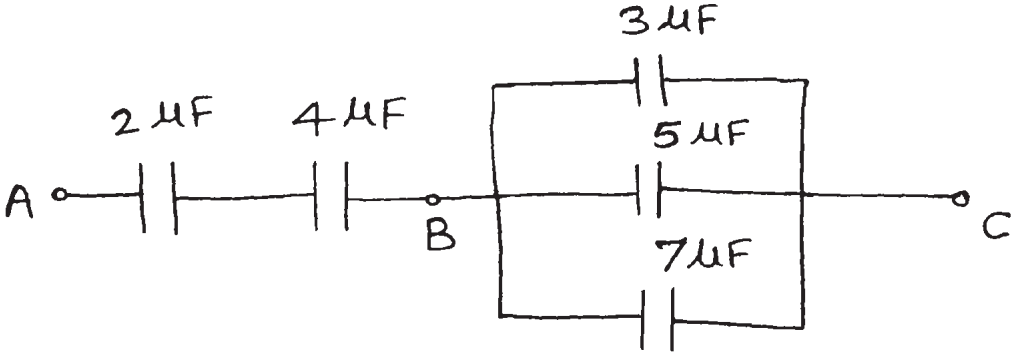

Fig. No. 3

e) Calculate the capacitance, charge, electric flux density and energy stored in a parallel plate capacitor of two metal plates 60 cm × 60 cm separated by a dielectric of 1.5 mm and relative permittivity is 3.5. The potential difference of 100 V is applied across it.

Marks

5. Attempt any TWO of the following: **12**

a) Give any six points of comparison between electric circuit and magnetic circuit.

b) A coil of 500 turns and resistance of 20Ω is wound uniformly on an iron ring of mean circumference 50 cm and cross sectional area 4 cm^2. It is connected to 24 V D.C supply. Relative permeability at material is 800, Find

(i) MMF

(ii) Magnetising Force

(iii) Total flux

(iv) Reluctance

c) Two coils A and B of 500 and 750 turns respectively are connected in series on the same magnetic circuit of reluctance 1.55×10^6 AT/Wb. Assuming that no leakage flux Calculate –

(i) Self inductance of each coil

(ii) Mutual inductance between coils.

6. Attempt any TWO of the following: **12**

a) Define useful flux and leakage flux with the help of neat diagram.

b) Define self inductance and prove that $L=N^2/S$ where N = number of turns S = reluctance.

c) (i) State the term Mutual inductance

(ii) Two coils of 800 and 200 turns are wound on a common magnetic circuit having a reluctance of 160×10^3 AT/Wb

(iii) Determine:

(1) The Mutual inductance

(2) The emf induced in the first coil when current is changing in the second coil at the rate of 500 A/second.

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22212

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

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(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

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Marks

1. Attempt any FIVE of the following : **10**

(a) Define the term resistance and state its unit.

(b) State Ohm's law applied to an electrical circuit and express it in the form of equation.

(c) Define dielectric strength and breakdown voltage.

(d) State the values of permeability of free space and permeability of air.

(e) Define the following terms :

(i) MMF

(ii) Reluctance

(f) List two types of induced emf.

(g) State Faraday's law of Electromagnetic induction.

2. Attempt any THREE of the following : **12**

(a) List any four types of resistors. Give one application of each.

(b) Find the equivalent resistance between terminals A and B shown in Figure No. 1 given below :

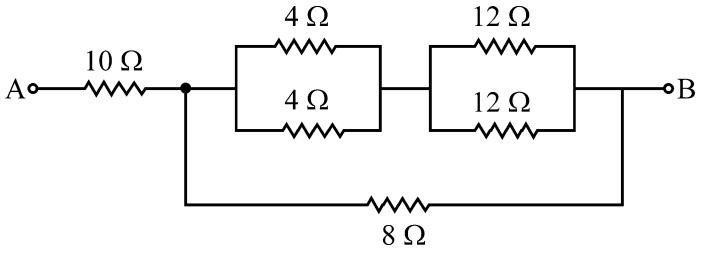

Figure No. 1

(c) (i) State the equation for energy stored in capacitor.

(ii) If 200 V source is applied to parallel combination of 3 capacitors of 4 μf, 8 μf and 12 μf. Calculate energy stored in each capacitor.

(d) Compare statically induced emf with dynamically induced emf on following four points :

(i) Movement of coil or magnet

(ii) Current

(iii) Expression of induced emf

(iv) Application

3. Attempt any THREE of the following : **12**

(a) State and explain Kirchhoff's voltage law.

(b) A furnace takes a current of 10 ampere from 200V DC supply for 8 hours. Calculate energy consumed in kWh.

(c) Find the current flowing through 8Ω resistor using KVL. Refer Figure No. 2.

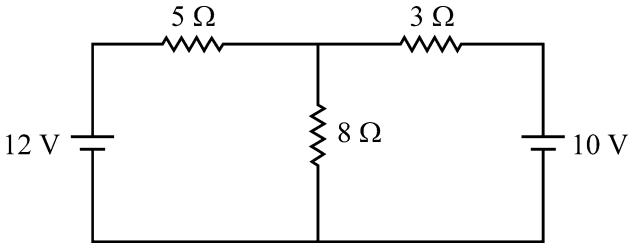

Figure No. 2

(d) List four factors affecting capacitance of capacitor.

4. Attempt any THREE of the following : **12**

(a) Define electrical work & electrical energy. Give SI units of each.

(b) Calculate resistance between terminals A and B, using star-delta conversion. Refer Figure No. 3.

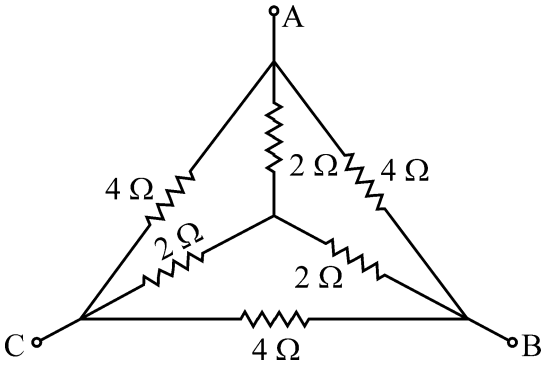

Figure No. 3

(c) The resistance of copper coil increases from 70 Ω at 12 ºC to 95.5 Ω at 60 ºC. Find temperature coefficient of material at 0 ºC.

(d) Three capacitors have capacitances 2 μf, 3 μf, 5 μf. What is the effective capacitance when connected in :

(i) Series

(ii) Parallel

(e) Derive an expression for capacitance of the parallel plate capacitor with medium partly air.

5. Attempt any TWO of the following : **12**

(a) Compare magnetic circuit and electric circuit stating three similarities & three dissimilarities.

(b) An iron ring of 20 cm diameter and 5 cm^2 cross-section area is wound with 300 turns. Flux density of iron is 1 Wb/m^2 and permeability of 500. Find :

(i) Reluctance

(ii) Flux

(iii) MMF

(iv) Current

(c) Calculate the inductance and energy stored in magnetic field of air cored coil of 300 cm long, 60 cm diameter and wound with 5000 turns and carrying 8 A current.

6. Attempt any TWO of the following : **12**

(a) Draw hysteresis loop for hard steel, cast steel, sheet steel and non-magnetic material. Also write application of each material.

(b) Two coils, A of 1500 turns and B of 1200 turns are such that 70% of flux produced by coil A links with coil B. A current of 5 Ampere in coil A produces flux of 0.04 Wb in coil A and 0.085 Wb in coil B. Find :

(i) L_1

(ii) L_2

(iii) M

(iv) K

(c) Related to electromagnetic induction :

(i) Define Self-inductance & Mutual inductance.

(ii) Write one equation of each of the above.

(iii) State the Values of Coupling Factor for tight coupling and loose coupling.

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22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*
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(4) Figures to the right indicate full marks.
(5) Assume suitable data, if necessary.
(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define electric current. **2**

(b) State the meaning of active and passive circuit. **2**

(c) State the meaning of the term dielectric strength. **2**

(d) Define Magneto Motive Force. **2**

(e) Define Magnetic Hysterisis. **2**

(f) Define Co-efficient of coupling. **2**

(g) State the formula to calculate the energy stored in a magnetic field. **2**

2. Attempt any THREE of the following : **12**

(a) State the effects of electric current. Explain any one effect with a suitable example. **4**

(b) Compare resistances in series and parallel. **4**

(c) With suitable diagram explain the action of capacitor. **4**

(d) State and explain statically and dynamically induced emfs. **4**

3. Attempt any THREE of the following : **12**

(a) State and explain ideal voltage source and current source. **4**

(b) An electric kettle is required to heat 0.6 litre of water from 10 °C to the boiling point in 5 minutes. Calculate the resistance of the heating element, if the supply voltage is 240 V. **4**

(c) State and explain Kirchoff's Voltage Law. **4**

(d) Enlist the types of capacitor. Explain the construction of any one. **4**

4. Attempt any THREE of the following : **12**

(a) Compare direct current and alternating current. **4**

(b) Calculate the resistance between the points B & D, for the Fig. 4.1. **4**

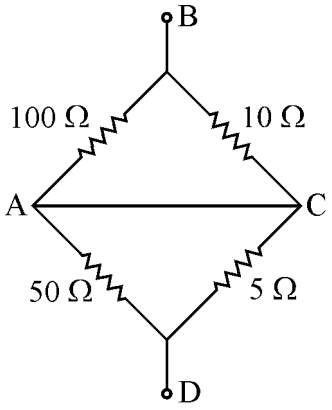

FIG. 4.1

(c) Applying Kirchoff's voltage law, find the current flowing through the resistance 6 Ω & for the circuit shown in Fig. 4.2 **4**

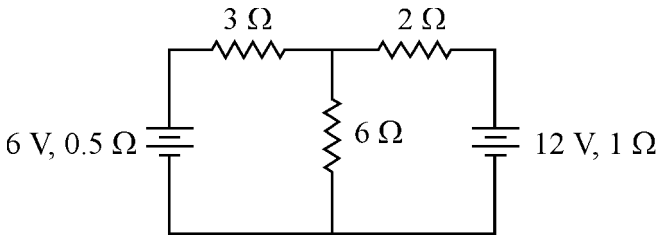

FIG. 4.2

(d) Derive the equation for energy stored in a capacitor. **4**

(e) Three capacitors A, B and C have capacitances 10, 50, 25 μF each are connected in parallel to a 250 V supply. Calculate

(i) Total capacitance

(ii) Charge across each capacitor. **4**

5. Attempt any TWO of the following : 12

(a) Draw the experimental setup to plot the 'B-H Curve' of a magnetic material. Explain the procedure and draw the curve. **6**

(b) An iron ring of mean length 50 cm has an air gap of 1 mm and a winding of 200 turns. If the permeability of iron is 400, calculate the fuel density when a current of 2 A flows through the coil. **6**

(c) (i) State Faraday's Laws of Electro Magnetic Induction.

(ii) Draw and explain the experimental setup to demonstrate the generation of statically induced emf. **6**

6. Attempt any TWO of the following : 12

(a) Compare electric and magnetic circuit. **6**

(b) Two coils having 50 and 400 turns respectively are wound side by side on a closed iron ring of area of cross-section 100 cm^2 and mean length 200 cm. Calculate

(i) Mutual inductance between the coils, if the relative permeability of iron is 2000.

(ii) emf induced in the second coil, when a zero ampere current grows to 10 A in a time of 0.02 sec in the first coil. **6**

P.T.O.

(c) If a coil of 1000 turns is linked with a flux of 0.02 weber, when carrying a current of 10 A, calculate

(i) Inductance of the coil.

(ii) Induced emf, if the current is uniformly reversed in the coil in 0.01 seconds. **6**

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3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Draw impedance triangle and phasor diagram for R L series circuit.

b) Define quality factor for parallel resonance and write its mathematical expression.

c) Define balanced 3 phase load.

d) Define power factor and state its value for pure resistance.

e) State maximum power transfer theorem.

f) Give equations of delta to star transformation.

g) State superposition theorem.

Marks

2. Attempt any THREE of the following: **12**

a) Explain the generation of single phase AC supply by an elementary alternator with neat diagram.

b) Impedance $Z_1 = (10 + j5)\Omega$ and $Z_2 = (8 + j6)\Omega$ are connected in parallel across $V = (200 + j0)$ using the admittance method. Calculate the circuit current and branch currents.

c) Give four advantages of three phase circuits over single phase circuits.

d) Using mesh analysis, find current I in the circuit shown in Figure No. 1.

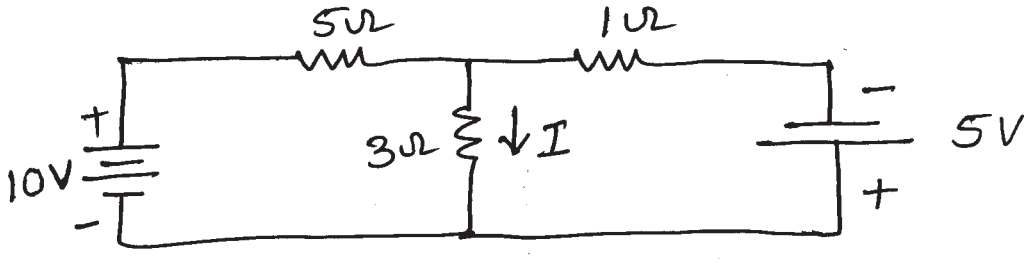

Figure No. 1.

3. Attempt any THREE of the following: **12**

a) A series RLC circuit is connected to 230 V, 50 Hz single phase supply. The value of R = 5 Ω, L = 13 mH, C = 140 μF. Find the

i) Total reactance

ii) Impedance

iii) Current drawn

iv) Power factor

b) In a 3ϕ star connected system, derive the relationship $V_L = \sqrt{3}\, V_{ph}$.

Marks

c) Using nodal analysis, find current I in the circuit shown in Figure No. 2.

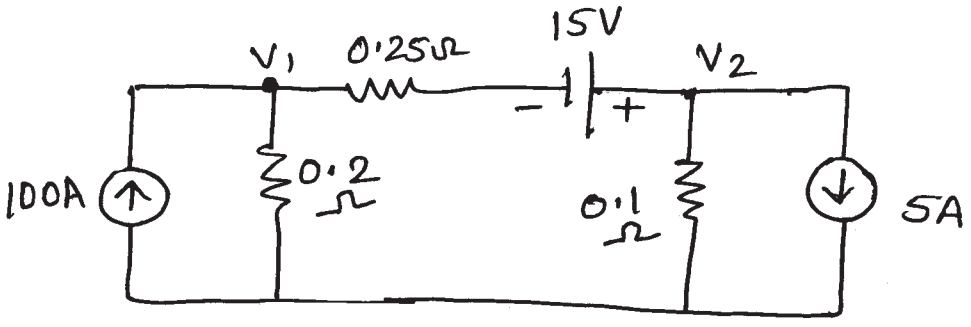

Figure No. 2.

d) Compare series resonance and parallel resonance on any four points.

e) State the Thevenin's theorem. Also write stepwise procedure for applying Thevenin's theorem to simple circuits.

4. Attempt any THREE of the following: **12**

a) A voltage of $(200 \angle 53.13)$ V is applied across two impedance in parallel. The values of the impedance are $(12 + j16)\Omega$ and $(10 - j20)\Omega$.

Determine

i) Active power

ii) Reactive power

iii) Apparent power in each branch and current in each branch.

b) A RLC series circuit with a resistance of 20 Ω, inductance of 0.25 H and capacitance of 100 μF is supplied with 240 V variable AC supply, Calculate

i) Resonance frequency

ii) Current at this condition

iii) Power factor

iv) Quality factor

Marks

c) Explain neutral shift in case of 3ϕ star connected un balanced load with diagram.

d) With neat circuit diagram, explain the concept of duality in electric circuit. State any four examples (pairs) of duality in electric circuit

5. Attempt any TWO of the following: **12**

a) Derive the formula for star to delta transformation.

b) A coil having resistance of 10 Ω and inductance of 0.1 H is connected in parallel with a capacitor of 10 μF across a 200 V, 50 Hz supply. Find the current in the coil and capacitor. Also find the current taken from the supply and overall power factor. Draw a neat phasor diagram and circuit diagram.

c) By Norton's theorem, find the current in 4 Ω resistor in the network shown in Figure No. 3.

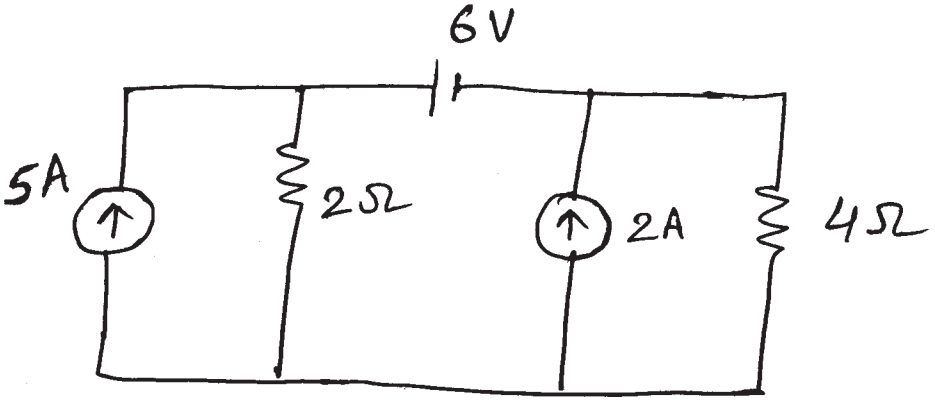

Figure No. 3.

Marks

6. Attempt any TWO of the following: **12**

a) A resistance of 100 Ω and 50 μF capacitor are connected in series across a 230 V, 50 Hz supply.

Find :

i) Impedance

ii) Current flowing

iii) Voltage across resistance and capacitance

iv) Power factor and power

b) Determine the current in 5 Ω resistor in the network given by superposition theorem. Refer Figure No. 4.

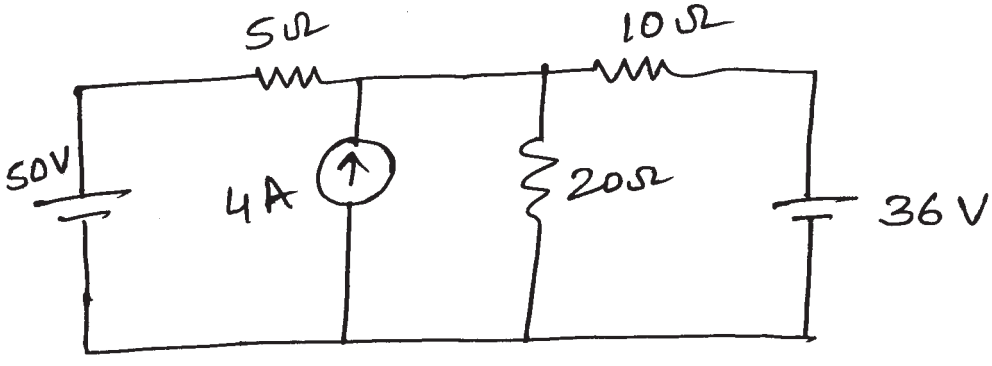

Figure No. 4.

c) A balanced delta, consists of per phase impedance of (5 + j7) Ω. It is supplied with 200 V, 50 Hz 3ϕ AC supply. Calculate line current, phase current, phase voltage, total power absorbed and power factor of the combination. Also draw vector diagram.

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3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Draw power triangle for R-C series circuit. State the nature of power factor of this circuit.

b) State relationship between line and phase values of voltage and current in balanced delta connection.

c) Define Reactive Power and Active Power and state its unit.

d) Define Conductance and Susceptance related to AC circuit and state their units.

e) Distinguish between loop and mesh.

f) State the value of internal resistance of

i) Ideal Voltage Source and

ii) Ideal current Source

g) State Norton's Theorem

Marks

2. Attempt any THREE of the following: **12**

a) With neat diagram, explain the phasor representation of sinusoidal quantity.

b) An AC circuit consists of two branches in parallel.

Branch I : R = 10 Ω and L = 0.1 H in series

Branch II : C = 50 μf

If the circuit is supplied from 200 V, 50 HZ supply

Calculate :-

i) Branch impedances

ii) Branch Currents

iii) Circuit Power factor

iv) Power consumed by Ckt

c) With the help of neat phasor diagram, derive the relationship between line and phase values of voltage in balanced star connection.

d) State the equivalent delta connection for star connection of three resistances R_1, R_2 and R_3, with proper equations.

3. Attempt any THREE of the following: **12**

a) For series R-L-C circuit, draw neat circuit diagram. State the conditions for RLC series ckt. Draw phasor diagram and voltage triangle impedance triangle for any 1 condition.

b) State any four properties of Parallel Resonance.

c) With neat labelled diagram, explain unbalanced star connected load.

d) With neat circuit diagram, explain how to convert a practical voltage source into an equivalent practical current source.

e) Explain the concept of "duality" in electric circuit with one example.

Marks

4. Attempt any THREE of the following: **12**

a) A series R-L-C circuit has R = 5 Ω, L = 10 mH and C = 15 μF. Calculate

i) Resonant frequency

ii) Q-factor of the circuit

iii) Bandwidth

iv) Voltage magnification

b) Explain the "Current Magnification" in parallel resonant circuit consisting of inductive branch (RL) in parallel with a pure capacitor (C). Derive equation for it.

c) Draw waveform of three-phase voltages. Draw phasor diagram for these voltages. Write equations for instantaneous values of these voltages. Express these voltages in polar form.

d) State and explain "Reciprocity theorem".

5. Attempt any TWO of the following: **12**

a) A coil having resistance of 5 Ω and an inductance of 0.2 H is connected in parallel with a series combination of 10 Ω resistor and 80 μF capacitor. If supply voltage is 230 V, 50 Hz, determine :

i) Total circuit impedance

ii) Total current taken by the circuit

iii) Power factor of the circuit

iv) Branch currents

v) Power consumed by the circuit

b) Using mesh analysis, find current in 5 Ω resistor in the network shown in Fig. No. 1.

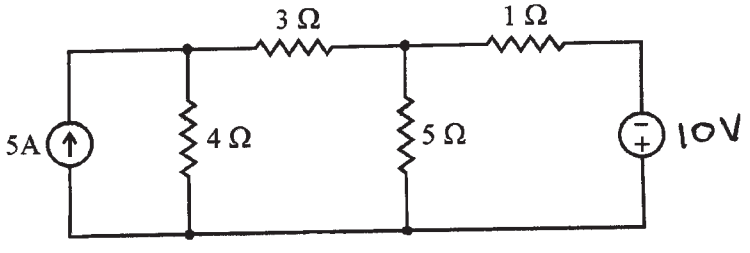

Fig. No. 1

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c) For the network shown in Fig. No. 2 below, determine value of R so that maximum power is delivered to it. Also compute the maximum power delivered.

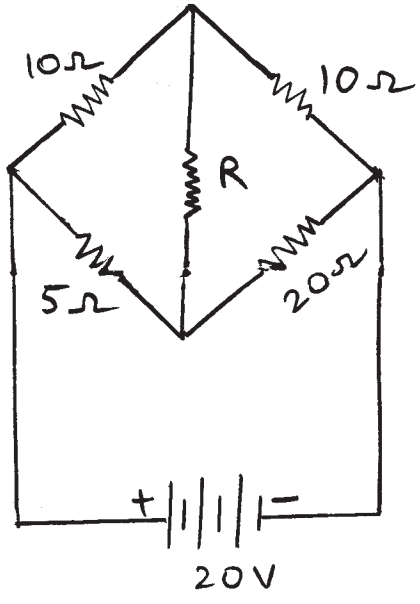

Fig. No. 2

6. Attempt any TWO of the following: **12**

a) For a series R-L-C circuit consisting of R = 5Ω, L = 0.01H and C = 10μF supplied with 230 V, 50 Hz supply, determine -

i) Circuit impedance

ii) Circuit current

iii) Circuit power factor

iv) Active power

v) Reactive power

vi) Apparent power

Marks

b) A star connected capacitive load is supplied from 3 Phase, 415 V, 50 Hz supply. If the line current is 15 A and total 3 phase power taken from supply is 30 kW, Find

i) Power factor

ii) Resistance in each phase

iii) Capacitance in each phase

c) Determine the voltage 'V' across 5Ω resistor in network shown in Fig. No. 3 using superposition theorem.

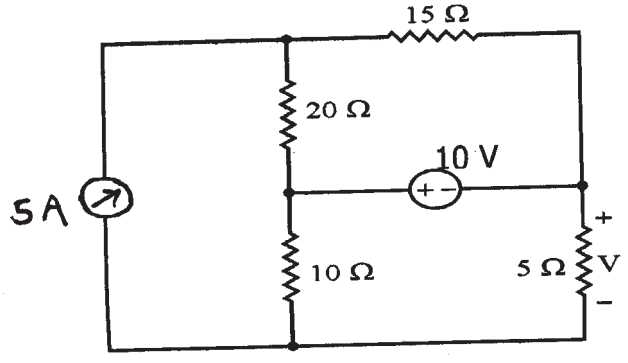

Fig. No. 3

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3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define Conductance and Susceptance related to AC circuit and state their units.

(b) Draw power triangle for R-L series circuit. Write equation of power in rectangular form.

(c) Express an instantaneous value of an alternating current varying sinusoidally in terms of its maximum value, frequency and time.

(d) State relationship between line and phase values of voltage and current in balanced delta connection.

(e) Distinguish clearly between loop and mesh.

(f) State the value of internal resistance of (i) Ideal Voltage Source and (ii) Ideal Current Source.

(g) State Norton's Theorem.

2. Attempt any THREE of the following : **12**

(a) With neat diagram, explain the phasor representation of sinusoidal quantity.

(b) For a parallel circuit consisting of an inductive branch (RL) in parallel with a capacitive branch (RC), draw phasor diagram and derive equation for resonant frequency.

(c) With the help of neat phasor diagram, derive the relationship between line and phase values of voltage in balanced star connection.

(d) State the equivalent delta connection for star connection of three resistances R_1, R_2 & R_2,with proper equations.

3. Attempt any THREE of the following : **12**

(a) For series R-L-C circuit, draw neat circuit diagram. State the conditions for RLC series ckt. Draw phasor diagram and voltage triangle impedance triangle for any 1 condition.

(b) State any four properties of Parallel Resonance.

(c) With neat labelled diagram, explain unbalanced star connected load.

(d) With neat circuit diagram, explain how to convert a practical voltage source into an equivalent practical current source.

(e) Explain the concept of "duality" in electric circuit with one example.

4. Attempt any THREE of the following : **12**

(a) A series R-L-C circuit has R = 5Ω, L = 10 mH and C = 15 μF. Calculate :

(i) Resonant frequency

(ii) Q-factor of the circuit

(iii) Bandwidth

(iv) Voltage magnification.

(b) Explain the "Current Magnification" in parallel resonant circuit consisting of inductive branch (RL) in parallel with a pure capacitor (C). Derive equation for it.

(c) Draw waveform of three-phase voltages. Draw phasor diagram for these voltages. Write equations for instantaneous values of these voltages. Express these voltages in polar form.

(d) State and explain "Reciprocity theorem".

5. Attempt any TWO of the following : **12**

(a) A coil having resistance of 5 Ω and an inductance of 0.2 H is connected in parallel with a series combination of 10 Ω resistor and 80 μF capacitor. If supply voltage is 230 V, 50 Hz, determine :

(i) Total circuit impedance.

(ii) Total current taken by the circuit.

(iii) Power factor of the circuit.

(iv) Branch currents.

(v) Power consumed by the circuit.

(b) Using mesh analysis, find current in 5 Ω resistor in the network shown in Fig. 5(b).

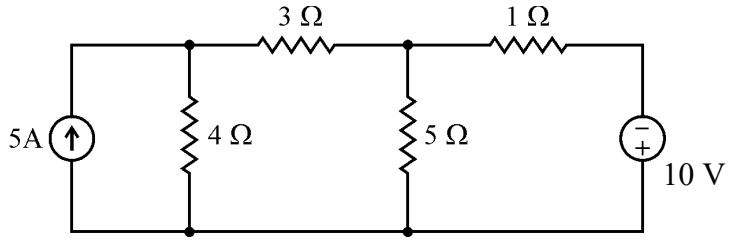

Fig. No. 5 (b)

(c) Find the current in 5 Ω resistor in the network shown in Fig. 5(c) by using Thevenin's theorem.

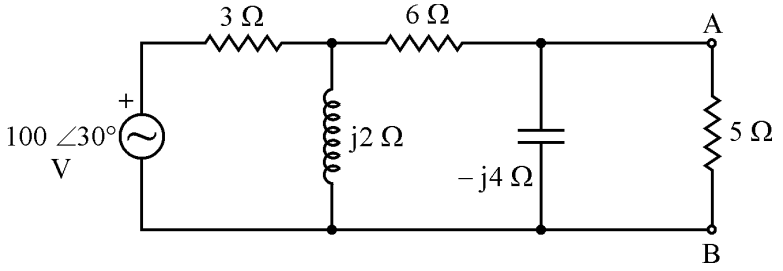

Fig. No. 5 (c)

6. Attempt any TWO of the following : **12**

(a) For a series R-L-C circuit consisting of R = 5 Ω, L = 0.01 H and C = 10 μF supplied with 230 V, 50 Hz supply, determine :

(i) Circuit impedance

(ii) Circuit current

(iii) Circuit power factor

(iv) Active power

(v) Reactive power

(vi) Apparent power

(b) A star connected capacitive load is supplied from 3 ϕ, 415 V, 50 Hz supply. If the line current is 15 A and total 3 ϕ power taken from supply is 30 kW , find :

(i) Power factor

(ii) Resistance in cash phase

(iii) Capacitance in each phase.

(c) Determine the voltage 'V' across 5 Ω resistor in network shown in Fig. 6(c) using superpositon theorem.

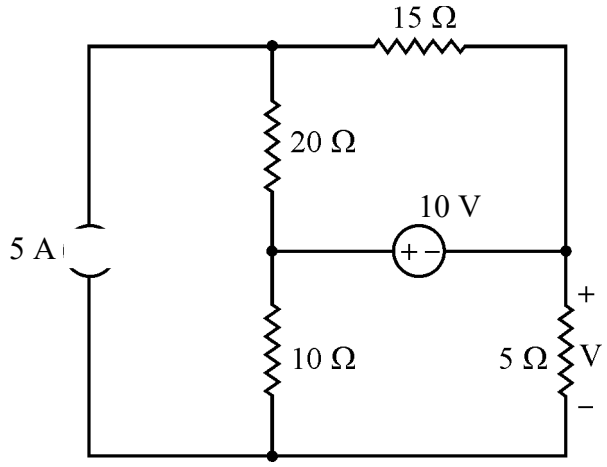

Fig. No. 6 (c)

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3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any <u>FIVE</u> of the following: **10**

a) Define active power and reactive power for R-L-C series circuit.

b) Define RMS value and average value related to sinusoidal AC waveform.

c) Define term conductance and susceptance, state its unit.

d) Define - Phase sequence and write equations for instantaneous values of 3ϕ voltages.

e) Give equations for delta to star transformation.

f) State Norton's theorem.

g) State Reciprocity theorem.

Marks

2. Attempt any THREE of the following: **12**

a) Derive the expression for current in pure inductor circuit when connected to 1ϕ AC Supply with graphical representation.

b) Draw and explain RLC parallel Ckt. Find out the equation for resonant frequency.

c) State any four advantages of polyphase circuit over single phase circuit. (system)

d) Find the current in 6Ω resistor in the circuit shown in Fig. No. 1 using mesh analysis.

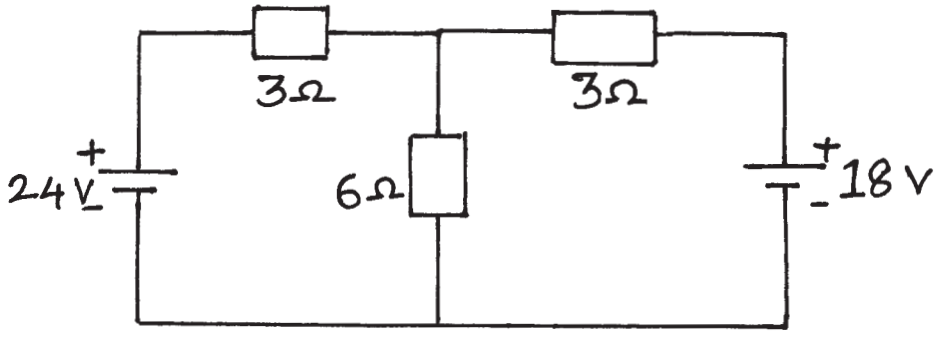

Fig. No. 1

3. Attempt any THREE of the following: **12**

a) Derive the expression for resonance frequency for a RLC series circuit.

b) Compare series resonance to parallel resonance on the basis of

i) Resonant frequency

ii) Impedance

iii) Current

iv) Magnification

c) A star connected 3ϕ load is supplied from 3ϕ, 415V, 50 Hz supply. If the line current is 20 A and total power taken is 10KW, then determine

i) Load resistance and reactance per phase

ii) Load power factor

iii) Total 3ϕ reactive power

Marks

d) Find current in 40Ω and 10Ω in Fig. No. 2 using node voltage analysis method.

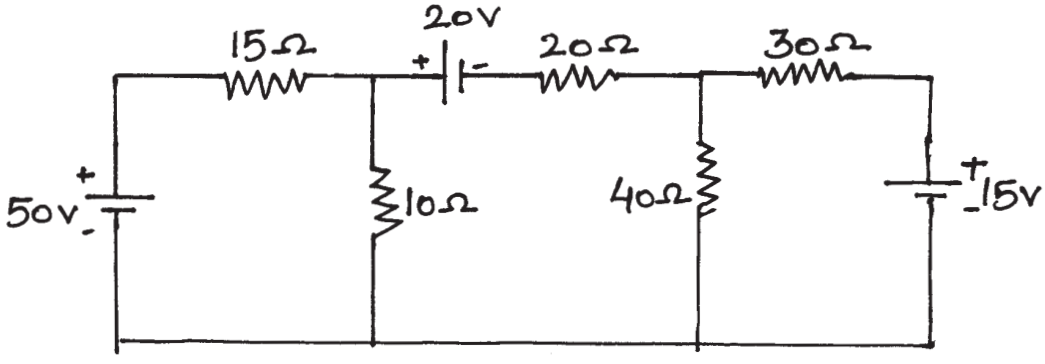

Fig. No. 2

e) State Norton's theorem. Also write stepwise procedure for applying Norton's theorem to simple Ckt.

4. Attempt any THREE of the following: **12**

a) A R-L-C series circuit with a resistance of 20Ω, inductance of 0.25 H and capacitance of 100μF is supplied with 240 V variable a.c. supply, calculate.

i) Resonance frequency

ii) Current at this condition

iii) Power Factor

iv) Quality Factor

b) A choke coil has a resistance of 2Ω and an inductance of 0.0035H is connected in parallel with 350μF capacitor which is in series with a resistance of 20Ω. When the combination is connected across a 200 V, 50 Hz.

Calculate

i) Total current taken

ii) P.F. of whole circuit

c) Each phase of delta-connected load comprise a resistor of 50Ω and capacitor of 50μF in series. Calculate the line and phase currents when the load is connected to a 440V, 3 phase, 50 Hz supply.

Marks

d) Calculate the value of R which will absorb maximum power from the circuit of Fig. No. 3.

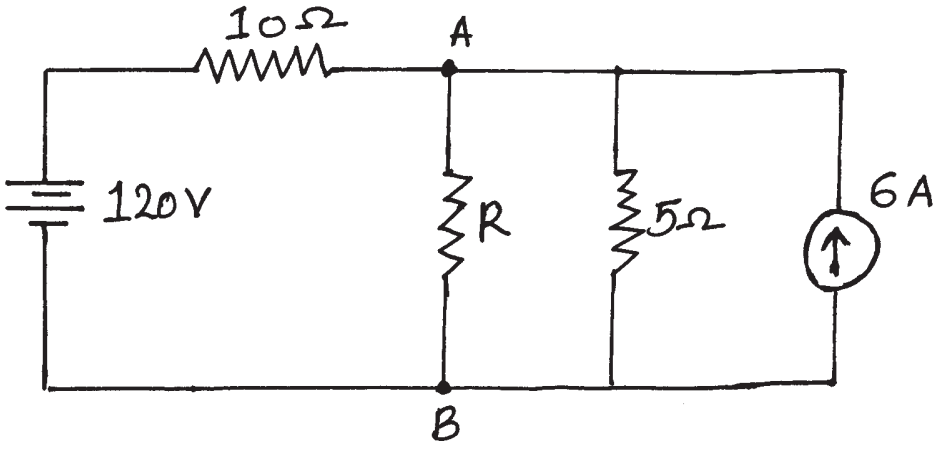

Fig. No. 3

5. Attempt any TWO of the following: **12**

a) A coil having resistance of 10Ω and inductance of 0.15H is connected in parallel with R-C series combination having R = 5Ω and C = 20μF . If supply voltage is 110 V, 50Hz then

i) Draw circuit diagram

ii) Calculate branch currents using impedance method

iii) Power absorbed by the each branch

b) Reduce the network shown in Fig No. 4 by applying Star/Delta or Delta/Star transformation and determine equivalent resistance 'RAB'.

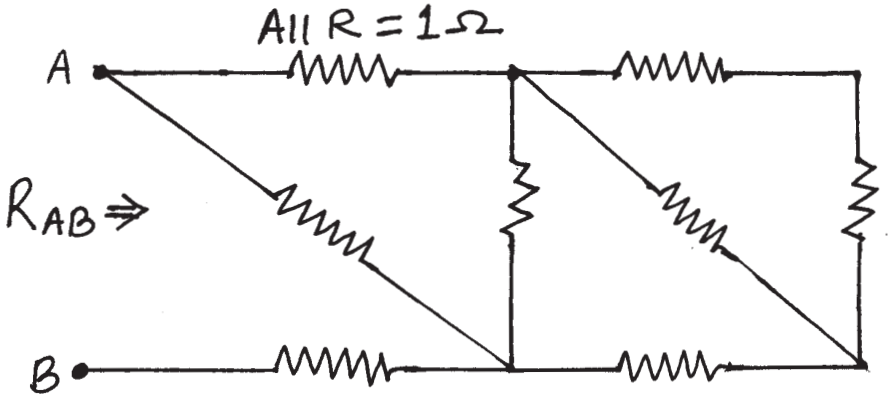

Fig. No. 4

Marks

c) Find I_L for the circuit shown in Fig. No. 5 using superposition theorem.

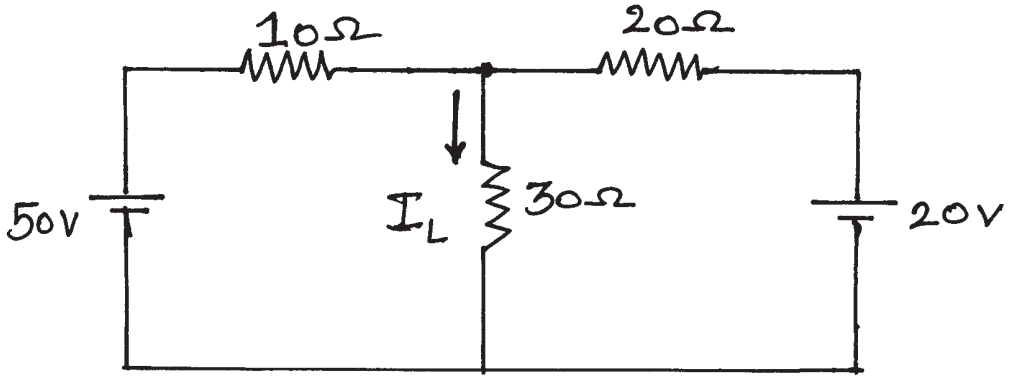

Fig. No. 5

6. Attempt any TWO of the following: **12**

a) An inductive coil (10+j40)Ω impedance is connected in series with a capacitor of 100μF across 230V, 50Hz, 1ϕ Mains.

Find :

i) Current through the circuit

ii) P.F of the circuit

iii) Power dissipated in the circuit.

iv) Draw the phasor diagram.

b) In a 3 Phase star connected system, derive the relationship $V_L = \sqrt{3}$ Vph.

c) Apply superposition theorem to compute current I in the network shown in Fig. No. 6.

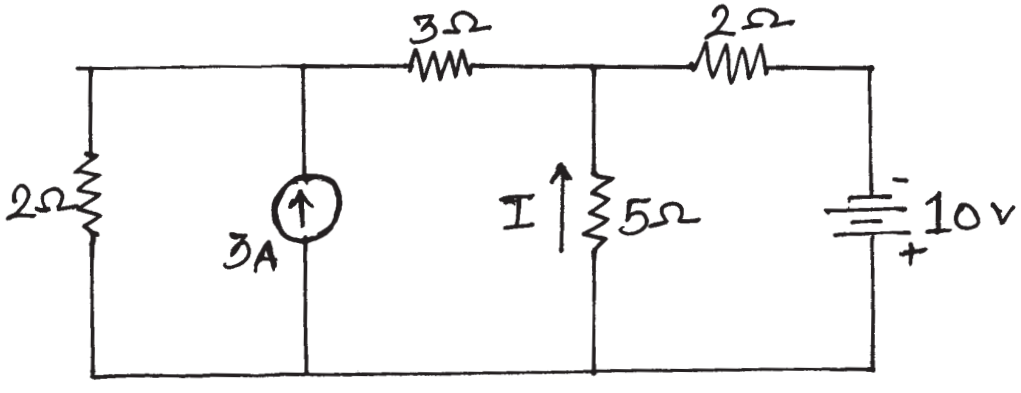

Fig. No. 6

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3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answer with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State significance of measurement.

b) Enlist types of errors in measuring instruments. (Any five)

c) Compare D.C. and A.C. voltmeter.

d) List the advantages of permanent magnet moving coil instrument. (Any four)

e) Draw a neat sketch of wattmeter connection.

f) State the difference between unity p.f. wattmeter and low p.f. wattmeter.

g) List the errors occurring in single phase electronic energy meter.

Marks

2. Attempt any THREE of the following: **12**

a) Sketch neat labelled diagram and describe the working principle of full wave rectifier type A.C. voltmeter.

b) Sketch and explain the construction and working of dynamometer type wattmeter.

c) Describe the constructional features of single phase electronic energy meter with neat labelled diagram.

d) Explain with neat diagram working of function generator.

3. Attempt any THREE of the following: **12**

a) With neat sketch of PMMC instrument explain it's working.

b) Explain the error occurred due to pressure coil inductance of the electrodynamometer type wattmeter. How this error is compensated?

c) Describe the circuit diagram of the calibration of single phase electronic energy meter using direct loading?

d) State need and construction of megger with suitable sketches.

4. Attempt any THREE of the following: **12**

a) State difference between analog and digital instruments.

b) Explain working of clamp-on-meter.

c) A three phase 500V motor load has a power factor of 0.4. Two wattmeters are connected to measure the input. They show input to be 30 kW. Find the reading of each wattmeter.

d) Draw a neat block diagram of three phase electronic energy meter.

e) Draw the block diagram of trivector meter. State the various measurements possible from trivector meter.

Marks

5. Attempt any TWO of the following: **12**

a) State why calibration is needed in all types of measuring instruments? Explain the procedure for calibration of given instruments.

b) Explain the labelled sketches the construction and working of synchroscope.

c) Draw and explain the block diagram of signal generator.

6. Attempt any TWO of the following: **12**

a) Describe the errors and their compensation in details related to three phase electronic energy meter.

b) Describe the procedure for the measurement of earth resistance by using earth tester.

c) Draw the block diagram of CRO and describe with suitable example; frequency measurement by Lissajous pattern on CRO.

22325

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define the term 'calibration' and state its need for measuring instruments.

b) What is the difference between conventional ammeter and clip-on ammeter?

c) Calculate the resistance of shunt required to make a milliammeter which gives maximum deflection for a current of 15 mA and which has a resistance of 5 Ω, read upto 10 Amp.

d) State the difference between unity P.F wattmeter and low P.F wattmeter.

e) A single phase wattmeter rated for 500 V; 5 A is having full scale deflection of 1000 watt. What is multiplying factor of the wattmeter?

f) State the various errors in single phase electronic energy meter.

g) State any two advantages of electronic energy meter?

Marks

2. Attempt any THREE of the following: **12**

a) State the types of errors in measuring instruments and reasons of occurrence of errors.

b) Define the following terms.

(i) Precision

(ii) Drift

(iii) Resolution

(iv) Back lash

c) Distinguish between:

(i) Absolute and secondary instruments

(ii) Analog and digital instruments.

d) Which meter has a greater sensitivity and why? Meter A having a range of 0-10 V and a multiplier resistance of 18 kΩ and meter B with a range of 0-300 V and multiplier resistance of 298 kΩ? Both meter movements have a resistance of 2 kΩ.

3. Attempt any THREE of the following: **12**

a) Describe with circuit diagram, the working of full wave rectifier type A.C Voltmeter.

b) A 3-phase, 500 volt motor load has a power factor of 0.4. Two wattmeter connected to measure the input. They show the input to be 30 KW. Find the reading of each wattmeter?

c) List the various errors occurred in dynamometer type wattmeter and describe the way of compensating any one type of error.

d) Describe with circuit diagram, the calibration of single phase electronic energy meter using direct loading?

Marks

4. Attempt any THREE of the following: **12**

a) Describe with block diagram working of single phase electronic energy meter.

b) Describe with block diagram; working of signal generator and state atleast two applications of signal generator.

c) What is Trivector meter? Describe the constructional details of Trivector meter?

d) Describe how the following measurements can be made with the use of CRO:

(i) Voltage measurement

(ii) Time period measurement

e) Describe with block diagram, the working of function generator.

5. Attempt any TWO of the following: **12**

a) Explain with sketch, the construction and working principle of repulsion type moving iron instrument? Compare repulsion type MI instrument with attraction type MI instrument?

b) Explain with suitable diagram, the constructional detail and working of Dynometer type wattmeter.

c) Draw a block diagram of CRO and state the function of each block.

6. Attempt any TWO of the following: **12**

a) Explain with block diagram the construction and working principle of three phases electronic energy meter?

b) What is the necessity of synchroscope in power system? Explain with neat sketch the working of synchroscope.

c) Explain with neat sketch:

(i) Earth resistance measurement using earth tester

(ii) High resistance measurement using megger.

22325

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State the meaning of 'Absolute standard' and 'Secondary Standard'.

b) State the working principle of PMMC Analog instrument.

c) Calculate the resistance of shunt required to make a milliammeter which gives maximum deflection for a current of 15 mA and which has a resistance of 5Ω ; read upto 10 Amp.

d) State the purpose of four quadrant meter.

e) A single phase wattmeter rated for 500V; 5A is having full scale deflection of 1000 watt, What is multiplying factor of the wattmeter?

f) List the errors occurring in single phase electronic energy meter.

g) State the advantages of electronic energy meter.

Marks

2. Attempt any THREE of the following: **12**

a) Compare analog instrument to digital instrument on the basis of accuracy; resolution, power required and portability.

b) List the types of systematic errors and state the reasons due to which these errors occur.

c) State the purpose of calibration of measuring instruments. Explain the procedure of calibration of D.C.Voltmeter by using D.C. Potentiometer.

d) A permanent magnet moving coil instrument of full scale deflection of 25 mA when P.D. across its terminal is 75 mV Calculate.

(i) Resistance of shunt required for full scale deflection of 150 A

(ii) Series Resistance for full scale reading 500 volts.

3. Attempt any THREE of the following: **12**

a) Explain with neat sketch: the working of full-wave rectifier voltmeter.

b) Draw the circuit diagram for:-

(i) Measurement of active power in 3-phase load circuit using two wattmeter.

(ii) Measurement of reactive power in 3-phase load circuit using one wattmeter.

c) Explain the error occurred due to pressure coil inductance of electrodynamometer type wattmeter How this error is compensated?

d) Describe with block diagram; the construction of single phase Electronic Energy meter.

Marks

4. Attempt any THREE of the following: **12**

a) Draw a neat labeled block diagram of 3-phase Electronic Energy meter.

b) Describe with block diagram; the principle of operation of digital storage oscilloscope.

c) Describe with block diagram; the working of digital frequency meter.

d) Describe with suitable example; frequency measurement by Lissajous patterns on CRO.

e) Draw the block diagram of trivector meter. State the various measurements possible from trivector meter.

5. Attempt any TWO of the following: **12**

a) Explain with neat sketch; the construction and working principle of Repulsion type moving Iron instrument.

b) Explain the effect of power factor on wattmeter readings in two wattmeter method of power measurement.

c) Draw a block diagram of function generator and state the function of each block.

6. Attempt any TWO of the following: **12**

a) Explain the calibration of single phase electronic energymeter using direct loading.

b) Describe the procedure for the measurement of Earth resistance by using Earth tester.

c) Explain with neat sketch; the construction and working principle of Megger.

22325

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. Attempt any FIVE of the following: **10**

a) State the significance of measurement of electrical quantities.

b) List any four advantages of permanent magnet moving coil instrument.

c) A moving coil instrument has resistance of 10 Ω and gives full scale deflection when carrying current of 50 mA. Show how it can be used to measure voltage upto 750 volts.

d) State the reason of using fixed coils as current coils in an Electrodynamometer wattmeters.

Marks

e) Two wattmeters connected to measure the input to a balanced three phase circuit indicate 2000 w and 500 w respectively. Find the power factor of circuit when both the readings are positive.

f) State the working principle of single phase electronic energy meter.

g) ''Electronic energy meter is also called as static energy meter.'' Justify the statement.

2. Attempt any <u>THREE</u> of the following: **12**

a) Describe the corrective measures employed to eliminate or to reduce undesirable effects which are responsible for Environmental Errors.

b) Compare Absolute and Secondary instruments on the basis of following points.

i) The method of determining the magnitude of the quantity being measured.

ii) Requirement of calibration.

iii) Place of application and

iv) Example.

c) Draw neat labelled diagram and describe the process of calibration of Ammeter using D. C. Potentiometer.

d) A moving coil ammeter has a fixed shunt of 0.02 Ω. With a coil resistance of R = 1000 Ω and a potential difference of 500 mV across it, full scale deflection is obtained.

i) Calculate the value of R to give full scale deflection when shunted current I is 10 A.

ii) With what value of R is 40% deflection obtained with I = 100 A?

Marks

3. Attempt any THREE of the following: **12**

a) Draw neat labelled diagram and describe the working of full wave rectifier type A.C. voltmeter.

b) A three phase 500V motor load has a power factor of 0.4. Two wattmeters are connected to measure the input. They show the input to be 30kW. Find the reading of each wattmeter.

c) One wattmeter of range 20A/300V is to be used to measure the power in variable load single phase circuit. Suggest the connection of wattmeter with sketch for measurement of power in case of
   i) Lower and
   ii) Higher value of load.

d) Describe the constructional features of single phase electronic energy meter with relevant sketch.

4. Attempt any THREE of the following: **12**

a) Describe any two errors and their compensation, related to three phase electronic energy meter.

b) Draw neat labelled diagram showing the controls available on front panel of general purpose CRO.

c) Describe the working of signal generator.

d) Describe the construction of Electrical resonance type (Ferrow dynamic) Frequency meter with labelled diagram.

e) Describe the use of CRO for measurement of
   i) Voltage
   ii) Frequency

Marks

5. Attempt any TWO of the following: **12**

a) Describe the construction of Repulsion type moving iron instrument with a labelled sketch.

b) Explain the working of maximum demand indicator with a neat sketch.

c) Draw neat labelled block diagram of function generator and describe the function of each block.

6. Attempt any TWO of the following: **12**

a) Describe with sketch the process of calibration of single phase electronic energy meter using direct loading.

b) i) Draw a neat labeled diagram of Kelvin double bridge.

ii) A Kelvin double bridge is balanced with following constants

Outer ratio arms 100Ω and 1000Ω

Inner ratio arms 99.92Ω and 1000,6Ω

Resistance of link = 0.1Ω,

Standard resistance 0.00377Ω

Calculate the value of unknown resistance.

c) Draw neat labeled diagram and describe the construction and working of Earth tester.

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22325

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define the terms:

i) Accuracy

ii) Precision

b) State the function of deflecting torque.

c) List classification of resistances along with their measuring devices used for measurement of resistance valve.

d) List the applications of multimeter.

e) State the working principle of dymeter type wattmeter.

f) State the effects of unity power factor and zero pf on wattmeter reading.

g) State the methods of range extension of ammeter.

Marks

2. Attempt any THREE of the following: **12**

a) Compare analog ammeter and voltmeter on any four points.

b) A moving coil has a deflection of fuel scale at 28 mA, when a potential of about 60 volt is applied calculate-

i) Series resistance for full scale deflection of 600 volts.

c) Compare absolute and secondary instrument.

d) Draw a neat sketch and label the parts of P.M.M.C. type ammeters.

3. Attempt any THREE of the following: **12**

a) Describe why CT's of secondary should not be opened while function on range extension.

b) State the principle and application of clamp on meter.

c) Describe with neat sketch working of moving iron instruments.

d) Explain with neat block diagram working of single phase electronic energy meter.

4. Attempt any THREE of the following: **12**

a) Draw a neat sketch of dynamometer type wattmeter and label its parts.

b) Compare current coil and potential coil of wattmeter. (any four)

c) State errors in measurement of electric energy and also mention its cause for errors. (any four)

d) Describe construction of weston type frequency meter with neat sketch.

e) Draw neat diagram for power measurement by two wattmeter method.

Marks

5. Attempt any TWO of the following: **12**

a) Describe working of function generator with neat sketch.

b) State necessity of calibration of measuring different devices and list its procedures.

c) Describe construction with neat sketch of megger.

6. Attempt any TWO of the following: **12**

a) Describe working principle and use of rotating phase sequence indicators.

b) Describe with sketches single phase energy meter for electrical energy measurement.

c) i) Draw neat diagram of Kelvin double bridge.

ii) Draw neat diagram of CRT and describe its construction.

22328

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answer with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State the use of following safety accessories –

i) Safety hand gloves

ii) Safety rubber mats.

b) With neat diagram explain "Magnetostriction" effect.

c) State any two properties of copper.

d) State the purpose of using oil in transformer.

e) State any two properties of porcelain.

f) Classify different types of wires on the basis of insulation used.

g) State the objective of earthing.

Marks

2. Attempt any THREE of the following: **12**

a) With neat diagram explain working of RCCB.

b) Draw and explain B-H curve.

c) Give thermal classification of insulating material with their temperature limits and give one example of class Y and A insulation.

d) Draw the series parallel circuit using one single pole one way switch and one two way switch for following conditions –

i) When one way switch is ON and two way switch at upper position (Position No. 1) lamp L_1 will be brightly ON and lamp L_2 will be OFF.

ii) When one way switch is ON and two way switch at down position (Position No. 2) lamp L_1 and L_2 will dimly ON (i.e. connected in series).

3. Attempt any THREE of the following: **12**

a) Explain any four IE rules of electrical safety.

b) Suggest the suitable insulating material for following applications,

i) Insulation used over 1.5 sq. mm wire

ii) Transformer bushing

iii) Insulation between 11 kV line and pole

iv) Insulation between heating element and base plate of iron.

c) Draw the circuit for four compartment godown and explain.

d) Suggest the suitable tools for following :–

i) To establish true vertical line

ii) Prepare hole using hammer in wall

iii) To cut tenon

iv) For making lines at right angle.

Marks

4. Attempt any THREE of the following: **12**

a) Suggest the suitable safety accessories –
   i) To protect from overload and short circuit conditions
   ii) To protect from leakage current.
   Also write the specifications of above accessories.

b) Identify the magnetic material from its hysteris loop shown in Figure No. 1 and Figure No. 2.

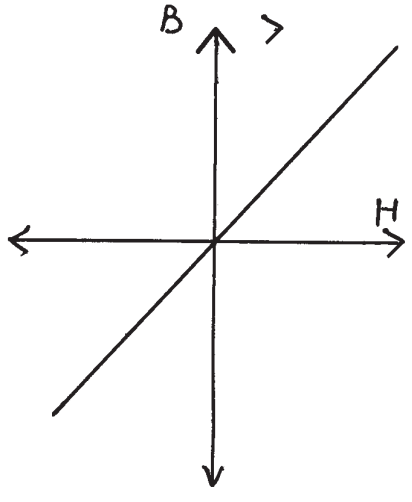

Fig. No. 1

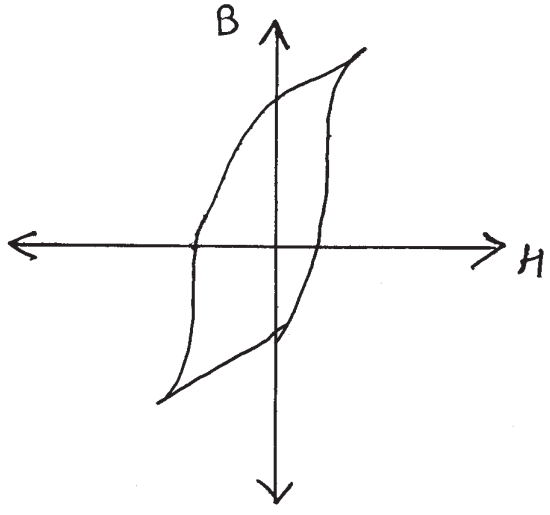

Fig. No. 2

c) Explain CRGO and HRGO steel.

d) Compare PVC conduit wiring with wooden casing capping wiring.

e) Draw the well labeled sketch of plate type of earthing with all dimensions as per IS and explain.

5. Attempt any TWO of the following: **12**

a) Compare hard and soft magnetic material on the basis of –
   i) Application
   ii) Retaining magnetism
   iii) Susceptibility
   iv) Coercivity
   v) Hysteresis loss
   vi) Magnetic energy stored.

b) With neat diagram explain breakdown in gaseous dielectric material.

c) Explain the factors on which earth resistance depends.

Marks

6. Attempt any TWO of the following: **12**

a) Observe the following Figure No. 3 and Figure No. 4 carefully and state whether person and bird touching the live wire will receive the electrical shock or not. Justify your answer.

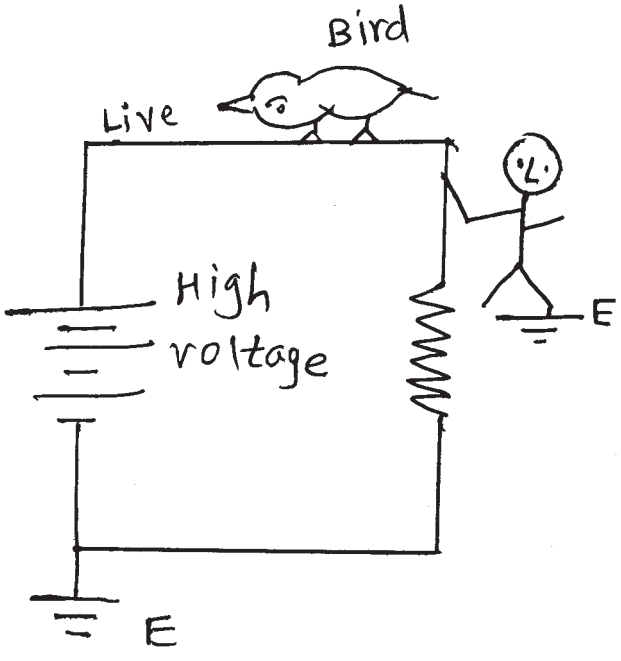

Fig. No. 3

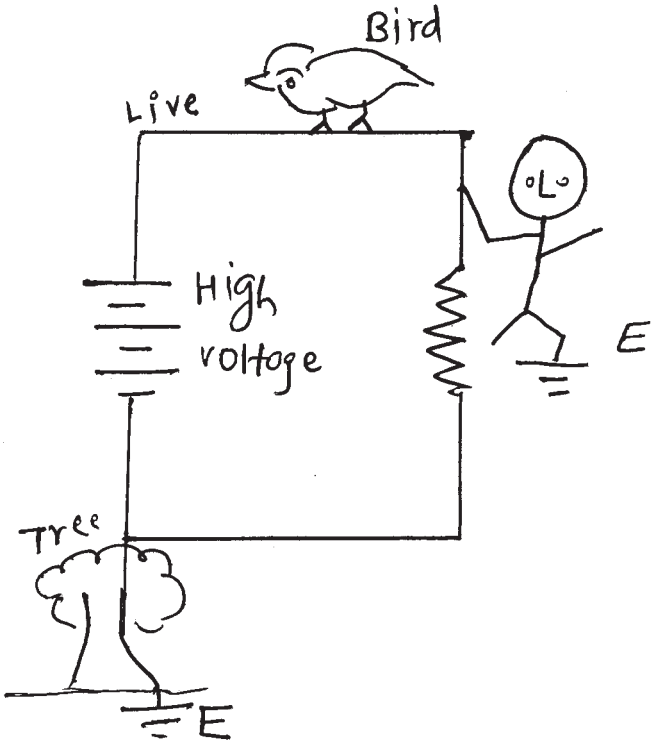

Fig. No. 4

b) Suggest the suitable insulating material for following application-

i) For cooling and insulating purpose of 11 kV/440 V distribution transformer core

ii) 33 kV line disc insulator

iii) Heating appliances like iron, hot plates

iv) Insulation of wire

v) Bedding of cable

vi) Holder body.

c) Write different types of cables and explain any one method of laying cable.

22328

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State the need for strictly following safety rules while working in electrical installations.

b) Write any two properties of good electrical insulation material.

c) Draw the labeled hystersis loop for an electromagnetic material.

d) Define dielectric failure of electrical insulating material.

e) Name one gaseous and one liquid electrical insulation material.

f) Draw a labeled circuit diagram of a one lamp control circuit using one switch.

g) Define earthing related to electrical wiring system.

Marks

2. Attempt any THREE of the following: **12**

a) Write any four of the IE rules to be followed in respect of safety while working in an electrical installation system.

b) Explain the suitability of copper as an electrical conductor with reference to its mechanical and electrical properties.

c) Explain the electrical and thermal properties of transformer oil those make it suitable as an electrical insulating medium.

d) Explain the process and need of crimping of cable joints.

3. Attempt any THREE of the following: **12**

a) Explain the use of following tools in carrying out electrical wiring installation:

(i) Nose pliers

(ii) Test lamps

(iii) Crimping tools

(iv) Cutter.

b) Describe with reasons the failure of porcelain insulators.

c) Explain with neat labeled circuit diagram the staircase wiring in which a lamp is controlled from two different locations.

d) Explain the uses of safety rubber hand gloves and rubber mats in electrical engineering.

Marks

4. Attempt any THREE of the following: **12**

a) Explain the use of the following components in electrical wiring system and give specification of each:

(i) MCB

(ii) ELCB

b) Explain with justification two uses of each of two following as an electrical conductor:

(i) Brass

(ii) Silver

c) Explain the phenomenon of loss of magnetism.

d) Describe with sketches the process of laying of underground cables by the drawing in method.

5. Attempt any TWO of the following: **12**

a) State the properties of copper and aluminium which make them good conductors of electricity.

b) Explain the reasons for failure of gaseous and solid dielectric materials used in electrical engineering application.

c) Describe with neat circuit diagram the measurement procedure of earth resistance for an installation.

6. Attempt any TWO of the following: **12**

a) Explain the criteria to be applied in deciding the earthing system for an electrical installation.

b) State two insulators of following types along with their areas of application:

(i) Class A

(ii) Class E

(iii) Class H

c) Compare the casing / capping system of electrical wiring to concealed system of electrical wiring. On the basis of look, cost, life, safety retentivity of material and suitability for locations.

22328

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) List the different types of switches.

b) Draw the labelled hysteresis loop for hard steel material.

c) State the causes for dielectric failure of highly purified transformer oil.

d) List any four applications of insulting material used in electrical fields.

e) Enlist four harmful effects of improper earthing.

f) State any two applications of gaseous insulating material used in switchgears.

g) State any two applications of

(i) Ferromagnetic

(ii) Paramagnetic material.

Marks

2. Attempt ant THREE of the following: **12**

a) State the causes of deterioration of liquid and solid dielectrics.

b) Explain the function of ELCB and ICDP switch. List two specifications of each.

c) Name any two applications of following gases.

(i) Nitrogen

(ii) Hydrogen

(iii) Sf6

(iv) Air.

d) Explain the suitability of copper as an electrical conductor with reference to its mechanical and electrical properties.

3. Attempt any THREE of the following: **12**

a) State the use of following:

(i) Screw driver

(ii) Nose pliers

(iii) Wire gauge

(iv) Test lamp

b) Enlist types of electrical wiring systems. Explain casing and capping type wiring system.

c) Compare copper and alluminium on the basis of.

(i) Tensile strength

(ii) Conductivity

(iii) Specific gravity

(iv) Application

d) Describe with neat sketch any one type of earthing system.

Marks

4. Attempt any THREE of the following: **12**

a) State any four IE Rules to be followed in respect of safety while working on electrical installation system.

b) Classify magnetic materials with two examples each.

c) Draw neat diagram for Godown wiring.

d) Define "Magneto-striction"? State the causes for loss of magnetism.

e) Give one application of

(i) Mineral oil

(ii) Varnish

(iii) Synthetic oil

(iv) Vegetable oil

5. Attempt any TWO of the following: **12**

a) Explain the function of :

(i) DB

(ii) Socket

(iii) Cable

(iv) Switch

b) Explain following wiring systems.

(i) Concealed wiring

(ii) Metal conduit wiring

c) Describe with neat sketch the installation of plate earthing.

Marks

6. Attempt any TWO of the following: **12**

a) State any two electrical, mechanical and thermal properties of insulating materials.

b) Draw neat circuit diagram for below mentioned requirements in electrical circuit.

(i) One lamp controled by one switch.

(ii) One lamp, one fan, one two pin socket controled by separate switches.

c) Explain the importance of proper earthing system. Recommend and justify the earthing system used for individual bunglow.

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22328

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following. **10**

a) List any four safety tools used in electrical installation.

b) State the significance of safety in electrical installation.

c) Write the name of fuse wire material and its main chacteristics.

d) Define dielectric strength and write its unit.

e) Write two example of gases and liquid insulating material.

f) State any two main factors considered for selection of cable in residential installation.

g) State the need of earthing.

Marks

2. Attempt any THREE of the following. **12**

a) Describe the functions and operation of crimping tool and continuity tester.

b) Explain the electrical and mechanical properties of copper conductor.

c) Explain the effect of temperature rise on the properties of insulating material.

d) Explain the control of one fan using two switch and one regulator with suitable diagram.

3. Attempt any THREE of the following. **12**

a) State the application of iron clad switches, MCBs in installation and write their specifications.

b) Differentiate between the wire and cable with respect to rating, cost, life and applications.

c) State and explain the insulation failure in undrground cables.

d) Describe the process of cable laying in LT distribution system and also list material used in this process.

4. Attempt any THREE of the following. **12**

a) Explain safety precautions while working on overhead lines.

b) Explain the ductility properties of conductor material and state it's significance.

c) State the difference in chacterrstics of CRGO and HRGO silicon steel and write application of these material.

d) Draw the neat labelled diagram of plate earthing.

e) State the types of magnetic materials with examples.

Marks

5. Attempt any TWO of the following. **12**

a) Explain the properties of soft and hard magnetic material with help of hystersis loop and material name and application.

b) Explain electrical and chemical properties of insulating oil. State causes to detoriate insulating oil strength.

c) Explain the procedure to test earthing resistance in domestic installation with suitable diagram.

6. Attempt any TWO of the following. **12**

a) State the insulating material used electrical machine, write functions of these material and corelate it with their properties.

b) Describe cable jointing process in underground cable, list materials and tools used in this process.

c) State the factors on which earth resistance depends and give the values of earth resistance for domestic installation, substation and industrial installation.

22328

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Write any four safety tools for working with electricity.

b) Define hysteresis loss.

c) Write the meaning of insulating material.

d) Enlist different methods of cable laying.

e) Write the importance of earthing.

f) Write the various properties which are to be considered while selecting conducting material.

g) State any four desirable properties of cable.

Marks

2. Attempt any THREE of the following: **12**

a) Enlist any four components with specification used in wiring system.

b) State any four applications of copper.

c) Explain any four adverse effects of improper earthing system.

d) Draw a labelled circuit diagram of a one lamp control by using one switch.

3. Attempt any THREE of the following: **12**

a) Compare between casing and capping system of electrical wiring (any four points)

b) Write the value of earth resistance for

i) Large power station

ii) Domestic wiring

c) With neat diagram explain staircase wiring.

d) Enlist any four thermal properties of insulating materials required to be considered.

4. Attempt any THREE of the following: **12**

a) Explain the use of safety rubber hand gloves and rubber mats in electrical engineering.

b) Differentiate between insulating materials and dielectric material. (any four points)

c) State different types of earthing.

d) Write any four properties and uses of the following

i) Brass

ii) Bronze

e) Write any four properties and uses of aluminium.

Marks

5. Attempt any TWO of the following: **12**

a) Explain dielectric failure in solid insulating material.

b) Explain the process of installing the given type of cables.

c) Explain magnetization curve with neat sketch. Also draw hysteresis loops for

i) Hard steel

ii) Wrought iron

iii) Alloyed steel

6. Attempt any TWO of the following: **12**

a) Write classification of insulating material according to their allowable working temperature.

b) Explain any one method of laying cable.

c) Explain the use of the following components in electrical wiring system and give specifications of each.

i) ELCB

ii) MCB

iii) RCB

22327

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

Marks

1. Attempt any FIVE of the following : **10**

(a) State any four factor governing selection of site for thermal power station.

(b) Give four constituents of hydro-electric power plant.

(c) Classify the hydro-electric water turbines used in hydro-electric plants.

(d) List the types of concentrated solar power system.

(e) State the applications and material used for photo voltaic cell.

(f) State the various types of wind turbines used on the basis of position of rotor.

(g) Define connected load and spinning reserves.

2. Attempt any THREE of the following : **12**

(a) State the advantages of thermal power plant.

(b) Explain the factor governing for site selection of hydro power station.

(c) Explain the basic components of wind energy conversion system.

(d) Explain load curve and load duration curve with neat diagram.

3. Attempt any THREE of the following : **12**

(a) Explain boiler water reactor (BWR) with neat diagram.

(b) State the salient features of electric generators used in large hydro power station.

(c) State the applications of flat plate collector and material used for it.

(d) Differentiate between horizontal axis and vertical axis wind turbine.

4. Attempt any THREE of the following : **12**

(a) Describe the purpose of the following components of nuclear power station :

(i) Control rod (ii) Moderator

(iii) Reactor vessel (iv) Reflectors

(b) Compare flat plate collector with concentrating type solar collector.

(c) Explain with block diagram the working of wound rotor induction generator.

(d) Describe the meanings of :

(i) Average demand (ii) Diversity factor

(iii) Demand factor (iv) Load factor

(e) Compare thermal power plant with nuclear power plant on the basis of :

(i) running cost (ii) initial cost

(iii) starting period (iv) site

5. Attempt any TWO of the following : **12**

(a) Elaborate the function of different parts of a typical thermal power plant with neat sketch.

(b) State the classifications of hydro power plants and describe working of any one.

(c) State the types of solar collector and describe with neat sketch any one of them.

6. Attempt any TWO of the following : **12**

(a) Describe the function of the following components of hydro power plant :

(i) Surge tank (ii) Water turbine

(iii) Spillways (iv) Electric generator

(v) Water turbine (vi) Catchment area

(b) Draw schematic layout of electricity generation by using biomass, explain it in brief.

(c) A residential load of a locality is given below :

Time in Hrs.	0 – 5	5 – 6	6 – 9	9 – 18	8 – 21	21 – 24
Load kW	3	7	20	0	12	8

Draw the load curve and find

(i) Maximum Demand (ii) Energy consumed in during 24 hrs.

(iii) Load factor (iv) Average load

22327

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define fission and fusion related to nuclear fuel.

b) Classify hydropower plant on the basis of water head and state turbine used for them.

c) State any two advantages of Kaplan turbine over Francis turbine.

d) List different types of concentrating type solar collectors.

e) State the various types of Biomass Resources.

f) State range of wind speed is considered favorable for wind power generation.

g) Define the term ‘‘cold reserve’’ and ‘‘hot reserve’’.

Marks

2. Attempt any THREE of the following: **12**

a) Describe Nuclear Hazards and various ways of disposal of nuclear waste.

b) Draw schematic arrangement of hydro electric power station and describe energy conversion process of hydro power plant.

c) Describe main features of various types of generators and their suitability w.r.t wind power generation.

d) State the causes and impacts of state grid system fault.

3. Attempt any THREE of the following: **12**

a) Compare fire tube and water tube boilers used in thermal power plants.

b) Describe safe practices for hydro power plants.

c) Describe with layout the working of solar Photo Voltaic (PV) power plant.

d) State the various problems caused during operation of large wind power generators.

4. Attempt any THREE of the following: **12**

a) Draw schematic arrangement of diesel engine power station and important systems and essential components of diesel plant

b) Explain layout of thermo-chemical based (Municipal waste) power plant.

c) Compare Horizontal axis and vertical axis wind machine on the basis of

(i) Power captured for the same tower height.

(ii) Noise problem.

(iii) Complexity of design and yaw mechanism

(iv) Effect of fatigue arising from numerous resonance in structure.

Marks

d) Define the terms:

(i) Load factor

(ii) Diversity factor

(iii) Demand factor

(iv) Plant capacity factor.

e) Explain how load curves helps in the selection of size and number of generating units.

5. Attempt any TWO of the following: **12**

a) Explain with layout the working of typical thermal power plant with steam turbines and electric generators.

b) Explain with neat sketch the construction and working of pelton turbine used in hydro power plant.

c) Explain with neat sketch, layout of Bio-chemical based (biogas) power plant.

6. Attempt any TWO of the following: **12**

a) Draw the layout of typical micro hydro scheme and describe potential locations of micro-hydro power plants in Maharashtra.

b) Explain with layout, the working of parabolic trough collector concentrated solar power plants.

c) A load on a power plant on a typical day is as under:-

Time	12-5 AM	5-9 AM	9-6 PM	6-10 PM	10PM-12AM
Load in MW	20	40	80	100	20

Plot the chronological load curve and load duration curve. Find the load factor of the plant and energy supplied by the plant in 24 hours.

22327

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) List any two Thermal Power Station in Maharashtra with their installed capacity.

b) State any two applications of solar energy.

c) List out major wind farms in India.

d) Define State grid and National grid.

e) Name the main parts of solar power plant.

f) Classify hydro power plant on the basis of availability of water head.

g) List any two large hydro power plants in Maharashtra with their capacity.

Marks

2. Attempt any THREE of the following: **12**

a) Describe any four safe practices for Hydro Power Plants.

b) Draw a neat layout of typical Thermal power station and label it.

c) State the salient features of constant speed electric generator and variable speed electric generator.

d) List any four causes of faults on grid system.

3. Attempt any THREE of the following: **12**

a) Draw a block diagram of gas turbine power plant and lable each block.

b) Explain with sketch the layout and working of parabolic through concentrated Solar Power plant.

c) State any four factors for selection of hydro power plant.

d) Describe with sketch the layout and working of Geared wind power plant.

4. Attempt any THREE of the following: **12**

a) Explain the purpose of shielding and reflector in a nuclear reactor.

b) Explain with layout diagram; the construction and working of solar photo voltaic (PV) power plant.

c) Describe the layout and working of the horizontal and vertical axis small wind turbines.

d) Define :

(i) Max Demand

(ii) Average Demand

(iii) Plant capacity factor

(iv) Plant use factor

e) Compare base load and peak load power plants.

Marks

5. Attempt any TWO of the following: **12**

a) State the types of radioactive wastes generated in a nuclear power station. Explain the methods employed for their disposal.

b) State the functions of the following parts of hydroelectric power station:

(i) Reservoir

(ii) Tailrace

(iii) Spillway

(iv) Surgetank

(v) Forebay

(vi) Turbine

c) Explain with sketch; the layout of a thermo chemical based (municipal waste) power plant.

6. Attempt any TWO of the following: **12**

a) Explain with sketches the construction and working of the Pelton turbine used for high head power plant.

b) Describe the features of solid, liquid and gas biomasses as fuel for biomass power plant.

c) The peak load on a power station is 30 MW. The loads having maximum demands of 25 MW, 10 MW, 5 MW and 7 MW are connected to the power station. Capacity of the power station is 40 MW and annual load factor is 50%. Find:

(i) Average load on power station

(ii) Energy supplied per year

(iii) Demand factor

(iv) Diversity factor

22327

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory*.

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the function of superheater and cooling tower of thermal power plant.

(b) Name any two hydroplants in Maharashtra with their capacity.

(c) State the function of penstock related to hydro-power plant.

(d) State any two disadvantages of solar energy.

(e) State the working of photovoltaic cell in brief.

(f) State any two applications of wind energy.

(g) Define the following terms :
(i) Cold reserve (ii) Spinning reserve

2. Attempt any THREE of the following : **12**

(a) Give the classification of coal and state the properties of each type.

(b) Draw the layout of a hydro-electric power plant and also state the function of reservoir and surge tank.

(c) Draw a neat layout of geared wind power plant and label it.

(d) State any four factors which should be considered while deciding the number of generating units and its size.

3. Attempt any THREE of the following : **12**

(a) Describe methods to dispose solid, liquid and gaseous nuclear waste in short.

(b) Draw a neat labelled diagram of Pelton turbine and explain its working in brief.

(c) Describe the working of Fresnel reflectors in detail.

(d) List out the salient features of wound rotor inductor generator used in large wind power plants.

4. Attempt any THREE of the following : **12**

(a) Describe four stroke cycle of a Diesel engine in detail.

(b) State the features of the solid, liquid and gas biomasses as fuel for biomass power plant.

(c) List out the features of permanent magnet synchronous generator.

(d) Compare base load plants with peak load plants on any four points.

(e) State the impact and reasons of Grid system fault.

5. Attempt any TWO of the following : **12**

(a) Draw a neat labelled layout of thermal power plant and explain the function of coal and ash handling plant.

(b) Classify hydro power plant according to head of water and explain each type in brief.

(c) Describe the working of Bio-Chemical based power plant with its layout.

6. Attempt any TWO of the following : **12**

(a) Describe the specific safe practices to be followed with respect to hydro power plants.

(b) Discuss the energy extraction process of Agro-chemical based power plant with its layout.

(c) A generating station has the following daily load cycle :

Time (hours) :	0-6	6-10	10-12	12-16	16-20	20-24
Load (MW) :	40	50	60	50	70	40

Draw the load curve and find :

(i) Maximum demand

(ii) Units generated per day

(iii) Average load and

(iv) Load factor

22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) State any two advantages of thermal power plant.

(b) List any two hydro power plants in Maharashtra state with their capacity.

(c) State four main constituents of hydro electric power station.

(d) List the applications of flat plate solar air collector.

(e) State the different types of material used for the solar photovoltaics.

(f) State the classification of wind turbine power plant.

(g) Define maximum demand and demand factor.

2. Attempt any THREE of the following : **12**

(a) State the factors governing the selection of site for thermal power plant.

(b) Explain the working of hydro power station with schematic layout.

(c) Draw the neat labelled diagram of wind mill and state its application.

(d) Explain how load curve help in selection of size and number of generating units in given load curve and operation schedule.

3. Attempt any THREE of the following : **12**

(a) Draw a neat labelled block diagram of gas turbine station.

(b) Explain the following terms in connection with hydroelectric power station.

(i) Tunnel

(ii) Surge tank

(iii) Spill ways

(iv) Tail race

(c) Explain with neat diagram the working and material used in photovoltaic cell.

(d) State any four advantages of wind energy system.

4. Attempt any THREE of the following : **12**

(a) Draw a neat constructional diagram of a nuclear reactor. Label it. State the function of moderator and control rods.

(b) Draw schematic diagram of solar power plant and how electricity is generated.

(c) Give comparison between horizontal axis wind turbine and vertical axis wind turbine.

(d) Draw and explain load duration curve used in power system operation.

(e) Describe the merits of interconnected power system.

5. Attempt any TWO of the following : **12**

(a) Elaborate the function of different parts of thermal power plant with neat sketch.

(b) State the classification of hydro-power plant according to quantity of water available, describe in brief.

(c) Describe with schematic layout for biochemical based power plant.

6. Attempt any TWO of the following : **12**

(a) State the types of turbine used in hydro power station. Describe working of any one.

(b) State any two types of solar collector with their particular application.

(c) Find out the average load and maximum demand of supply system having following loads :

Types of Load	M.D. (kW)	Load Factor	Diversity Factor
Residential	1000	20	1.2
Commercial	2000	25	1.1
Industrial	10000	80	1.25

Assume overall diversity factor = 1.3 & load factor = 0.5

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Draw the V-I characteristics of power transistor.

(b) State the applications of power electronics.

(c) Define forward break over voltage (VBO) of SCR.

(d) Define triggering. List the types of Gate triggering methods.

(e) Write the function of free wheeling diode.

(f) Define transfer time and backup time of UPS.

(g) State the requirements of SMPS.

2. Attempt any THREE of the following : **12**

(a) Describe with sketch the construction of IGBT.

(b) Draw the V-I characteristics of SCR. Define :

(i) Latching Current

(ii) Holding Current

(c) Explain $\frac{dy}{dt}$ triggering of SCR.

(d) Explain with circuit diagram the operation of single phase full bridge controlled rectifier with R load.

3. Attempt any THREE of the following : **12**

(a) Explain two transistor analogy of SCR with a neat diagram.

(b) Draw circuit diagram of UJT triggering of SCR. Draw waveform to show firing angle control.

(c) Draw waveform of the following power electronic circuit. Also identify the name of the circuit. Refer Fig. No. 01

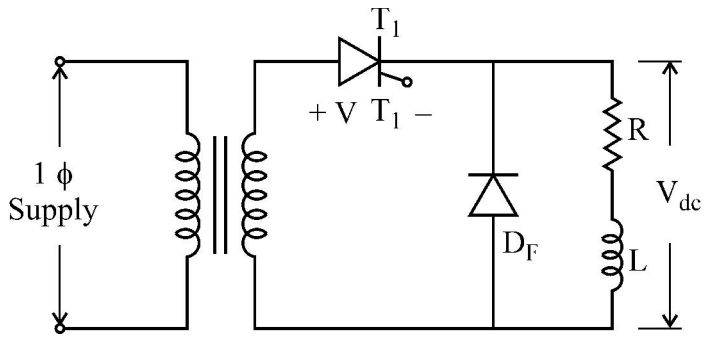

Fig. No. 01

(d) Explain the operation of Burglar alarm system with diagram.

4. Attempt any THREE of the following : **12**

(a) Describe SCR mounting and cooling with neat sketch.

(b) Explain the operation of RC triggering circuit with a diagram.

(c) Draw a neat diagram of 1 ϕ half wave controlled converter with RL load. Give its operation.

(d) Explain the operation of AC circuit breaker with circuit diagram.

(e) Describe emergency lighting system with neat diagram.

5. Attempt any TWO of the following : **12**

(a) State the different turn ON methods of SCR.

(b) Explain in detail over voltage protection.

(c) Draw symbol and characteristics of GTO, DIAC, PUT.

6. Attempt any TWO of the following : **12**

(a) Define firing angle and conduction angle.

(b) State the effect of source inductance in controlled rectifier with waveform.

(c) State what is online & offline UPS.

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(8) Use of steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. Attempt any FIVE of the following : **10**

(a) Give the applications of IGBT.

(b) What is the need of UPS ?

(c) Draw a neat circuit diagram of class F commutation.

(d) Define :

(i) Firing angle

(ii) Conduction angle

(e) How GTO is advantages over SCR ?

(f) State the main difference between PUT & UJT.

(g) Write the function of Freewheeling diode.

2. Attempt any THREE of the following : **12**

(a) Describe triggering of SCR using UJT relaxation oscillator.

(b) Draw the I-V characteristics of power transistor. Show all regions.

(c) With neat circuit diagram explain working of emergency light system.

(d) Compare SCR & TRIAC (any four).

3. Attempt any THREE of the following : **12**

(a) Explain with neat circuit diagram operation of temperature controller using SCR.

(b) Draw the circuit diagram of class-D commutation & explain its working.

(c) With neat constructional diagram write operating principle of PUT.

(d) Explain with circuit diagram of 1ϕ mid-point controlled rectifier with R-load.

4. Attempt any THREE of the following : **12**

(a) Draw a neat labelled I-V characteristics of SCR.

Define :

(i) Latching

(ii) Holding current

(b) Differentiate between Natural and Forced commutation (any four).

(c) Draw construction of IGBT. State any two applications of it.

(d) Explain with circuit diagram the working of 1ϕ halfwave controlled rectifier with R-L load.

(e) Draw a suitable circuit to control the speed of the motor using TRIAC and also give its operation.

5. Attempt any TWO of the following : **12**

(a) Draw a structure of TRIAC with doping levels. Write operating principle and give two applications of it.

(b) Draw the circuit diagram & waveforms of class A commutation. Explain its working.

(c) Draw & explain the working of 1ϕ mid-point controlled rectifier with RL-Load. Also Draw input-output waveforms of it.

6. Attempt any TWO of the following : **12**

(a) Draw full bridge & half bridge configuration with common cathode.

(b) Explain working of AC circuit breaker using SCR with circuit diagram.

(c) Draw symbol & V-I characteristics of

(i) LASCR

(ii) DIAC &

(iii) TRIAC

22326

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define (i) Holding current, (ii) Latching current of SCR. **2**

(b) Draw circuit diagram of Class B commutation. **2**

(c) State classification of Phase controlled rectifiers. **2**

(d) Define (i) Conduction angle, (ii) Firing angle. **2**

(e) Draw circuit diagram of symmetrical configuration of bridge converter. **2**

(f) State the advantages of SMPS. (any two) **2**

(g) State the need of UPS. **2**

2. Attempt any THREE of the following : **12**

(a) Describe with neat sketch the constructional details of IGBT. **4**

(b) Explain two transistor analogy of SCR with neat diagram. **4**

(c) With neat diagram explain synchronized UJT triggering circuit. **4**

(d) Explain working of static A.C. circuit breaker. **4**

3. Attempt any THREE of the following : 12

(a) Give comparison of SCR & TRIAC. (any four points) **4**

(b) Explain the thermal triggering method of SCR. Enlist different triggering methods of SCR. **4**

(c) Draw single phase full wave mid-point converter for inductive load. Draw input and output waveforms for it. **4**

(d) Draw the circuit diagram of battery charger using SCR and explain it's working. **4**

4. Attempt any THREE of the following : 12

(a) Draw I-V characteristics of power transistor. Show different regions. **4**

(b) With reference to GTO answer the following : **4**

(i) State advantage of GTO over SCR.

(ii) Draw construction of GTO.

(c) Explain triggering of SCR using opto-coupler. State its advantages. **4**

(d) Describe the operation of single phase fully controlled bridge converter with R-load. **4**

(e) Explain the working principle of SMPS with neat diagram. **4**

5. Attempt any TWO of the following : **12**

(a) With neat sketch explain four modes of operation of a TRIAC. **6**

(b) Explain with neat circuit diagram and input output waveforms, single phase half wave converter with R-L load. Give significance of freewheeling Diode. **6**

(c) Describe working of online UPS. List any two applications of UPS. **6**

6. Attempt any TWO of the following : **12**

(a) Draw symbols and V-I characteristics of the following devices : **6**

(i) LASCR (ii) DIAC

(iii) PUT (iv) SCS

(b) For a class D commutation, answer the following : **6**

(i) Explain the operation with a circuit diagram.

(ii) Interpret with waveforms.

(c) A 1-ϕ half controlled rectifier supplied with voltage V = 300 sin 314 t, and load resistance is 100 Ω. Find : **6**

(i) Average output DC voltage.

(ii) Load current.

(For $\alpha = 60°$ and $\alpha = 100°$)

22326

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) Draw the symbol of IGBT and MOSFET.

(b) State the application of power transistor (any two).

(c) State the types of protection circuits (any four).

(d) Give the types of SCR turn on methods.

(e) Define firing angle and conduction angle.

(f) Give any four specifications of UPS.

(g) State the requirements of SMPS.

2. Attempt any THREE of the following : **12**

(a) Describe the constructional details of MOSFET with sketches.

(b) Draw VI characteristics of SCR with neat sketch and explain its regions.

(c) Explain the operation of RC triggering circuit with neat sketch.

(d) Explain the operation of single phase half controlled rectifier with RL load.

3. Attempt any THREE of the following : **12**

(a) Describe overcurrent protection with suitable circuit arrangement.

(b) Explain the operation of synchronized UJT triggering circuit with a neat sketch.

(c) Explain the operation of single phase fully controlled midpoint configuration rectifier with RL load.

(d) Explain the operation of battery charger using SCR with a neat sketch.

4. Attempt any THREE of the following : **12**

(a) Describe SCR mounting and cooling with neat sketch.

(b) Explain with sketch the operation of an auxiliary voltage commutation.

(c) A single phase fully controlled rectifier supplied with voltage V = 100 sin 314 t, $\alpha = 30°$ and load resistance is 50 Ω. Find (i) Average output dc voltage and (ii) Load current.

(d) Explain the operation of emergency light system with a neat sketch.

(e) Explain illumination control by using TRIAC with the help of neat sketch.

5. Attempt any TWO of the following : **12**

(a) For the device GTO, answer the following :

(i) Give the constructional details with a neat sketch.

(ii) State the advantages of GTO over SCR.

(b) For a class C commutation, answer the following :

(i) Explain the operation with circuit diagram.

(ii) Interpret with waveforms.

(c) Explain the modes of operation in TRIAC with quadrant diagram.

6. Attempt any TWO of the following : **12**

(a) State the effect of source inductance in controlled rectifies with waveforms.

(b) Justify with sketches the effect of freewheeling diode in a fully controlled rectifier with RL load.

(c) If a person use one ceiling fan (80 W), two tube lights (40 W per one tubelight), two CFL (7 watt per one CFL) simultaneously with UPS having 12 V, 150 AH battery, calculate backup time of UPS battery.

22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

Marks

1. Attempt any FIVE of the following : **10**

(a) Draw the V-I characteristics of Power Transistor.

(b) Give the applications of IGBT.

(c) Draw the symbol of UJT & LASCR.

(d) Define triggering. List the types of Triggering methods.

(e) Define conduction angle & firing angle.

(f) State classification of phase controlled rectifier.

(g) State the advantages of UPS.

2. Attempt any THREE of the following : **12**

(a) Explain two transistor analogy of SCR with neat diagram.

(b) Explain synchronized UJT triggering with neat diagram.

(c) With a neat sketch, explain the construction and working of MOSFET.

(d) Draw and explain single phase full wave midpoint converter for resistive load.

3. Attempt any THREE of the following : **12**

(a) Explain the working principle of SMPS.

(b) Explain the circuit of Opto-coupler based triggering.

(c) Describe the operation of Snubber protection circuit with neat diagram.

(d) Draw and explain full bridge configuration with common cathode.

4. Attempt any THREE of the following : **12**

(a) Draw the circuit diagram and input/output waveforms of single phase half wave controlled rectifier connected to R-load.

(b) Describe emergency lighting system with neat diagram.

(c) Differentiate between Natural & Forced commutation.

(d) Give the operation of battery charger using SCR with neat diagram.

(e) Draw symbol & V-I. Characteristics of DIAC & TRIAC.

5. Attempt any TWO of the following : **12**

(a) Draw a symbol and neat labelled for V-I characteristics of GTD and explain its operation.

(b) Explain Auxiliary commutation with neat diagram. Also draw its waveforms.

(c) A single phase half controlled rectifier supplied with voltage V = 100sin314t and load resistance of 50Ω. Find

(1) Average output dc voltage

(2) Load current for ($\alpha = 60^{o}$ & $\alpha = 120^{o}$)

6. Attempt any TWO of the following : **12**

(a) Explain in detail the crowbar protection circuit with neat diagram.

(b) With a neat circuit diagram explain the working of static AC circuit breaker using SCR.

(c) Justify with sketches the procedure to eliminate the reverse power flow in fully controlled rectifier with RL load.

22421

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Sketch symbol and write truth table of two input EX-OR gate.

(b) Define the term 'Multiplexer'. State two examples of multiplexer.

(c) Implement T flip flop using J K flip flop. Write its truth table.

(d) Implement following Boolean equation using fundamental gates :

$Y = ABC + A\,\overline{B}\,C + \overline{A}\;\overline{C}\,B$

(e) Identify direct addressing instructions from following instructions :

(i) MOV R0, R5

(ii) MOV R0, 80 H

(iii) MOV R0, #75H

(iv) ADD A, 45 H

(f) If initial content of accumulator is 44 H, find out the new content of accumulator after execution of the instruction

RR A

(g) Find out number of data lines required to interface 16 LEDs arrange in the 4×4 matrix form.

2. Attempt any THREE of the following : **12**

(a) Define following terms related to logic families :

(i) Noise Margin

(ii) FAN-OUT

(iii) Propagation delay

(iv) Power dissipation

(b) State Demorgan's theorem's and prove both theorems using truth table.

(c) State functions of preset, clear, clock and SR inputs related to SR flip flop.

(d) Sketch diagram of 4 bit asynchronous counter using suitable flip flop. Sketch timing diagram.

3. Attempt any THREE of the following : **12**

(a) List out any four assembler directives and state their functions.

(b) Sketch diagram showing interfacing of two chips of RAM having size $2k \times 8$ to 8051 microcontroller. Write its memory map.

(c) Minimize following Boolean equation using 'k' map :

$Y = A\overline{B}C + \overline{A}\,\overline{B}C + \overline{A}\,\overline{B}\,\overline{C} + ABC$

and implement using basic gates.

(d) List out three types of buses. State their functions.

4. Attempt any THREE of the following : **12**

(a) List out features of any four addressing modes of 8051.

(b) With the help of PCON register, explain Power down mode and Idle mode of 8051.

(c) Construct full adder circuit using K map.

(d) Justify 'NOR gate is called as universal gate'. Sketch relevant diagram.

(e) Compare microprocessor with microcontroller on the basis of any four factors.

5. Attempt any TWO of the following : **12**

(a) Explain with neat diagram microcontroller based water level controller.

(b) Develop ALP for 8051 to perform addition, anding, multiplication of two data – Data-1 is at memory location 55 H and Data 2 is 20 H. Store result at internal memory locations.

(c) Explain internal and external memory organisation of 8051.

6. Attempt any TWO of the following : **12**

(a) Explain functions of all pins of Port 0, Port 1, Port 2 and Port 3.

(b) Sketch diagram showing interfacing of single 7-segment common Anode display to 8051. Develop ALP to display number '7.' on it.

(c) Convert following Boolean equation to standard SOP form and implement using NAND-NAND logic.

(i) $y = A\overline{B}C + ABC\overline{D} + A\overline{C}D$

(ii) $y = PQ + PQR + PQ\overline{R}$

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) State :

(i) Duality Theorem

(ii) De-Morgan's Theorem

(b) Draw symbol and truth table of Universal Gates.

(c) State race arround condition in J-K flip flop.

(d) Draw symbol and truth table of T-type flip flop.

(e) Explain assemble directives

(i) DB (ii) EQU

(f) Explain PUSH instruction with one example.

(g) State the function of LCD display pins.

(i) R/W (ii) RS

2. Attempt any THREE of the following : **12**

(a) Compare between TTL and CMOS. (Any four points)

(b) Draw OR gate and AND gate using Universal Gates.

(c) Design 8:1 MUX using 4:1 & 2:1 MUX. Draw Truth table.

(d) Minimise the following Boolean expression using K-map and realize it using the basic logic gates.

3. Attempt any THREE of the following : **12**

(a) Explain any four addressing modes of 8051 microcontroller with one example each.

(b) Interface stepper motor to 8051 microcontroller and write an ALP to rotate stepper motor in Anti-clockwise direction continuously.

(c) Compare between combinational and sequential circuit (Any four points)

(d) Draw memory organization for $E\overline{A} = 0$ and $E\overline{A} = 1$ and explain the same.

4. Attempt any THREE of the following : **12**

(a) Explain the following instruction :

(i) DAA

(ii) DIV AB

(iii) CJNE A, data, rel

(iv) SWAP A

(b) Compare between Harvard and Von-Neuman architecture (Any four points).

(c) Design Half-adder using K-map and implement using basic logic gates.

(d) Realize the following equations using NAND Gates only :

(i) $Y = (A + B) \cdot (B + C)$

(ii) $Y = AB + C$

(e) What are the alternate function of port 3 of 8051 micro-controller ?

5. Attempt any TWO of the following : **12**

(a) Interface 8 LED's with port 1 of 8051 micro-controller. Write ALP to make LED's ON and OFF after 10 msec. delays. Assume suitable data.

(b) Develop an ALP to arrange ten numbers stored in internal memory locations starting from 40H location in descending order.

(c) Draw Architecture of 8051 micro-controller.

6. Attempt any TWO of the following : **12**

(a) Explain power saving options

(i) Idle mode

(ii) Power down mode

(b) Draw interfacing diagram of 8K × 8 program ROM with 8051 and also write memory map for the same.

(c) Construct 3 bit asynchronous up-counter using flip-flop. Draw its timing diagram.

22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE : **10**

(a) State & Explain Duality Theorem.

(b) Draw symbol & write Truth Table for EX-OR Gate & EX-NOR Gate.

(c) Convert binary number 1011 into gray number.

(d) Define min. term & max. term.

(e) State the function of compiler.

(f) Identify the addressing mode of the instruction MOV A, @ RO.

(g) State the function of RS and R/W pin in 16 × 2 LCD display.

2. Attempt any THREE : **12**

(a) State and verify de-morgan's first and second theorem using Truth Table.

(b) Compare TTL, CMOS, ECL Logic family on the basis of (1) Fan-out (2) Power dissipation (3) Figure of merit (4) Propagation delay.

(c) What is Rule around condition in J-K flip flop. Suggest a suitable method to overcome drawback.

(d) State the need of De-multiplexer. Design 1 : 8 De-multiplexer using 1 : 4 De-multiplexer.

3. Attempt any THREE : **12**

(a) Simplify using K-map and implement using NAND-NAND gate only.

$Y = \Sigma m\ (0, 1, 2, 3, 5, 7, 8, 9, 11)$

(b) Compare between Micro-processor & Micro controller. (4 points)

(c) Evaluate the following program and specify the content of accumulator and status of PSW Register after execution :

```
MOV A, # 23 H
MOV OF OH, # 02 H
MUL AB
END.
```

(d) Draw the interfacing diagram of 8 LED connected to port 2 of 8051. Write a program to toggle LED after some delay.

4. Attempt any THREE : **12**

(a) $Y = A\overline{B} + \overline{A}B + AB + \overline{A}\overline{B}$. Simplify this expression using Boolean rules.

(b) Design Full Adder with Two half adder and write its Truth Table.

(c) Draw pin diagram of 8051 and explain function of pin 9, pin 20, 40.

(d) Which pins of 8051 are used to perform the following function :

(i) Receive the serial data

(ii) Enable External memory interface.

(iii) Multiplexing & De-multiplexing of address / data lines.

(iv) Applying External interrupts.

(e) List addressing mode of 8051 with one example of each.

5. Attempt any TWO : **12**

(a) Draw block diagram of internal architecture of 8051 and explain function of each block.

(b) Develope ALP to transfer seven number from internal memory location 20 H to 40 H.

(c) Draw interfacing diagram of 7 segment display with 8051. Write ALP to display number from 0 to 9.

6. Attempt any TWO : **12**

(a) Construct 3 bit asynchronous up counter using Flip Flop. Draw it's timing diagram.

(b) Describe the memory organization of 8051 microcontroller.

(c) Draw a interfacing diagram of stepper motor with 8051. Write ALP to rotate stepper motor in clockwise direction.

22421

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **5 × 2 = 10**

(a) Construct OR gate using NAND gate.

(b) Define the term 'multiplexer'. State two examples of multiplexer.

(c) Implement T flip-flop using JK flip-flop. Write its truth table.

(d) Explain :

(i) Fan-in

(ii) Fan-out

with respect to logic families.

(e) Define :

(i) Address bus

(ii) Data bus

(f) Identify the addressing mode of the instruction :

(i) MOVX@Ro, A

(ii) CJNE A, # data, rel

(g) Find the number of address lines required for

(i) 4 K RAM

(ii) 8 K ROM

2. Attempt any THREE of the following : 3 × 4 = 12

(a) State and explain De-Morgan's first theorem.

(b) Design full adder using K-map. Draw circuit diagram with truth table.

(c) Solve the following SOP expressions with the help of K-map :

(i) $F(A, B, C, D) = \Sigma m(0, 1, 3, 4, 5, 7)$

(ii) $F(A, B, C) = \Sigma m(0, 1, 4, 5, 6, 7)$

(d) Write any two laws of Boolean algebra. Justify with the help of truth table.

3. Attempt any THREE of the following : 3 × 4 = 12

(a) Explain any four addressing modes of 8051 microcontroller with one example each.

(b) Sketch diagram showing interfacing of two chips of RAM having size 2 K × 8 to 8051 microcontroller. Write its memory map.

(c) Minimize following Boolean equation using 'K' map : $Y = A\bar{B}C + \bar{A}\bar{B}C + ABC$ and implement using basic gates.

(d) List any eight features of microcontroller 8051.

4. Attempt any THREE of the following : 3 × 4 = 12

(a) Explain different program development steps in assembly language programming.

(b) Compare between Harvard and Von-Neumann architecture. (any four points)

(c) Design 3-bit binary to gray code converter.

(d) Justify 'NOR gate is called as universal gate'. Sketch relevant diagram.

(e) Draw and explain the flag register of 8051 microcontroller.

5. Attempt any TWO of the following : **2 × 6 = 12**

(a) Explain with neat diagram microcontroller based water level controller.

(b) Develop an ALP to generate square wave of 1 kHz at port pin 1.4. Draw flowchart for it.

(c) Draw architecture of 8051 microcontroller.

6. Attempt any TWO of the following : **2 × 6 = 12**

(a) Explain power saving options :

(i) Idle mode

(ii) Power down mode

(b) Develop an ALP for interfacing of LEDs with port 1 of 8051. Draw interfacing for the same.

(c) Construct 3 bit asynchronous up-counter using flip-flop. Draw its timing diagram.

22418

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

a) List the different parts of D.C. machine.

b) State the working principle of DC motor.

c) How many % frictional losses occurs in transformer.

d) Why transformer is rated in KVA instead of KW ?

e) Draw neat labeled diagram of phasing out test carried on 3 phase transformer.

f) State the use of current transformer.

g) Compare two winding transformer with auto transformer on any four points.

Marks

2. Attempt any THREE of the following : **12**

a) Explain construction and working principle of 3 phase induction motor with neat diagram.

b) Draw neat labeled diagram showing constructional parts of DC machine.

c) List different speed control methods of DC series motor. Explain any one of them.

d) A 220 V SC shunt motor runs at a speed of 850 rpm and takes current of 20 A from mains. Calculate the speed if the torque is doubled. Armature resistance is 0.2 Ω.

3. Attempt any THREE of the following : **12**

a) Explain construction and working principle of BLDC motor.

b) Derive EMF equation of transformer.

c) Draw equivalent circuit diagram of 1 phase transformer referred to secondary side. State the meaning of each term related to equivalent circuit.

d) The efficiency of a 100 KVA, 11000 / 440 V, 1Ø transformer is 87% on half load at 0.8 (lag) and 89% on full load at unity p.f. Determine iron and copper losses.

4. Attempt any THREE of the following : **12**

a) Explain with the neat diagram Scott connection scheme for conversion of 3Ø to 2Ø supply.

b) Compare distribution transformer and power transformer on any four points.

c) Give any four selection criterion for

i) Distribution transformer.

ii) Power transformer

d) A 3300/230V, 50Hz single phase transformer is to be operated at a maximum flux density of 1.2 Wb/m^2 in the core. The effective cross sectional area of the transformer is 150 cm^2. Calculate suitable values of primary and secondary turns.

e) Explain with circuit diagram use of potential transformer to measure 33 KV.

Marks

5. Attempt any TWO of the following : **12**

a) A 4 pole generator having wave wound armature winding has 51 slot each slot containing 20 conductors. What will be the voltage generated in machine when driven at 1500 rpm assuming flux per pole to be 7 mWb ?

b) Explain construction and working of isolation transformer.

c) i) State the need of parallel operation of transformer.

ii) State the conditions for parallel operation of transformer.

6. Attempt any TWO of the following : **12**

a) A 500 KVA, distribution transformer having copper and iron losses of 5 KW and 3 KW respectively on full load, The transformer is loaded as shown below.

Loading (KW)	Power Factor (lag)	No. of hrs.
400	0.8	08
300	0.75	10
200	0.8	03
No load	—	03

Calculate all day efficiency.

b) Identify the parts shown in the diagram of a transformer in Fig. No. 1.

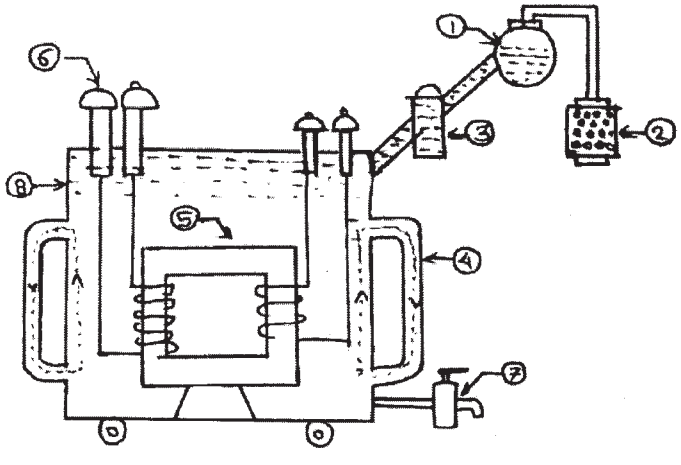

Fig. No. 1.

c) List the special features of welding transformer.

22418

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State Fleming's right hand rule.

b) State working principal of DC generator.

c) "DC series motor should never be started at no load". Justify.

d) State why a transformer always have a efficiency of more than 90%.

e) Give the specification of three phase transformer as per IS 1180 (part 1) 1989 (any four)

f) State two applications of isolation transformer.

g) List two special features of welding transformer.

Marks

2. Attempt any THREE of the following: **12**

a) Explain the working principal of Induction motor.

b) State at least one function and material used for the following parts of DC motor.

c) A 3300 / 250V, 50Hz single phase transformer is built on a core having an effective cross sectional area of 125 cm^2 and 70 turns on the low voltage winding.

Calculate:

(i) the value of max flux density.

(ii) number of turns on the high voltage windings.

d) Draw the equivalent circuit of transformer refered to the primary state the meaning of each term related to equivalent circuit.

3. Attempt any THREE of the following: **12**

a) Explain the necessity of starter for DC motor. State various types of DC motor starter.

b) Derive the emf equation of a transformer.

c) A single phase transformer has 300 turns on its primary side and 750 turns on its secondary side, the maximum flux density in the cone is 1 wb/m^2. Calculate:

(i) the net cross sectional area of the cone.

(ii) the emf induced in the secondary side

d) Compare cone type and shell type transformer.

Marks

4. Attempt any THREE of the following: **12**

a) Give any four selection criteria for :

(i) Distribution transformer

(ii) Power transformer

b) With the help of neat diagram, describe the procedure to carry out phasing out test on 3 phase transformer. Also state the purpose of conducting this test on 3-phase transformer.

c) Explain with the neat circuit diagram only the scott connection scheme for conversion of three phase supply to two phase supply. Name one application of the same.

d) In 20kVA, 1000/400V, 1 ϕ 50Hz transformer iron and full load copper losses are 300 W and 500 W respectively. Calculate its efficiency at $\frac{3}{4}$ full load at unity power factor.

e) Explain with circuit diagram use of potential transformer to measure 33kV.

5. Attempt any TWO of the following: **12**

a) A 250V, shunt motor on no load runs at 1000 rpm and takes 5A. The total armature and shunt field resistance are respectively 0.2Ω and 250Ω. Calculate the speed when loaded and taking a current of 50A, if armature reaction weaken on the field by 3%.

b) List the conditions for parallel operation of three phase transformer.

c) A 500kVA distribution transformer having copper and iron losses of 5kW and 3kW respectively on full load. The transformer is loaded as shown below:

Loading (kW)	Power Factor (Lag)	No. of hours
400	0.8	06
300	0.75	12
100	0.8	03
No load	-	03

Calculate the all day efficiency.

Marks

6. Attempt any TWO of the following: **12**

a) Explain with the help of neat diagram the following methods of speed control for DC series motor.

(i) Field diverter method.

(ii) Tapped field method.

b) Explain with the help of neat diagram working of 3 phase autotransformer. Write any two application.

c) Explain the effects of Harmonics on the transformer.

22418

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Classify the different types of motors.

b) State the rule used for calculating direction of e.m.f. induced in armature winding of D.C Generator.

c) Define voltage transformation ratio of transformer.

d) Classify various losses of transformer.

e) State any two conditions of parallel operation of three phase transformer.

f) State the importance of "K" factor of transformer.

g) State any two application of pulse transformer.

Marks

2. Attempt any THREE of the following: **12**

a) Suggest the material for the following part of motor

i) Armature winding

ii) Commutator

iii) Brushes

iv) Frame

b) Explain the principle of working of an induction motor.

c) Explain construction and working of Brushless D.C motor.

d) Draw labelled diagram of three point starter.

3. Attempt any THREE of the following: **12**

a) Describe with sketches, speed control method used for getting speed below normal speed in case of D.C shunt motor.

b) Derive the EMF equation for the single phase transformer.

c) Draw the labelled phasor diagram of single phase transformer supplying load at lagging power factor.

d) Compare shell type and core type single phase transformer (any four points)

4. Attempt any THREE of the following: **12**

a) Compare the distribution and power transformer on any four points.

b) Explain the effects of harmonics on the operation of transformer.

c) Describe with neat relevant diagram, the test carried out on three phase transformer to identify the windings corresponding to same phase.

d) In a 25 KVA, 2000/200V single phase transformer, the iron and full load copper losses are 350 watt and 400 watt respectively. Calculate the efficiency at unity power factor on full load.

e) List any four features of isolation transformer with any four applications.

Marks

5. Attempt any TWO of the following: **12**

a) A dc series motor runs at 600 rpm taking 100 Amp from 230 V supply. Armature and series field winding resistances 0.12 Ω and 0.03 Ω respectively. Calculate the speed when current has fallen to 50 amp. Assume flux to be directly proportional to field current.

b) Give the criteria for selection of distribution transformer and power transformer as per IS : 10028 (part - I)

c) Two single phase transformer with equal turns have impedance of (0.5 + j3) Ω and (0.6 + j10) Ω respect with secondary. If they operate in parallel. Determine how they will share a load of total 100 kW p.f. of 0.8 lagging?

6. Attempt any TWO of the following: **12**

a) A 10 KVA, 1 phase, 50 Hz 500/250 V transformer have following result.

OC test - (LV side) - 250 V, 3 A, 200 W

SC test - (HV side) - 15 V, 30 A, 300 W.

calculate efficiency and regulation at full load 0.8 p.f. lagging.

b) Explain with neat sketch the Scott connection scheme for conversion of three phase to two phase supply.

c) A 50 KVA, 4400/200 V transformer has $R_1 = 3.45\,\Omega$, $R_2 = 0.009\,\Omega$. The value of reactances are $X_1 = 5.2\,\Omega$ and $X_2 = 0.015\,\Omega$

Calculate for the transformer

i) Equivalent resistance and reactance as referred to HV side.

ii) Equivalent resistance and reactance as referred to LV side.

22418

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State Fleming's Left Hand Rule.

b) State Working Principle of DC Motor.

c) Write Voltage Equation of DC Motor. State meaning of each term.

d) State losses in transformer.

e) A 3 kVA 220/110 V transformer has 500 turns on it's primary. Find its transformation Ratio and Secondary Turns.

f) State any two applications of Single phase Auto-Transformer.

g) Give Technical specification of Isolation Transformer.

Marks

2. Attempt any THREE of the following: 12

a) Draw a neat sketch of construction of DC Machine and Label the following components.

i) Eye Bolt

ii) Yoke/Body

iii) Field Pole

iv) Field Winding

v) Pole Shoe

vi) Air Gap

vii) Armature winding

viii) Commutator and Brushes

b) State types of DC motors and Draw a neat sketch of types of DC motor.

c) The readings of direct loading test on a Single Phase Transformer are

Load	On primary side			On secondary side		
Condition	V_1	I_1	W_1	V_2	I_2	W_2
No Load	220	0.7	40	102	0	0
Full Load	220	4.45	960	98	8.8	862.4

Find efficiency and Regulation at a given load condition.

d) Draw the equivalent circuit of transformer. State the meaning of each tern related to it.

Marks

3. Attempt any THREE of the following: **12**

a) Derive EMF equation of DC Generator.

b) Distinguish between core type and shell type transformer on the basis of following points

i) Figure

ii) Winding

iii) Window

iv) limb

v) Mechanical Protection

vi) Cooling

vii) Repair

viii) Magnetic Circuit

c) A 5 kVA, 230/110 V, 1-ϕ Transformer is operating at Full load condition. Determine primary and secondary current I_1, I_2 and secondary turns N_2; if primary winding is having 80 Turns.

d) Derive EMF equation of Transformer.

4. Attempt any THREE of the following: **12**

a) Describe Bank of 3 - single phase transformer with neat labelled diagram. State its advantages and disadvantages.

b) Distinguish between power transformer and distribution transformer on the basis of -

i) Use

ii) Typical Voltage

iii) Power Rating

iv) Load

v) Insulation Level

vi) Flux Density

vii) Maximum Efficiency

viii) Turns Ratio

Marks

c) Explain need of parallel operation of 3-ϕ transformer. Also state condition of parallel operation.

d) A 100 kVA transformer has iron loss of 2 kW and full load Copper loss 1 kW. Calculate the efficiency of transformer at

i) F. L. Unity P.F.

ii) H. L. Unity P.F.

e) Explain with circuit diagram use of C.T. to measure high value current in a line.

5. Attempt any TWO of the following: **12**

a) A 230 V DC shunt motor has field resistance of 230 Ω and Armature resistance of 0.25 Ω, running at 1500 RPM taking 20 A from supply. Calculate Back emf in armature of motor.

b) List the selection Criteria for distribution transformer as per IS10028 : Part I : 1985

c) Find the all-Day efficiency of 500 kVA distribution transformer whose Cu-losses and Iron loss at full load are 4.5 kW and 3.5 kW resp. During a day of 24 Hrs. it is loaded as under

No. of Hours	Loading (kW)	Power factor
06	400	0.8
10	300	0.75
04	100	0.8
04	0	– 0 –

6. Attempt any TWO of the following: **12**

a) Explain with the help of neat sketch "Brake test of DC shunt motor." State its advantages and disadvantages.

b) Draw a neat labelled diagram of construction of 3-ϕ amorphous transformer. State material and function of each part.

c) Explain K-Factor transformers. State its significance. Also write effect due to harmonics and overheating due to non-linear load.

22419

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Attempt answers in sequential order, preferably.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State the meaning of Single line diagram

b) State the classification of transmission lines depending on length of transmission lines.

c) State the type of distribution substation.

d) List different transmission line components used for power transmission. (any four)

e) State features of wireless power transmission.

f) State line parameters of transmission line.

g) Define voltage regulation and Transmission Efficiency.

Marks

2. Attempt any THREE of the following: **12**

a) Differentiate between overhead transmission and underground transmission.

b) Draw the layout of Homopolar transmission line.

c) State the advantages of use of high voltage in transmission of Electric power.

d) Draw the layout of power system indicating Generation, Transmission and distribution parts.

3. Attempt any THREE of the following: **12**

a) Draw the diagram representing transposition of conductor and state its importance.

b) State the standard voltage in India for Generation, transmission distribution system.

c) List the factors to be considered while designing feeders and distribution with their functions in brief.

d) State advantages and disadvantages of radial distributor system.

4. Attempt any THREE of the following: **12**

a) List classification of distributor system with their advantages each. (any two)

b) A 3-ϕ overhead line supported by 6 disc insulators, the potential across the unit is 11 KV. Assuming shunt capacitance between each Insulator and each metal link is of 1/5th of capacitance of insulator. Calculate :

(i) line voltage

(ii) string efficiency.

c) State the meaning of skin effect and how can it be minimised.

d) Draw the diagram of pin type and suspension type insulators.

e) State the effects of low power factor on efficiency and voltage regulation of short transmission lines.

f) State the condition for selecting site for distribution substation.

Marks

5. Attempt any TWO of the following: **12**

a) Derive equation for string efficiency with 3 - disc insulators of suspension type.

b) Define Corona, List its causes and state how can it be avoided. (two each)

c) State the meaning of ferranti effect and proximity effect.

6. Attempt any TWO of the following: **12**

a) Compare nominal - I and nominal - II method of transmission line (Any six points)

b) State the meaning of FACTS and explain in brief d-types facts controller.

c) (i) List the properties of line insulators in brief.

(ii) List the methods of Line Support Erection and explain in brief any one.

22419

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Write the standard transmission voltages in INDIA.

b) Define –

(i) Transmission efficiency

(ii) Voltage regulation in transmission lines

c) State any four factors on which skin effect depends.

d) Give any two limitations of EHVAC w.r.t. distribution system.

e) Compare feeder and distributor on any two parameters.

f) Draw the simple arrangements for radial distribution system.

g) State any two advantages of ACSR conductors.

P.T.O.

Marks

2. Attempt any THREE of the following: **12**

a) "Electric power is to be transmitted at high voltage." Justify this statement.

b) Explain the effect of load power factor on performance of the transmission line.

c) Draw a neat sketch of Bipolar HVDC transmission system. State any two merits of the same.

d) Compare overhead system with underground system on the following parameter –

(i) Useful life

(ii) Maintenance cost

(iii) Interference with communication lines.

(iv) Conductor size

3. Attempt any THREE of the following: **12**

a) Describe with neat sketch the construction method of 33KV distribution system.

b) Explain the features of wireless transmission of electrical power.

c) Draw the typical layout diagram of 11 KV/400 sub station.

d) Draw a neat sketch of pin insulator. State any two causes of failure with its limitations.

4. Attempt any THREE of the following: **12**

a) Compare primary transmission and secondary transmission system. (any four points)

b) Describe the need for transposition of conductor with sketch.

c) Give the comparison between HVDC and EHVAC transmission on any four points.

d) Classify distribution substation on basis of –

(i) Service requirement

(ii) Constructional feature

e) A 3 phase overhead transmission line is being supported by 3 disc insulators. The potential across top unit and middle units are 8 KV and 11 KV.
Calculate :-

(i) Line voltage

(ii) String efficiency

Marks

5. Attempt any TWO of the following: **12**

a) In medium transmission line, for nominal T method, show the derivation for sending end voltage with the help of neat phasor diagram.

b) Draw a neat block diagram of HVDC system. Also give any two advantages and limitations of the same.

c) A single phase AC distributor 'AB' 300 meter long is fed from end A and loaded as under :-

(i) 100 A at 0.707 pf lagging 200 m from point A.

(ii) 200 A at 0.8 pf lagging 300 m from point A.

The load resistance and reactance of distributor is 0.2 Ω and 0.1 Ω per km. Calculate the total voltage drop in the distributor. The load power factors refer to the voltage at the far end.

6. Attempt any TWO of the following: **12**

a) A 3 phase, 50 Hz overhead transmission line has the following distributed parameters. R = 30 Ω, Inductive reactance = 60 Ω and capacitive susceptance = 4×10^{-4} mho. If load at the receiving end is 75 MVA at 0.8 pf lagging with 132 KV between lines,

Calculate :

(i) Regulation

(ii) Efficiency of transmission for this load.

Use nominal 'π' method.

b) Describe ring main system of distribution with diagram. Also state any two advantages of ring distribution load.

c) With the help of neat diagram explain draw in system for laying of underground system. Also give any two disadvantages of this system.

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22419

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State the characteristics of high voltage for power transmission. (any two)

b) Give the classification of transmission line based on length of transmission line and voltage.

c) State the application of HVDC transmission line. (any two)

d) State the skin effect of transmission line. Where this effect occurs.

e) Define primary and secondary distribution system.

f) Give advantages and disadvantages of distribution substation. (any two each)

g) State any two properties of insulating material used for overhead insulator.

Marks

2. Attempt any THREE of the following: **12**

a) Draw single line diagram with components of electric supply of transmission and distribution system.

b) Draw circuit diagram and vector diagram of short transmission line.

c) Draw and explain monopolar HVDC transmission system.

d) State the requirement of line support used in transmission and distribution system.

3. Attempt any THREE of the following: **12**

a) Give the voltage level of following:

i) Primary transmission

ii) Primary distribution

iii) Secondary transmission

iv) Secondary distribution

b) State the meaning of FACTS and explain in brief.

c) List the factors to be considered while designing feeders and distributors with their function in brief.

d) Draw and explain construction of underground cable.

4. Attempt any THREE of the following: **12**

a) Explain any four advantages of high voltage power transmission.

b) Explain various line parameters of transmission line.

c) State the limitations of EHVAC transmission line.

d) Explain with diagram ring type distribution system.

e) Explain shackle type insulator with neat sketch.

Marks

5. Attempt any TWO of the following: **12**

a) A 3-ph line of 6 km length 5000 kW at a p.f of 0.8 lagging to a load the resistance and reactance per km of each conductor are 0.3 Ω and 0.6 Ω respectively. If the voltage at the supply end is maintained at 11 kV. Calculate the received end voltage.

b) Explain the Ferranti effect and corona effect. Discuss any two methods of reducing corona.

c) Draw the symbols and state their function of components used in substation. (any six)

6. Attempt any TWO of the following: **12**

a) Compare nominal I and nominal II method of medium transmission line. (any six)

b) Draw single line diagram for 33/11 kV distribution substation. List out components used in it and function of each components.

c) Each line of 3-ph system is suspended by a string of 3 similar insulator. If the voltage across the line unit is 20kV, Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $1/10^{th}$ of the capacitance of insulator itself. Also find the string efficiency.

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22419

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State the classification of transmission lines depending on length of transmission lines.

b) State the effect of inductance or performance of transmission lines.

c) State any four factors on which skin effect depends.

d) State any four features of wireless power transmission.

e) List any four components of distribution system.

f) Define feeder and distributor.

g) State any two properties of insulating material used for overhead insulator.

Marks

2. Attempt any THREE of the following: **12**

a) Draw single line diagram of AC electric transmission and distribution system.

b) Explain proximity effect and state its two disadvantages.

c) Explain the phenomenon of Corona. State how Corona effect can be reduced?

d) Distinguish between overhead system and underground system on the following parameters :–

i) Charging current

ii) Overload capacity

iii) Power factor

iv) Appearance.

3. Attempt any THREE of the following: **12**

a) Compare primary transmission and secondary transmission line on the basis of :–

i) Portion of transmission line

ii) Height of tower

iii) Loading point

iv) Installation of PLCC.

b) Draw and explain HVDC Bi-Polar transmission system.

c) Give any four points to be considered while designing distributor.

d) Discuss any two methods of improving string efficiency.

4. Attempt any THREE of the following: **12**

a) Explain with neat sketch construction method of 33kV distribution system.

b) Draw equivalent circuit diagram and phasor diagram of medium transmission line, using 'T' method.

c) Give any eight important reasons for adoption of EHVAC transmission.

d) Draw a neat diagram of radial distribution system and state any two advantages.

Marks

e) A string of three unit suspension insulator observed to have voltage distribution on top disc 9kV, middle disc 12kV. Calculate:

i) Line voltage

ii) String efficiency.

5. Attempt any TWO of the following: **12**

a) Draw the vector diagram for a short transmission line connected to lagging power factor load. Derive equations for efficiency and regulation.

b) Explain any four features of flexible AC transmission line. State types of FACTS controller.

c) A single phase AC distributor of 600 mtr length has total impedance of (0.02 + j 0.04) Ohm and is fed from one end at 220V. If it is loaded as shown in Figure No. 1. Calculate the voltage drop and voltage at far end.

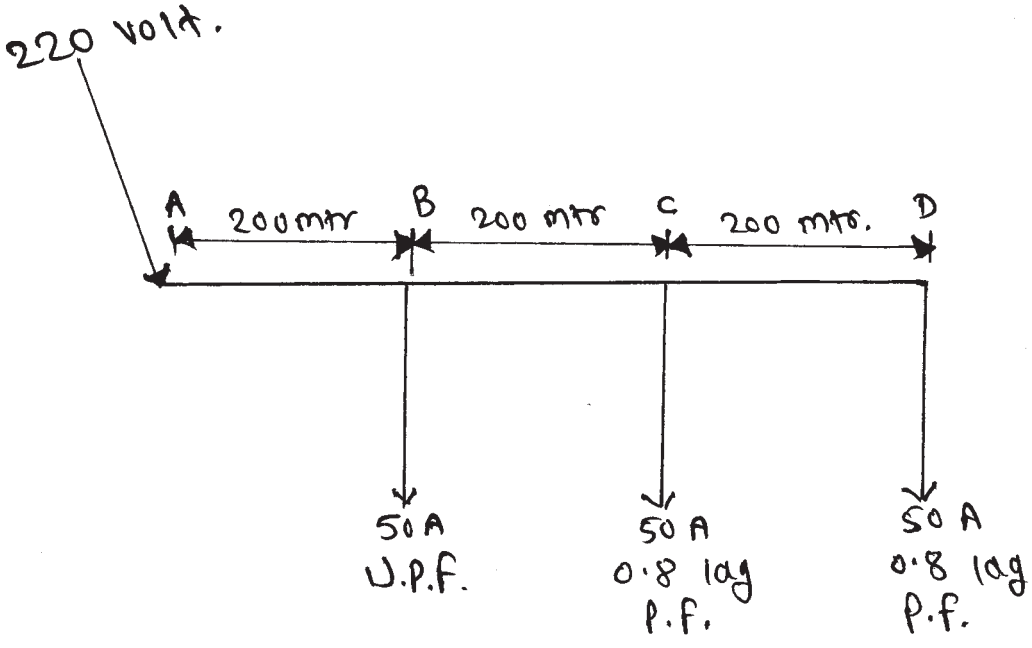

Fig. No. 1

Marks

6. Attempt any TWO of the following: **12**

a) Distinguish between nominal T and nominal π method of analysis of medium transmission line. (Any six points)

b) i) State the different types of distribution schemes.

ii) Draw a neat labelled single line diagram for 11 kV/400V distribution substation.

c) State different methods of laying of underground cables. Explain any one method in detail.

22420

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State necessity of instrument calliberation.

b) Give classification of transducer on any two factors

c) List any two specifications of electrical pressure transducer.

d) Define Atmospheric pressure and Absolute pressure.

e) Define laminar flow and turbulent flow.

f) Give classification of level measurement methods.

g) Convert 45°C into Farhenite.

2. Attempt any THREE of the following: **12**

a) Draw symbol and characteristic of LDR. Give material used for it.

b) Compare Bellows and diaphragm w.r.to construction, sensitivity, working principle and application.

c) Draw and explain Doppler type flow measurement.

d) Explain calliberation of capacitive type level measurement.

P.T.O.

Marks

3. Attempt any THREE of the following: **12**

a) Give one application each of following transducer.

(i) LVDT

(ii) RVDT

(iii) Capacitive

(iv) Piezoelectric

b) Compare U tube manometer and well type manometer on any four points.

c) Compare Nuclear Radiation type and Ultrasonic level measurement.

d) Draw and explain filled system thermometer.

4. Attempt any THREE of the following: **12**

a) List any two advantages and two applications of Bellows.

b) State Seeback effect and Petlier effect.

c) List any two advantages and applications of RADAR type level measurement.

d) Name the material used and the sensitivity of following thermocouple type.

(i) J

(ii) K

(iii) R

(iv) S

e) Explain with neat labelled diagram measurement of flow using venturimeter.

Marks

5. Attempt any TWO of the following: **12**

a) Draw neat sketch of Rotameter and explain its working principle.

b) Draw optical type pyrometer and list its advantages.

c) State function of strain gauge. Give its types and explain working of any one type of it.

6. Attempt any TWO of the following: **12**

a) Draw and explain the construction and working of Dead Weight Tester.

b) List any two direct methods of level measurement. Explain Hydrostatic method of level measurement. Give one advantage and one disadvantage of it.

c) Related to ultrasonic flow meter:

(i) Give any two types of it.

(ii) Write any two specifications.

(iii) Write two advantages over rotameter.

22420

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(6) Preferably, write the answers in sequential order.

Marks

1. Attempt any FIVE of the following: **10**

a) State the need of transducers in instrumentation system.

b) Define :–

i) Atomospheric Pressure.

ii) Gauge Pressure

c) List the types of electrical flow meter.

d) Define :–

i) Laminar flow.

ii) Turbulent flow.

e) Write applications of level transducer (Any four).

f) List units of temperature and conversion formula for them (Any two unit).

g) Name the metals used in J and K type thermocouple.

Marks

2. Attempt any THREE of the following: **12**

a) State the working principle of potentiometer, describe the major difference in linear and angular potentiometer.

b) Write any two applications of capacitive and inductive transducer.

c) Describe the classification of pressure transducers.

d) i) Describe with neat diagram the measurement of pressure using Bourdon tube with LVDT.

ii) State the advantage of this system over Bourdon tube system.

3. Attempt any THREE of the following: **12**

a) Classify the following transducer at least by two ways :–

i) Strain gauge and

ii) Thermocouple.

b) Describe criteria for the selection at transducer for following applications :–

i) Weighting machine in grocery shop.

ii) Water level controller for home.

c) Differentiate between the u-tube manometer and inclined tube manometer.

d) Describe the construction and working of the orifice plate meter.

4. Attempt any THREE of the following: **12**

a) Draw neat sketch of Rota meter and explain the use of it for the flow measurement.

b) i) State the working principle of ultrasonic type level measurement with help of neat sketch.

ii) State the frequency range of the same.

c) Describe the salient features of the float type level measurement transducer.

d) Compare ultrasonic type and radar type level measurement transducer

e) Write the advantages and limitations of optical pyrometer.

Marks

5. Attempt any TWO of the following: **12**

a) i) Describe the calibration procedure with help of sketch for capsule and diaphragm type transducer.

ii) State the range of pressure measured by diaphragm type transducer.

b) Describe the problems occurs in working of ultrasonic flow meter and write the procedure to troubleshoot these problems.

c) Draw labelled diagram of electromagnetic flow meter and write the output equation of it and basic condition for working of this flow meter.

6. Attempt any TWO of the following: **12**

a) Explain the calibration procedure for capacitance type level transducer.

b) i) Describe the working of RTD with help of sketch.

ii) Write its two applications and material used in it.

c) Suggest the temperature transducer with reason for the following applications.

i) Temperature of the winding of electrical machines.

ii) Temperature of refrigerator and air conditioner.

iii) Temperature of furnace and oven.

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22420

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define Primary and Secondary transducer and give one example of each.

b) List the four different units of pressure.

c) State formula for Reynold's number.

d) List different flow measurement methods.

e) Give two advantages and disadvantages of float type level sensor.

f) State seeback effect.

g) List any four temperature scale and state their abbreviates.

Marks

2. Attempt any THREE of the following: **12**

a) Explain with neat sketch construction and working of bonded strain gauge.

b) Draw the block diagram of instrumentation system and state the function of each block.

c) Draw the figure showing Vacuum, Atmospheric pressure, gauge pressure and absolute pressure.

d) Explain in detail calibration technique and draw the calibration curve in general for pressure measurement.

3. Attempt any THREE of the following: **12**

a) State the selection criteria of transducer for any application. (any eight points)

b) Compare active and passive transducer. (Any four points)

c) Explain construction, working principle of Bourdon tube with neat sketch.

d) Explain working of Electromagnetic flowmeter. Give its mathematical equation.

4. Attempt any THREE of the following: **12**

a) Explain different types of orifice plates with figure.

b) Explain with the help of neat sketch Hook type level measurement.

c) Explain working principle of hydrostatic type level measurement.

d) Compare ultrasonic and radar level measurement with respect to working principle, construction, waves used and application.

e) Convert the following temperature from °f (fahrenheit) to °C (celsius)

i) 0°F

ii) –40°F

iii) 250°F

iv) 41°F

Marks

5. Attempt any TWO of the following: **12**

a) Draw constructional diagram of LVDT. State its working principle for displacement measurement.

b) Determine the velocity of flow in an electromagnetic flow meter for flowing condition. The flux density in the liquid has an average value of 0.08 weber/m^2. The diameter of the pipe is 10 cm. The induced voltage of electromagnetic flow meter is recorded as 0.2 mV.

c) State applications and compare the advantages and disadvantages of an Nutating disc meter and Lobed impeller meter.

6. Attempt any TWO of the following: **12**

a) Explain the working of following level detector with neat sketch.

i) Capacitance level detector

ii) Ultrasonic level detector

b) Compare RTD with thermistor with reference to

i) Working principle

ii) Relation between temperature and resistance

iii) Materials

iv) Range of measurement

v) Cost

c) Describe calibration procedure with a neat diagram of temperature measurement system with input from RTD and thermocouple.

22420

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define active and passive transducers.

b) State the need of transducer.

c) List out any two pressure measuring devices.

d) List the types of electric flow meter.

e) Define Reynold's number turbulent flow.

f) List any two non-contact type level measurement methods.

g) Name the metals used in J&K type thermocouple.

2. Attempt any THREE of the following: **12**

a) Draw and explain the block diagram of instrumentation system.

b) Draw constructional detail of C-type Bourdon tube.

c) Draw and explain Manometer U-tube.

d) List classification of level measurement methods.

Marks

3. Attempt any THREE of the following: **12**

a) Describe the construction of LVDT with neat diagram.

b) Explain the working of Electromagnetic flow meter with neat sketch.

c) Draw and explain capacitive type level transducer.

d) Compare Thermocouple and Thermistor. (Any four points)

4. Attempt any THREE of the following: **12**

a) State the selection criteria for transducer.

b) Explain the process of calibration of pressure gauge by Dead Weight Tester.

c) Draw neat sketch of linear and rotary potentiometer liquid level gauge.

d) State applications of temperature measurement transducer :

i) RTD

ii) Thermometer

e) Describe with diagram optical pyrometer type temperature sensor.

5. Attempt any TWO of the following: **12**

a) Write any three applications of capacitive and inductive transducer.

b) Describe construction and working and diagram of orifice plate meter.

c) Explain the working of rotameter with neat diagram.

Marks

6. Attempt any TWO of the following: **12**

a) Describe the salient features of the flow type level measurement transducer.

b) Compare between -

i) Ultrasonic and radar type level measurement.

ii) List out the troubles and related remedies in capacitive type level measurement.

c) Explain with neat sketch the working of Bimetallic thermometer and write two applications.

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22525

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define Energy conservation.

(b) List any two functions of MEDA.

(c) List the energy conservation technique in induction motor.

(d) Define the following terms :

(i) Luminous intensity

(ii) Luminous flux

(e) State the losses in secondary distribution system.

(f) State the advantages of cogeneration.

(g) List the different types of tariff.

2. Attempt any THREE of the following : **12**

(a) State the difference between energy conservation and energy audit.

(b) Explain the energy conservation technique "By improving power quality of I.M.".

(c) State the working principle and operation of automatic power factor controller used in transmission & distribution system.

(d) Write any four merits of cogeneration.

3. Attempt any THREE of the following : **12**

(a) State the needs and benefits of star labelling.

(b) State the advantages of amorphous core transformer.

(c) Describe the following energy conservation techniques in lighting system :

(i) replacing lamp source

(ii) using light control gear

(d) State ABC analysis related to energy audit.

4. Attempt any THREE of the following : **12**

(a) Why energy conservation technique should be adopted in transformer even though its efficiency is mostly more than 90%.

(b) State the various commercial losses in transmission & distribution system. Also, state EC technique adopted for optimizing distribution system.

(c) Discuss how power factor tariff results in energy conservation.

(d) State difference between "walk through audit" and "detailed audit".

(e) Define and explain the procedure to calculate the payback period. Also, state its significance.

5. Attempt any TWO of the following : **12**

(a) (i) State the significant feature of soft starter.

(ii) Describe variable frequency drive with suitable diagram.

(b) For the tariff of ₹ 125/kVA of maximum demand and ₹ 3.00 per unit consumed ; load factor = 50%, find overall cost/unit at

(i) unity power factor

(ii) 0.8 p.f consider maximum demand = 10 kVA.

(c) Explain with flow chart the energy audit procedure.

6. Attempt any TWO of the following : **12**

(a) Describe detailed energy audit procedure to be carried out for an organization.

(b) Explain with diagram :

(i) Topping cycle type of cogeneration

(ii) Bottoming type of cogeneration

(c) Explain the following energy conservation technique :

(i) Controlling I^2R losses

(ii) Balancing phase current

22525

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) Answer each next main Question on a new page.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Assume suitable data, if necessary.

(4) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE : **10**

(a) Explain the National Scenario related to Energy demand and supply.

(b) Define Energy Audit as per Energy Conservation Act, 2001.

(c) List out any four energy conservation techniques applicable to induction motor.

(d) List out the energy conservation equipments suitable for electrical motors.

(e) Specify any two types of Energy efficient transformers.

(f) Define the term "Simple payback period" and state how it helps in Energy Audit Project.

(g) Draw a neat labelled Energy flow diagram for an Induction Motor.

2. Attempt any THREE : **12**

(a) State the role of MEDA in present energy scenario.

(b) State the need of energy conservation for transformers in present energy scenario.

(c) Explain the technical & commercial losses in power system.

(d) Explain the method for optimum use of energy sources in the chemical industries.

3. Attempt any THREE : **12**

(a) Identify five and explain any two energy conservation techniques for transformer.

(b) Illustrate with neat sketch the working of Automatic power factor controller as an energy conservation equipment.

(c) State the benefits of Availability Based Tariff and Time-off-day Tariff.

(d) State any four major energy audit instruments and explain their uses.

4. Attempt any FOUR : **12**

(a) Differentiate the star labelled electrical equipments from non-labelled electrical equipments on any four factors.

(b) Explain the following energy conservation technique suitable for induction motors – operating in star mode – improving the power quality.

(c) Explain the energy conservation technique adopted for a lighting system using the energy efficient lamp sources.

(d) Identify the factors to be considered for selection of cogeneration system for a fascility.

(e) Provide probable questionnairy to carry out energy audit of an electrical workshop.

5. Attempt any TWO : **12**

(a) Explain the methods to reduce technical losses in the transmission and distribution systems (any three).

(b) Explain the tepping cycle co-generation technique.

(c) Describe the different steps involved in detailed energy audit procedure.

6. Attempt any TWO : **12**

(a) A manufacturing plant is fed with three phase 400 V, 50 Hz supply and runs from 9.00 to 17.00 Monday to Friday. During the operating period the demand is constant at 60 kVA. Calculate the monthly energy bill if demand charge is ₹ 260/ kVA per month and unit charge is ₹ 2/unit p.f. is 0.94.

(b) Describe the incentives and penalities related to following tariffs :

- Power factor tariff
- Time-off-day tariff
- Load factor tariff

(c) The existing illumination scheme of an electrical installation is having 40 lamps of 40 watt each. If the tariff is flat rate with ₹ 2/unit and fixed charge of ₹ 140/- month. Calculate the monthly energy bill. If the lamps are replaced with energy efficient lamps giving same level of illumination with 25 watt rating and if the replacement cost per lamp is ₹ 250. Calculate the payback period.

22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) List any two designated consumers as per Energy Conservation Act.

(b) Write any four energy conservation techniques in transformer.

(c) What is technical loss in electrical installation system ?

(d) What is the need of energy conservation in lighting system ?

(e) Define : (i) Co-generation (ii) Tariff

(f) Define Energy Audit as per Energy Conservation Act.

(g) List any four energy conservation equipments.

2. Attempt any THREE of the following : **3 × 4 = 12**

(a) Why star labelling of equipment is required ? Also state its benefits.

(b) State any four methods for energy conservation techniques in induction motor.

(c) Draw block diagram / SLD for APFC & write its working principle.

(d) Differentiate between topping cycle and bottoming cycle.

3. Attempt any THREE of the following : **3 × 4 = 12**

(a) State any four advantages of energy audit.

(b) State and explain how to achieve energy conservation in lighting system by (1) using energy efficient Luminaries (2) using light controlled gears.

(c) What are different types of tariff structures ? State how TOD & ABT is applied to consumers.

(d) Write the roles of following agencies :

(1) B.E.E. (2) M.E.D.A.

4. Attempt any THREE of the following : **3 × 4 = 12**

(a) Differentiate between primary and secondary energy sources.

(b) Why periodical maintenance is necessary in transformer ? How does it result in energy conservation ?

(c) What is soft starter ? State its need and benefits.

(d) Classify co-generation system. Draw the diagram for bottoming cycle.

(e) What is payback period ? Calculate the payback period if investment is ₹ 2,00,000 & saving is ₹ 50,000 per month.

5. Attempt any TWO of the following : **2 × 6 = 12**

(a) Compare conventional Induction motor with Energy efficient motor on following points :

(1) Efficiency

(2) Cost

(3) Vibrations

(4) Heat dissipation

(5) Losses

(6) Energy conservation

(b) List any three energy conservation equipments in transmission and distribution system. Describe the role of any one equipment in transmission and distribution from energy conservation point of view.

(c) What is Sankey diagram ? State its two significance & draw Sankey diagram for induction motor.

6. Attempt any TWO of the following : **2 × 6 = 12**

(a) State the difference between 'Walk through Audit' & Detailed audit. Write stepwise procedure for detailed audit.

(b) List different commercial losses in transmission and distribution system. State its causes and remedies.

(c) A consumer has maximum demand of 700 KW at 70% Load factor. If tariff is ₹ 100/KW of maximum demand plus 20 paise per KWh. Find :

(1) Unit consumed per year

(2) Annual charges

(3) Overall cost/KWh

22525

23124
3 Hours / 70 Marks

Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define Energy conservation.

(b) List the energy conservation technique in Induction Motor.

(c) List out the different technical losses that take place in transmission & distribution system.

(d) State co-generation with suitable example.

(e) State power factor tariff ?

(f) List four relevant instruments to carry out energy audit.

(g) Prepare any four questions related to energy audit.

2. Attempt any THREE of the following : **12**

(a) State the need and benefit of star labelling.

(b) Explain the following Energy Conservation methods of electrical motor :

(i) Rewinding of motor

(ii) By operating in star mode

(c) Explain energy conservation method in lighting system by using installation of servo stabilizer.

(d) State any four advantages of co-generation system.

3. Attempt any THREE of the following : **12**

(a) State the need of energy conservation in transformer and material used to improve the design & performance of transformer.

(b) State and explain any four commercial losses in transmission and distribution system.

(c) What are the different types of tariffs ? Explain in short (any four).

(d) State various instruments used in energy audit procedure with their functions.

4. Attempt any THREE of the following : **12**

(a) What is the Energy Conservation Act, 2001 ?

(b) Explain how Variable Frequency Drive (VFD) can help to conserve electrical energy.

(c) Differentiate between technical and commercial losses.

(d) How TOD and peak-off tariff can help for energy conservation ?

(e) State any four advantages of energy audit.

5. Attempt any TWO of the following : **12**

(a) State the working principle & operation of APFC used in transmission & distribution system.

(b) For the tariff of 125/kVA of maximum demand and 3.00 per unit consumed; load factor = 50%, find overall cost/unit at :

(i) Unity power factor

(ii) 0.8 p.f. consider maximum demand = 10 kVA.

(c) Describe methods of reducing technical losses in transmission & distribution system.

6. Attempt any TWO of the following : **12**

(a) Outline the step wise activities to be carried out to assess the performance of existing lighting system of electrical installation.

(b) An industrial plant has incandescent load of comprising 100 nos. of 60 W, and 140 nos. of 100 W. Calculate the energy saving and simple payback period if each incandescent load is replaced by 1 × 40 W fluorescent lighting load. Lighting is required for 4000 hrs/year and cost of electricity is ₹ 6.00/kwh. Replacement cost is ₹ 150/unit.

Consider ballast consumption as 15 watt.

Given data :

(i) 100 W incandescent lamp = 2200 lumens

(ii) 60 W incandescent lamp = 1320 lumens

(iii) 40 W fluorescent lamp = 2400 lumens.

(c) Explain with the flow chart energy audit procedures.

22523

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State the function of following parts in Induction motor.

(i) Stator

(ii) Seiprings

b) State suitable single phase motor for following applications:

(i) Table fan

(ii) Mixers and Grinders

c) State advantages of short pitch winding over full pitch winding in alternators.

d) List different torques in synchronous motor.

e) State advantages of rotating field type alternators. (any four)

f) List applications of stepper motor.

g) List applications of servomotor.

Marks

2. Attempt any THREE of the following: **12**

a) Derive the condition for maximum torque under running condition of a 3 phase induction motor.

b) A 16 pole, 3 phase star connected alternator armature has 12 slots with 24 conductors per slot and flux per pole is 0.1 wb. sinusoidally distributed. Calculate line emf generated at 50 Hz.

c) Explain the effect of variable excitation on the behaviour of synchronous motor under constant load condition.

d) Prove that for a 3ϕ induction motor.
Rotor copper loss = S. Rotor input.

3. Attempt any THREE of the following: **12**

a) The power input to a 500V 50Hz 6Pole 3ϕ induction motor running at 975 rpm is 40 kW. The stator losses are 1kW and friction and windage losses are 2kW. Calculate :

(i) Seip

(ii) Rotor copper loss

(iii) Shaft power

(iv) Efficiency

b) Prove that $K_d = \frac{\sin(m\beta/2)}{m\sin(\beta/2)}$ in an alternator.

c) Explain working of resistance split phase single phase induction motor with vector diagram.

d) A 400V, 50Hz seipring type three phase induction motor is star connected and has per phase rotor resistance and standstill reactance of 0.5 and 1.5 ohm respectively. Calculate resistance to be added per phase to achieve maximum torque at starting.

Marks

4. Attempt any THREE of the following: **12**

a) Explain working of autotransformer starter for a 3 phase induction motor with neat diagram.

b) Explain phase shifting (production of rotating magnetic field) in shaded pole induction motor with neat diagram.

c) Explain the construction and working of permanent magnet stepper motor.

d) Describe with neat sketch working of hystersis motor.

e) Explain construction and working of AC servomotor.

5. Attempt any TWO of the following: **12**

a) Explain the activities carried out during weekly maintenance of 3 ph. Induction motor.

b) Define voltage regulation of an alternator. Explain synchronous impedance method for finding regulation of alternator.

c) State the modifications to be done in dc series motor to work satisfactorily as ac series motor. State applications of ac series motor.

6. Attempt any TWO of the following: **12**

a) Define armature reaction in an alternator. Explain the effect of armature reaction at various P.F. of loads of alternator.

b) Draw and explain 'V' and 'inverted V curves' for synchronous motor.

c) List different starting methods of three phase synchronous motor. Explain any one of them.

22523

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define synchronous speed and slip speed.

b) State any four types of single phase Induction motor.

c) List any four applications of single phase Induction motor.

d) Define synchronous impedance and synchronous reactance.

e) State methods of starting of synchronous motor.

f) Draw schematic diagram of AC servo motor.

g) List any four applications of BLDC motor.

2. Attempt any THREE of the following: **12**

a) Draw block diagram showing power stages of 3ϕ Induction motor.

b) With neat sketch state the working principle of Star-Delta starter.

c) Draw the phasor diagram of loaded alternator when load is capacitive and also write the equation of no-load induced emf.

d) Explain the principle of operation of 3 phase synchronous motor.

P.T.O.

Marks

3. Attempt any THREE of the following: **12**

a) The power input to a 500 V, 50 Hz, 6 pole, 3 ϕ induction motor running at 975 RPM is 40 kW. The stator losses are 1 kW and the friction and windage losses total 2 kW. Calculate :

i) The slip

ii) The rotor cu loss

iii) Shaft power

iv) The efficiency

b) State why three phase induction motor never runs on synchronous speed.

c) State the double field revolving theory of single phase Induction Motor.

d) Define the following terms and write their mathematical expression.

i) Pitch factor

ii) Distribution factor related to the winding of alternator.

4. Attempt any THREE of the following: **12**

a) Describe with neat sketch, the principle of operation of single phase shaded pole Induction Motor.

b) Compare resistant split phase motor with capacitor split phase motor on the basis of

i) Output

ii) Starting Torque

iii) Power Factor

iv) Applications

c) Why synchronous motor is not self starting? Explain in detail.

d) Draw a schematic diagram of a DC servo motor. Draw a speed torque characteristics of DC servo motor.

e) Explain working principle of BLDC motor.

Marks

5. Attempt any TWO of the following: **12**

a) A 3 phase Induction Motor has a starting torque of 100% and maximum torque of 200% of the full load torque. Determine –

i) Slip at which maximum torque occurs.

ii) Full load slip.

iii) Rated current at starting in per unit of full load rotor current.

b) A 6 pole, 50 Hz, 3ϕ Induction Motor running on full load develops a useful torque of 150 N-M at a rotor frequency of 1.5 Hz. Calculate the shaft power output. If the mechanical torque lost in friction be 10 N-M, Determine–

i) Rotor cu loss

ii) The input to the motor and

iii) The efficiency

c) Describe the factors affecting the regulation of three phase alternator and draw the phaser diagram of loaded alternator when operating power factor is lagging and loading.

6. Attempt any TWO of the following: **12**

a) i) Write the formula C for Xs ; 2s of an alternator.

ii) Explain the effect of armature reaction at various power factor of load on alternator. Draw suitable wave forms showing the effect.

b) i) Find the no load line voltage of a star connected 3 phase, 6 pole alternator which runs at 1200 RPM, having flux per pole of 0.1 wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by one slot.

ii) State any four advantages of rotating field over rotating armature of 3 phase alternator.

c) Draw and explain V and inverted V curves of synchronous motor.

22523

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(6) Preferably, write the answers in sequential order

Marks

1. Attempt any FIVE of the following: **10**

a) State the reasons of skewed rotor bars in 3 ϕ squirrel cage I.M.

b) State any four applications of hysteresis motor.

c) State why distributed windings are preferred over concentrated winding in alternator.

d) List four advantages of having a stationary armature and rotating field of 3-phase alternator.

e) State any two functions of damper winding in a synchronous motor.

f) Draw Torque-speed characteristics of BLDC motor.

g) Define step angle and write its equation in case of stepper motor.

Marks

2. Attempt any THREE of the following: **12**

a) Compare squirrel cage I.M. and phase wound I.M. with reference to construction speed control, maintenance and applications.

b) Derive the torque equation of 3 ϕ I.M. under running condition.

c) State the factors affecting terminal voltage of an alternator and describe their effect on terminal voltage.

d) State why synchronous motor is not self-starting. List the methods generally used to start synchronous motor.

3. Attempt any THREE of the following: **12**

a) Explain production of R.M.F. in 3-phase I.M. when 3 ϕ supply is fed to it. Draw its phasor diagram.

b) Draw the approximate equivalent circuit diagram along with its vector diagram of 3 ϕ I.M.

c) Suggest type of 1 ϕ Induction motor suitable for the following applications.

i) Washing machine

ii) Refrigerater

iii) Petrol pumps

iv) Sewing machine

d) Open circuit test and short circuit test were carried out on a 3 ϕ alternator. It was found that at a field current of 10A, it produces a current of 200 A on short circuit and developed 1150 V on open circuit. The effective resistance of phase winding is 0.6 Ω. The alternator is star connected. Determine synchronous impedance / ph and synchronous reactance / ph.

Marks

4. Attempt any THREE of the following: **12**

a) Power input to a 400 V, 60 Hz, 6 pole 3 ϕ I.M. running at 1140 rpm. is 40 Kw. at 0.8 p.f. lag. Stator losses are 1000 W. and friction windage losses are 2000 W. Calculate -

i) Slip

ii) Rotor copper loss

iii) Shaft power

iv) efficiency

b) Explain the reason why single phase induction motor is not self starting how to make it self starting.

c) Explain construction and working of two value capacitor start and run. 1 ϕ induction motor with neat suitable diagram.

d) Draw and explain dynamic characteristics of stepper motor.

e) Describe the working of switched reluctance motor with suitable diagram.

5. Attempt any TWO of the following: **12**

a) A 3 ϕ I.M. has synchronous speed of 250 rpm and 4% slip at full load. The rotor has a resistance of 0.02 Ω/ph and stand still reactance of 0.15 Ω/ph. Calculate

i) The speed at which max torque is developed.

ii) The ratio of maximum to F. L. torque.

iii) The ratio of maximum to starting torque.

iv) What value of resistance/ph have so that the starting torque is half the max torque.

b) Describe the construction, working of shaded pole I.M. with neat diagram.

c) A 3 ϕ, 50 Hz, λ connected 200 KVA, 2300 V alternator gives S.C. current of 60 A for certain field excitation on. With same excitation O.C. voltage/ph is 900 V. The armature resistance is 1.2 Ω/ph, find F.L. regulation at

i) U.p.f

ii) 0.8 p.f lagging.

Marks

6. Attempt any TWO of the following: **12**

a) Explain with suitable diagram the phenomenon of hunting. State causes and effect of hunting in 3ϕ synchronous motor.

b) Compare salient pole rotor with smooth cylindrical rotor of 3ϕ alternator (any six points)

c) A 400 V, 50 Hz, 3ϕ, 37.5 Kw, λ connected synchronous motor has a F. L. efficiency of 85%. The synchronous impedance of the motor is $(0.2+j1.6)\Omega$/ph. If the excitation of motor is adjusted to give a leading power factor of 0.9. Calculate the following for full load.

i) The excitation e.m.f.

ii) The total mechanical power developed.

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22523

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define Rotor frequency and slip of three phase induction motor.

b) State any two applications of Hysteresis motor.

c) State working principle of induction motor.

d) Define short pitch factor and distribution factor.

e) State methods of starting of synchronous motor.

f) List any four applications of BLDC motor.

g) Define synchronous reactance and synchronous impedance.

Marks

2. Attempt any THREE of the following: **12**

a) List the speed control methods of three phase induction motor and explain any one method.

b) Draw with neat diagram of shaded pole motor.

c) Derive EMF education of alternator. State the meaning of each term used in it.

d) Explain motor selection for different application as per load speed characteristics.

3. Attempt any THREE of the following: **12**

a) Compare slip ring induction motor with squirrel cage induction motor on any four points.

b) Explain construction and mixing of hysteresis motor

c) Explain factor affecting the terminal voltage of alternator in armature resistance and voltage leakage drops.

d) "The synchronous motor is not self starting". Justify.

4. Attempt any THREE of the following: **12**

a) A three phase, 50 Hz, 6 pole alternator has star connected winding with 120 slots 6 conductor per slot. The fuse per pole is 0.04 wb, sinusoidally distributed. Determine the phase and line voltages.

b) Explain power flow diagram of 3 phase induction motor with neat sketch.

c) Draw and explain torque speed characteristics of Repulsion motor.

d) Explain armature reaction on various power factor and synchronous impedance. (units p-f, zero p-f lagging, zero p-f leading)

e) Compare AC and DC servomotors.

Marks

5. Attempt any TWO of the following: **12**

a) Draw and explain V and inverted V curves of synchronous motor.

b) A 3 phase, 4 pole 50 Hz, induction motor has rotor impedance of $(0.05 + j\ 0.16)\Omega$ / phase. Calculate speed of motor when delivery maximum voltage. Also calculate the resistance to be added to achieve 3/4th of maximum torque at time of starting.

c) Draw and explain torque speed characteristics of universal motor and suggest the application of same.

6. Attempt any TWO of the following: **12**

a) Draw and explain with working of synchronous reluctance motor with help of neat diagram.

b) Define voltage regulation of alternator. A 400V, 20 kVA, 3 phase star connected alternator has resistance per phase of 2.0 Ohm. open circuit voltage per phase of 90 r is obtained for field current of 1.5 A for same field current, short circuit current per phase is 20A. Calculate –

i) Synchronous impedance

ii) Synchronous reactance

iii) Open circuit voltage/phase

iv) Regulation while supply a load current of 20 A at 0.7 power factor lagging.

c) Explain hunting in Synchronous motor state its causes and effects.

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22524

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define normal and abnormal conditions in electrical power system.

b) State the need of current limiting reactors.

c) Define

i) Breaking capacity and

ii) Making capacity of circuit breakers

d) Define terms selectivity and reliability of protective relays.

e) State any four faults that may occur in alternator.

f) State any four faults that can occur in motor.

g) List any two protection schemes used for the transmission line.

Marks

2. Attempt any THREE of the following: **12**

a) State any four types of faults and their causes in electrical power system.

b) Define the terms:

i) A/C voltage

ii) Recovery voltage

iii) Restriking voltage

iv) RRRV for circuit interrupting devices.

c) State PSM and TSM for protective relays and name the relay in which PSM and TSM are applicable.

d) A three phase, 11 KV/400 V, 50 Hz, Δ/λ (delta/star) transformer has CT of ratio 200/5 on I.V. side. Calculate the CT ratio on H.V. side (i.e. 11 KV side).

3. Attempt any THREE of the following: **12**

a) Four 11 KV, three phase, 5 MVA alternators having reactance of 20% each operate in parallel and supply power to 25 MVA, 3 phase transformer of ratio. 11 KV / 132 KV. The transformer % reactance is 2.5%. Calculate the fault KVA on H.V. side of transformer.

b) Compare simple KitKat fuse with MCB for

i) Reliability

ii) Braking capacity

iii) Cost

iv) Applications.

c) Draw the block diagram of static relay and state its working principle.

d) With neat line diagram, state the working of over current and earth fault protection of alternator.

Marks

4. Attempt any THREE of the following: **12**

a) State the principle and working of single phase ELCB (Earth Leakage Circuit Breaker) with neat circuit diagram.

b) State the working principle of directional power relay with neat diagram.

c) State the working principle of Bucholz relay. Draw sketch of Bucholz relay.

d) State the working principle of differential protection for bus bar with single line diagram.

e) State the working of fault bus protection scheme with neat sketch.

5. Attempt any TWO of the following: **12**

a) With the help of neat sketch, state the construction and working of SF_6 gas circuit breaker.

b) Draw block diagram and state sequence of operation of ϕ microprocessor based over current protection.

c) A three phase, 2 pole, 10,000 KVA alternator has neutral earthed through resistance of 7Ω. The machine (alternator) has current balance protection which operated upon out of balance current exceeding 20% of full load. Determine percentage of winding protected against earth fault.

Marks

6. Attempt any TWO of the following: **12**

a) Draw neat sketch of pantograph type of isolator. State the sequence of operation of circuit breaker, isolator and earthing switch while opening and closing.

b) State following three basic relay terminologies

i) Relay time

ii) Pick up

iii) Reset and

Define

i) Instantaneous relay

ii) Over current relay

iii) Differential relay

c) With the help of neat sketch, state the operation of distance protection scheme for the transmission line.

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22524

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Preferably, write the answers in sequential order.

Marks

1. Attempt any FIVE of the following: **10**

a) Draw neat circuit diagram of

(i) Feeder reactor and

(ii) Generator reactor

b) State four functions of protective system.

c) Define the term "Insulation co-ordination".

d) Draw a typical time-current characteristic for IDMT relay.

e) List two limitations of Differential-Protection scheme for transformer.

f) State two requirements of transmission line protection.

g) State four abnormalities that taking place in case of motors.

Marks

2. Attempt any THREE of the following: **12**

a) Explain in brief four causes of faults in the power system.

b) Define the following terms related to circuit breaker

(i) Breaking Capacity

(ii) Making Capacity

(iii) Short time rating and

(iv) Normal current rating

c) Define the following terms with respect to protective relays

(i) Relay time

(ii) Reset current

(iii) Plug setting multiplier and

(iv) Time setting multiplier.

d) A three phase, 66/11KV, star-delta connected transformer is protected by Merz-Price system. The CT's on LV side have a ratio of 400/5. Find the ratio of CT's on the HV side.

3. Attempt any THREE of the following: **12**

a) With neat diagram explain the operation of Horizontal break isolator.

b) Describe the working of HRC fuse with neat diagram.

c) With neat sketch explain the working of Thermal relay.

d) A star connected, 3-phase, 10MVA, 6.6KV alternator is protected by Merz-Price circulating current principle using 1000/5 ampers current transformers. The star point of the alternator is earthed through a resistance of 7.5Ω. If the minimum operating current for the relay is 0.5A, calculate the percentage of each phase of the stator winding which is unprotected against the earth faults, When the machine is operating at normal voltage.

Marks

4. Attempt any THREE of the following: **12**

a) "ELCB" is must for a residential installation''. Justify the statement.

b) Describe the operation of current differential relay with neat sketch.

c) Discuss in brief the principle of distance protection and state four advantages of distance protection scheme.

d) Explain differential protection scheme for busbars with neat sketch.

e) Explain with neat sketch, the Pilot wire protection scheme applied to transmission line.

5. Attempt any TWO of the following: **12**

a) Describe the construction and operation of Buchholz relay with neat labelled diagram.

b) Explain the working of single phasing preventer with neat diagram.

c) Two 11KV, 3-phase, 3000KVA generators having reactance of 15% operate in parallel. The generator supply power to a transmission line through a 6000KVA transformer of ratio 11/22KV and having leakage reactance of 5%. Calculate fault current and fault KVA on H.T. side of transformer.

6. Attempt any TWO of the following: **12**

a) Describe the construction of SF6 circuit breaker with neat diagram.

b) With the help of neat diagram, explain the operation of static relay.

c) Explain the "Differential Protection Scheme" used for alternators with neat labelled diagram.

22524

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State any two functions of protective system.

b) List any four applications of HRC fuse.

c) State function of RCBO and MPCB

d) State the need of directional relay.

e) List any four protection schemes used for alternator.

f) Draw time - current characteristic of IDMT relay.

g) List any four faults related to busbar.

Marks

2. Attempt any THREE of the following: **12**

a) State importance of feeder reactor. Write any two disadvantages of it.

b) Define : - arc voltage, restriking voltage, recovery voltage and RRRV.

c) A 3ϕ 66 kV/ 33 kV star / delta transformer is protected by Merz - Price protection scheme. CT's on LV side have a ratio of 600/5. Find CT ratio on HV side.

d) Explain short circuit protection of 3ϕ IM.

3. Attempt any THREE of the following: **12**

a) List different types of faults occured on a power system. Draw necessary sketches (any four)

b) Explain working of vertical break isolator with neat sketch.

c) Define - Relay time, reset current, pick-up current, current setting.

d) Draw neat sketch of Buchholz relay. State any four points related to its construction.

e) With neat sketch explain pilot wire protection scheme for transmission line.

4. Attempt any THREE of the following: **12**

a) Explain with neat sketch working principle of distance relay.

b) Explain reverse power protection of 3ϕ alternator.

c) With neat sketch explain working of restricted earth fault protection scheme of transformer.

d) List any four major faults related to 3ϕ IM. Draw sketch of single phasing preventer.

e) Explain with neat sketch differential protection scheme of bus bar.

Marks

5. Attempt any TWO of the following: **12**

a) Compare ACB and MCB on any six points.

b) Draw a block diagram of microprocessor based over current protection. State function of each block.

c) List any three difficulties experienced in differential protection of alternator. State the remedies to overcome each.

6. Attempt any TWO of the following: **12**

a) Related to vacuum circuit breaker -

i) Draw neat sketch

ii) Write any four important points related to its construction.

iii) Give any two advantages and two disadvantages.

b) Describe any six fundamental quality requirements of protective relaying.

c) A plant consists of two 10 MVA generators of reactance 18% each and two 5 MVA generators of 12% each. All are connected to bus bar to supply a load through three step up transformers of 8 MVA each having reactance of 8%. Determine fault MVA on HV side of transformer.

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22524

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State any four causes of faults.

b) State four functions of protective system.

c) Define isolator and state their types.

d) Define Reliability and Sensitivity.

e) State any four faults occurs in transformer.

f) List protection scheme used in motor.

g) State any four faults occurs in bus-bar and transmission line.

Marks

2. Attempt any THREE of the following: **12**

a) Draw symbol of following:

i) Earth Switch

ii) Lightning arrester

iii) Circuit breaker

v) Isolator

b) Define terms related to circuit breaker:

i) Making capacity

ii) Breaking capacity

iii) Short time Rating

iv) Normal current Rating

c) Explain with neat sketch basic trip circuit of protection relaying.

d) A 3-phase 66/11 KV star-delta connected transformer is protected by merz-price protection scheme. The CTs on the LT side have a ratio of 420/5A. Find the ratio of the C.B. on H.T. side.

3. Attempt any THREE of the following: **12**

a) Two generators of 11 KV, 3-phase, 3000 KVA having reactance of 15% operates in parallel. The generator supply power to transmission line through 6000 KVA T/F ratio of 11/22 KV having reactance of 5%. Calculate fault current and fault KVA on H.T. side of the transformers.

b) Compare Fuse and MCCB on

i) Size

ii) Cost

iii) Reliability

iv) Replacement strategy.

c) With neat sketch explain working of attracted armature type relay.

d) State the location of buchholz relay with next diagram. Which equipment is protected by it and for which faults.

Marks

4. Attempt any THREE of the following: **12**

a) Describe with neat sketch the principle of operation of vacuum circuit breaker.

b) With neat sketch explain watt-hr. meter structure of induction type relay.

c) Explain reverse power protection of alternator.

d) Explain the single phasing preventer with neat sketch.

e) Explain differential protection of bus bar.

5. Attempt any TWO of the following: **12**

a) Explain arcing phenomenon in circuit breaker and state methods of arc extinction.

b) With the help of block diagram explain operation of Micro-processor based over current protection.

c) With a neat labelled diagram explain differential protection scheme used for alternators.

6. Attempt any TWO of the following: **12**

a) Describe the construction of SF_6 circuit breaker with neat diagram and state any four properties of SF_6 gas.

b) Draw and explain operation of induction type direction of over current relay.

c) Explain with neat sketch, the pilot wire protection scheme applied to transmission lines.

22526

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) Draw the symbol of following components.

(i) Limit switch

(ii) Pressure switch

(iii) Overload relay

(iv) Earthing

(b) Draw block diagram of PLC.

(c) State the need of automation.

(d) Draw ladder diagram for OR operation.

(e) State any two uses of HMI.

(f) Draw ladder diagram of seal in circuit.

(g) List the different components of ladder diagram. (any four)

2. Attempt any THREE of the following : **12**

(a) Draw power & control circuit for FWD-STOP-REV control circuit of an induction motor.

(b) Explain with block diagram digital output module of PLC.

(c) Explain the following relay type instructions

(i) IF-OPEN

(ii) IF-CLOSE with its symbol.

(d) Develop ladder & wiring diagram for DOL starter with OLR contacts.

3. Attempt any THREE of the following : **12**

(a) Explain on delay timer instruction with timing diagram.

(b) Draw block diagram of SCADA & list different components of it.

(c) Develop the ladder diagram for stepper motor control.

(d) Explain different programming languages used in PLC.

4. Attempt any THREE of the following : **12**

(a) State the function of latching of relay using PLC.

(b) Classify & explain the PLCs available in the market.

(c) Explain with block diagram working of soft starter.

(d) Explain the working of STAR-DELTA starter with power circuit diagram.

(e) Explain any four speciality modules of PLC.

5. Attempt any TWO of the following : **12**

(a) Develop a generalized DCS architecture for control of plant.

(b) Explain PLC based water level controller with the help of ladder diagram.

(c) Develop control & power circuit for conveyor control.

6. Attempt any TWO of the following : **12**

(a) Explain up counter instruction in PLC with timing diagram.

(b) Draw and explain the block diagram of analog input module of PLC.

(c) Develop ladder diagram for traffic light controller.

22526

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the need of automation.

(b) Draw the symbol of following :

(i) push button

(ii) limit switch

(iii) proximity switch

(iv) pressure switch

(c) Draw the block diagram of PLC.

(d) Draw and explain ladder diagram for AND operation.

(e) List types of timers.

(f) State the function of seal in circuit w.r.t. PLC.

(g) Give the full form of SCADA & HMI.

2. Attempt any THREE of the following : **12**

(a) Develop the control circuit for star-delta starter used for starting a 3 ϕ induction motor.

(b) State the functions of PLC memory w.r.t. types, speed of execution.

(c) Develop the ladder diagram for stepper motor control.

(d) Write the ladder program for 24 hour clock.

3. Attempt any THREE of the following : **12**

(a) Explain count up (CTU) instruction with timing diagram.

(b) Develop the ladder diagram for forward-reverse control of a 3 ϕ induction motor.

(c) Explain instructions :

(i) If-closed

(ii) If-open

(d) Explain block diagram of SCADA. Identify different components of it.

4. Attempt any THREE of the following : **12**

(a) Explain with block diagram, the working of soft starter.

(b) Explain the working of FWD – STOP – REV control circuit of an induction motor.

(c) Draw the block diagram of analog input module of PLC. State the function of each block.

(d) Explain the function of

(i) Communication module

(ii) PID controller module

(e) Develop ladder and wiring diagram of DOL starter with OLR.

5. Attempt any TWO of the following : **12**

(a) Develop control and power circuit diagram of hoist control and mill.

(b) Develop a generalised DCS architecture for control of a plant.

(c) Explain the working of PLC based bottle filling system with the help of ladder diagram.

6. Attempt any TWO of the following : **12**

(a) Develop a ladder diagram for ON/OFF temperature control.

(b) Explain the instruction T_{on} and T_{off} with timing diagram.

(c) Draw the block diagram of digital output module of PLC and explain the function of each block.

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22526

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **5 × 2 = 10**

(a) Explain the function of Push button and limit switch used in control circuit.

(b) Distinguish between two wire and three wire control.

(c) Draw the symbols of following component used in industrial control circuit :

(i) ON/OFF push button

(ii) OLR Control contact

(d) Draw the block diagram of PLC in detail.

(e) State the use of Human Machine Interface.

(f) Draw the ladder program for verifying the AND and OR Logic gates.

(g) State the function of seal in circuit with respect to PLC.

2. Attempt any THREE of the following : **3 × 4 = 12**

(a) Explain the concept of control and power circuit diagram using DOL starter.

(b) Explain the block diagram and function of each part in PID controller.

(c) Draw the symbols of following relay type inspections :

(i) IF – OPEN

(ii) IF – CLOSE

(d) Develop a PLC Ladder Logic of DOL starter with OLR contact.

3. Attempt any THREE of the following : **3 × 4 = 12**

(a) Develop the control circuit for Star/Delta starter using timer, for starting of a 3 ϕ Induction motor.

(b) Draw block diagram of Analog Input–Output module of PLC with its specification.

(c) Classify timers of PLC and explain T_{ON} timer in detail.

(d) Develop the Ladder Logic program for Forward-Reverse control of 3ϕ induction motor.

4. Attempt any THREE of the following : **3 × 4 = 12**

(a) Explain the working of Soft starter with block diagram.

(b) Draw block diagram of Digital Input/Output module of PLC with its specification.

(c) Classify counter of PLC and explain any one counter function in detail.

(d) State the function of Latching relay using PLC.

(e) Explain block diagram of SCADA. Identify different components of it.

5. Attempt any TWO of the following : **2 × 6 = 12**

(a) Develop control and power circuit for lifting magnet used as a material handling equipment.

(b) Explain the block diagram and function of each part in communication module.

(c) Develop the PLC Ladder Logic for stepper motor control.

6. Attempt any TWO of the following : **2 × 6 = 12**

(a) Describe a generalised DCS architecture.

(b) Draw Ladder diagram for two Motor system with following conditions :

(i) Starting push-button starts Motor-1.

(ii) After 10 sec. Motor-2 is ON.

(iii) Stopping switch stops motor 1 and 2.

(c) Develop the PLC Ladder Logic for water level controller.

22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Figures to the right indicate full marks.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the use of proximity switch & pressure switch.

(b) State any two benefits of automation.

(c) State any two PICs available in market with no. of IO's.

(d) Draw ladder diagram for AND gate.

(e) Draw ladder diagram for XOR gate.

(f) State the function of seal in circuit w.r.t. PLC.

(g) Define SCADA.

2. Attempt any THREE of the following : **12**

(a) Explain the working of FWD-STOP-REV control circuit of an Induction motor.

(b) Explain Digital output module of PLC.

(c) Develop ladder diagram & wiring diagram of DOL starter.

(d) Explain latching relay using PLC.

3. Attempt any THREE of the following : **12**

(a) Explain down counter module with example.

(b) Explain the instruction T_{ON} and T_{OFF}.

(c) Develop Bottle filling system using Ladder diagram.

(d) Explain SCADA architecture with neat sketch diagram.

4. Attempt any THREE of the following : **12**

(a) Explain solenoid valve with neat sketch diagram.

(b) Explain function of different parts of PLC.

(c) Explain any two input and output devices of automation.

(d) Develop ladder diagram & wiring diagram of DOL starter with OLR.

(e) Explain :

(i) Stepper motor control module

(ii) Communication module in PLC.

5. Attempt any TWO of the following : **12**

(a) Draw control & power circuit diagram of conveyor control.

(b) Develop Traffic light control using ladder diagram.

(c) Compare the salient features of SCADA, PLC & DCS system.

6. Attempt any TWO of the following : **12**

(a) Draw a ladder diagram for 3 motor operation for following condition :

(i) Start push button starts motor M_1. After 15 seconds M_2 & M_3 starts.

(ii) Stop push button stops M_3 and after 15 seconds motor M_2 and M_1.

(b) Explain IF-CLOSED, IF-OPEN & internal relay instructions.

(c) Explain PLC based water level controller with neat ladder diagram.

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22530

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Write any special instructions if any. Preferably write the answers in sequential order.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define Enhance lighting.

(b) Compare the salient features of LED and CFL based on

(i) Lamp efficiency

(ii) Life span

(c) Define the terms incandescent and incandescent lamp.

(d) State two types of electronic dimmer.

(e) State the first law of illumination.

(f) State the Lux Level recommended for (1) Class Room (2) College Auditorium.

(g) State any two type of lamps used in Horticulture.

2. Attempt any THREE of the following : **12**

(a) Explain the features of Aquarium lighting.

(b) Illustrate with neat wiring diagram a single lamp control by two point method.

(c) Explain the working of HPMV Lamp with neat diagram.

(d) Compare the AC and DC Arc lamps.

3. Attempt any THREE of the following : **12**

(a) Explain the working of Neon sign tube with diagram.

(b) State the selection criterion of the lamp for various purposes.

(c) State any four design considerations for illumination scheme of commercial complex.

(d) Describe the working principle of Thyristor operated dimmer with the help of circuit diagram.

4. Attempt any THREE of the following : **12**

(a) Select the illumination level required as per ISI for following working plane in residential building :

(i) Kitchen sink

(ii) Staircase

(iii) Dining room

(iv) Study room

(b) Explain the lighting scheme to be designed for each of the following :

(i) Special ward in hospitals

(ii) Dentist's cabin

(c) Analyse the effect of supply voltage on performance of LED, as regards current, Lumen output, efficacy and life.

(d) State the purpose of light control. List the different types of dimmer.

(e) State the different types of outdoor flood lighting and where are they used ?

5. Attempt any TWO of the following : **12**

(a) State the various lighting calculations method and describe any one of them.

(b) A workshop measures 10 m × 25 m. The shop is illuminated by 24 lamps of 200 watts each. The lumen efficiency of each lamp is 15 lumens per watt. Depreciation factor is assumed to be 0.8 and a co-efficient of utilisation 0.5. Determine the illumination on the working plane.

(c) State the requirements of illumination scheme of shipyard.

6. Attempt any TWO of the following : **12**

(a) Enlist the luminaries used in factory lighting and lux level required in various areas.

(b) Describe control of a single lamp from three places. Draw the relevant circuit diagram.

(c) A drawing hall 30 metres by 15 metres with a ceiling height of 5 metres is to be provided with a general illumination of 120 lumens per metres square ; taking a co-efficient of utilization of 0.5 and depreciation factor of 1.4. Determine the number of fluorescent tubes required, their spacing, mounting height and total wattage. Take luminous efficiency of fluorescent tube as 40 lumens per watt for 80 watt tubes.

22530

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE : **10**

(a) Define each of following terms of illumination. – lux, lumen, luminous flux, illumination.

(b) Explain concept of photometry.

(c) State any four selection criteria for lamps for different purposes.

(d) Draw a neat labelled diagram of Sodium Vapour Lamp.

(e) Draw a neat circuit diagram of resistance type salt water Dimmer.

(f) State basic working principle of Dimmer.

(g) Name any two Lamps used for indoor games.

2. Attempt any THREE : **12**

(a) Compare Mercury Vapour lamp and Sodium Vapour lamp on the basis of :

(i) Life (ii) Luminous efficiency (iii) Starting time (iv) Light output (colour)

(b) Describe working principle of Auto Transformer Dimmer with a neat sketch.

(c) Elaborate the points of selection of Luminairies for interior lighting.

(d) State any four general requirements of outdoor lighting.

3. Attempt any THREE : **12**

(a) Draw a single line diagram showing lighting distribution of scheme of factory lighting.

(b) State illumination level required as per ISI for following working plane : (i) Bed room (ii) Bathroom (iii) Bathroom mirror (iv) Study room

(c) Explain with a neat sketch working of (i) Resistance type Dimmer (ii) Salt water dimmer

(d) Describe working of glass envelope type neon lamp with neat sketch.

4. Attempt any THREE : **12**

(a) State any advantages and applications of mercury iodide lamp.

(b) Draw control circuit for :

(i) One lamp controlled from one point

(ii) Two lamps controlled by 2 switches.

(c) State the general requirements for the lighting for the Interior Location of commercial premises.

(d) State any four general requirements for Aquarium lighting.

5. Attempt any TWO : **12**

(a) A hall of 80 × 40 m^2 with ceiling height of 5.2 m. is to be provided with general illumination of 150 lumens / square metre. Assuming coefficient of utilisation of 0.6 and depreciation factor of 1.35 determine number of fluorescent tubes required; the distance between them, mounting height, total wattage. The luminous efficiency of fluorescent tube is 35 lumens per watt for 40 watt tube light.

(b) State and explain :

(i) Law of Inverse Square

(ii) Lambert Cosine Law

(c) State importance of light house in shipyards and state different types of lamps used for light houses.

6. Attempt any TWO : **12**

(a) State the meaning of flood lighting and illustrate different types of flood light projectors.

(b) State any four general requirements for hospital lighting and Lux level requirement for the following places :

(i) Operation theatre

(ii) General ward

(c) A uniform illumination of 200 lux is to be obtained on the floor of room measuring 20 m × 20 m by arranging electric light suitably. Calculate number of Lamps & Wattage of each lamp, if lamp efficiency is 20 Lumen / Watt. Assume and write suitable value of constant for this calculation.

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22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the purpose of lighting control. **2**

(b) Compare filament lamp and fluorescent lamp on the basis of following : **2**

(i) Quality of light

(ii) Life of lamp

(c) State any two advantages of LED lamp. **2**

(d) State different types of electric dimmer. **2**

(e) State the applications of polar curve. **2**

(f) State the recommended illumination level for : **2**

(i) Stair (ii) Study room

(g) Name any two lamps used for aquariums. **2**

2. Attempt any THREE of the following : **12**

(a) State any four characteristics of flood lighting. **4**

(b) Explain the working of salt water dimmer with the help of diagram. **4**

(c) Explain with neat sketch construction and working of fluorescent lamp. **4**

(d) State the factors to be considered while selecting a lamp for a particular application. **4**

3. Attempt any THREE of the following : **12**

(a) Explain the lightening schemes provided in stage lighting. **4**

(b) Explain working of sodium vapour lamp. **4**

(c) State any four benefits of good industrial lighting. **4**

(d) Draw and explain how one lamp can be controlled by two switch. **4**

4. Attempt any THREE of the following : **12**

(a) State illumination level in lux as per ISI for residential purposes in following places : **4**

(i) bedroom (ii) living room

(iii) kitchen (iv) dressing table

(b) State which type of lamps should be selected for following applications : **4**

(i) stage lighting (ii) flood lighting

(iii) advertisement (iv) street lighting

(c) Explain with neat sketch working of Metal Halides lamp with its applications. **4**

(d) Explain with circuit diagram the working of Triac operated dimmer. **4**

(e) State the requirement of illumination scheme for shipyard. **4**

5. Attempt any TWO of the following : **12**

(a) Define : **6**

(i) Mean spherical candle power

(ii) Space to height ratio

(iii) Luminous efficiency

(b) A room of 20 m × 10 m is illuminated by 20 numbers of 200 W lamps. The MSCP of each lamp is 240. If utilization factor is 0.65 and the depreciation factor is 1.25, then find average illumination produced on the floor. **6**

(c) Explain how lightening scheme should be designed for each of the following : **6**

(i) Operation theatre in hospital,

(ii) general ward in hospital.

Suggest the lamps for above locations.

6. Attempt any TWO of the following : **12**

(a) State the requirement of illumination scheme for (i) sport lighting (ii) railway lighting and suggest the lamps for above locations. **6**

(b) Draw control circuit for – **6**

(i) single lamp control by two point method

(ii) single lamp control by three point method

(iii) single lamp control by four point method

(c) A hall of 12 m × 16 m is to be illuminated to 150 lumen per sq. meter on working plane. If utilization factor is 0.6 and depreciation factor is 0.8 and source gives an output 40 lumen per watt, determine number of lamps. **6**

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22530

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) State any two types of transformer available as a dimmer for illumination control.

(b) Enlist the two types of arc lamps.

(c) State any two advantages of LED lamp.

(d) State any two methods used for light control.

(e) State the units used for measurement of luminous flux and illumination.

(f) State the recommended illumination level for (i) Class Room (ii) College Library.

(g) Name any two types of lamps used in decorative lighting.

2. Attempt any THREE of the following : **12**

(a) State any four desirable characteristics required in Aquarium.

(b) Explain operation of Auto transformer dimmer with the help of diagram.

(c) State any four factors to be considered while selecting a lamp for a particular application.

(d) Compare LED lamp with fluorescent lamp with reference to (i) Life (ii) Running Cost (iii) Luminous efficiency (iv) C.R.I.

3. Attempt any THREE of the following : **12**

(a) Meaning of flood lighting. State the purpose of flood lighting.

(b) Draw neat circuit diagram of HPMV and label the following components :

(i) Main Electrode

(ii) Starting Electrode

(iii) Outer Glass Tube

(iv) Discharge Tube

(c) State any four design considerations for interior location of residential unit.

(d) Draw and explain single lamp control by three point and four point method.

4. Attempt any THREE of the following : **12**

(a) Select illumination level required as per ISI for following working plane in residential building (i) kitchen, (ii) living room, (iii) dining room and (iv) study room.

(b) State the importance of light house based on navigation and safety in the shipyards and state any two types of lamps used in light house.

(c) LED lamps are becoming more popular, now-a-days. Discuss it based on the (i) Life (ii) Cost (iii) Maintenance (iv) Luminous efficiency.

(d) Suggest the suitable lighting scheme and lamp for following location in hospital :

(i) Reception

(ii) Corridors

(iii) Patient Wards

(iv) Operation Theatres

(e) State any two lighting schemes with reason used for agricultural and horticultural applications.

5. Attempt any TWO of the following : **12**

(a) State the meaning of Polar curve with suitable diagram. Also give its applications for designing lamps.

(b) A minimum illumination of 80 lux is required in the room of 50 m × 12 m. Calculate the number, location and wattage of the lamps to be used. Assume that depreciation factor is 1.2, utilization factor is 0.4 and efficiency of lamp is 14 lumens/watt.

(c) Which type of lamps should be selected for following applications ?

(i) Aquariums (ii) Stage lighting

(iii) Flood lighting (iv) Advertisement

(v) Factory lighting (vi) Street lighting

6. Attempt any TWO of the following : **12**

(a) Enlist the luminaries used and lux level required in factory lighting for following areas : (i) Office Building (ii) Workshop (iii) Testing Centre (iv) Quality control department (v) Store Room without sunlight (vi) Outdoor Parking Area.

(b) Illustrate with neat diagram a Staircase wiring and draw the truth table according to position of switch and lamp condition.

(c) Estimate the number and wattage of lamps which is required to illuminate a workshop space 80 m × 30 m by means of lamps mounted 8.5 m above working plane. The average illumination is 90 lux, co-efficient of utilization is 0.48, luminous efficiency 20 lumens per watt. Assume a space height ratio of unity maintenance factor 0.9.

22527

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **10**

(a) Draw a neat sketch of IGBT.

(b) Draw symbol and output V-I characteristics of FCT.

(c) State the applications of MCT.

(d) State the need of Inverter.

(e) List the different types of Inverter.

(f) State the effect of firing angle in dual converter.

(g) Draw a neat circuit diagram of AC circuit Breaker.

2. Attempt any THREE of the following : **12**

(a) Draw a neat circuit diagram of type C chopper and explain its working.

(b) Explain with a neat labelled sketch the operation of basic parallel inverter.

(c) Describe the operation of single phase cyclo converter with a neat diagram.

(d) Describe the operation of relay type AC voltage stabilizer with a neat diagram.

3. Attempt any THREE of the following : **12**

(a) List the various control techniques used in chopper and explain any one technique in detail.

(b) Draw and explain working of single phase half bridge inverter.

(c) Draw the circuit diagram of single phase dual converter and sketch the input/output waveforms.

(d) Describe the working principle of dielectric heating with block diagram.

4. Attempt any THREE of the following : **12**

(a) Draw circuit diagram of four quadrant chopper and its labelled quadrant diagram.

(b) Explain with a neat labelled diagram the working principle of the single phase parallel inverter.

(c) Explain the operation of Battery charger control with a neat diagram.

(d) Describe the operation of three phase to three phase cyclo convertor with neat circuit diagram.

(e) Explain with circuit diagram the working principle of the circulating current mode dual converter.

5. Attempt any TWO of the following : **12**

(a) Explain the operation of Jones chopper with a neat circuit diagram. Draw the waveforms.

(b) Describe the operation of close loop speed control method for DC servo motor with the help of diagram.

(c) Explain the operation of MC-Murray Half bridge inveter with a neat circuit diagram.

6. Attempt any TWO of the following : **12**

(a) With a neat diagram, explain the operation of SIT and state two applications of SIT.

(b) With a neat circuit diagram and relevant waveforms describe the operation of Morgan Chopper.

(c) Discuss the method of overcoming the intermittent power flow in a basic series inverter. Illustrate your answer with relevant circuit and waveform.

22527

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the applications of IGBT.

(b) Draw symbol and V-I characteristics of power MOSFET.

(c) Draw V-I characteristics of SCR.

(d) List four switching components used in inverters.

(e) List the different types of inverter.

(f) State any two applications of dual converters.

(g) State the applications of power electronics.

2. Attempt any THREE of the following : **12**

(a) With a neat circuit diagram, explain the working principle of Jones Chopper.

(b) Explain with a neat labelled sketch the working principle of the single phase series inverter.

(c) Explain the operation of cyclo converter with a neat diagram.

(d) Draw a schematic of step up-chopper and explain it.

3. Attempt any THREE of the following : **12**

(a) Draw a neat circuit diagram of class D chopper and give its operation with waveform.

(b) Draw a neat circuit diagram of single phase full bridge inverter with R-L load and give its operation.

(c) Explain with circuit diagram the working principle of the circulatory current free mode converters.

(d) Draw the diagram of electric welding control and describe its operation.

4. Attempt any THREE of the following : **12**

(a) Differentiate between class A and class B chopper (any four points).

(b) Explain the control techniques of a chopper with a neat waveform.

(c) Explain the operation of class C chopper with neat circuit diagram. Also draw the waveform.

(d) Draw the circuit diagram of single phase to three phase cyclo-converter and sketch the input/output waveforms.

(e) Draw input and output waveforms of cycloconverter to produce $\frac{1}{4}^{th}$ of input frequency. Show the firing sequence of thyristors in the relevant waveform.

5. Attempt any TWO of the following : **12**

(a) Explain the operation of Battery charger control with a neat diagram.

(b) Describe the operation of close loop speed control method for AC servo motor with the help of diagram.

(c) Explain the operation of static VAR compensation system with a neat diagram.

6. Attempt any TWO of the following : **12**

(a) With neat diagram, explain the operation of MCT and state two applications of MCT.

(b) Explain the operation of McMurray half bridge inverter with circuit diagram.

(c) Explain operation of basic parallel inverter with waveform.

22527

21222

3 Hours / 70 Marks

Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) Draw labelled output characteristics of IGBT.

(b) Define latching current & holding current of SCR.

(c) List any two applications of Power MOSFET.

(d) Write the different types of inverter.

(e) List four switching components used in inverters.

(f) List the types of dual converters.

(g) Write any two application of induction heating.

2. Attempt any THREE of the following : **12**

(a) Explain with a neat labelled sketch the working principle of the single phase series inverter.

(b) Explain with circuit diagram the working principle of type D chopper.

(c) Explain with circuit diagram the working principle of the non-circulatory current mode dual converter.

(d) Compare step-up and step-down chopper on any four points of difference.

3. Attempt any THREE of the following : **12**

(a) Draw circuit diagram of single quadrant chopper for motoring of dc motor and its labelled quadrant diagram.

(b) Describe the operation of Mcmurray half bridge inverter with circuit diagram.

(c) Draw the circuit diagram of single phase to single phase cyclo converter and sketch the input and output waveforms.

(d) Describe the principle of dielectric heating with suitable diagram.

4. Attempt any THREE of the following : **12**

(a) Identify a suitable chopper for producing the output in first and second quadrant and explain its operation.

(b) Explain the operation of Jones chopper with neat circuit diagram.

(c) The applied dc voltage of a type A chopper is 200 V and a load resistance of 50 Ω. Calculate the average output voltage if duty cycle is 0.4.

(d) Draw the input and output waveforms of cycloconverter to produce $(1/5)^{th}$ of input frequency. Show the firing sequence of thyristors in the relevant waveform.

(e) Describe the operation of three phase cycloconverter with labelled quadrant diagram.

5. Attempt any TWO of the following : **12**

(a) Explain with neat labelled sketch the speed control of AC servo motor.

(b) Identify a suitable AC voltage stabiliser that uses solid state devices. Describe its operation with diagram.

(c) Identify a suitable type of heating method to heat conducting material. Explain its operation with diagram.

6. Attempt any TWO of the following : **12**

(a) Justify FCT as a voltage controlled device with characteristics. Write its applications.

(b) Identify a suitable inverter in which load is connected in parallel with commutating components. Explain its operation with circuit diagram.

(c) Explain the operation of Mcmurray Bedford inverter with circuit diagram.

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22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) Draw labelled transfer characteristics of Power MOSFET.

(b) Define Latching current of SCR.

(c) List any two applications of SIT.

(d) Write the different types of Inverter.

(e) State need of Inverter.

(f) List any two applications of cyclo converter.

(g) List the types of high frequency heating.

2. Attempt any THREE of the following : **12**

(a) Explain with circuit diagram the working principle of type E chopper.

(b) Describe the operation of three phase bridge inverter with circuit diagram.

(c) Explain with circuit diagram the working principle of the circulatory current free mode dual converter.

(d) Define duty cycle of a chopper. Explain various control techniques used in chopper.

3. Attempt any THREE of the following : **12**

(a) Explain the operation of Jones Chopper with circuit diagram.

(b) Describe the operation of McMurray half bridge inverter with circuit diagram.

(c) Describe the operation of three phase to single phase cycloconverter with neat circuit diagram.

(d) Explain principle of dielectric heating.

4. Attempt any THREE of the following : **12**

(a) Differentiate between type A and type B choppers.

(b) Identify the role of the saturable reactor in Morgan chopper. Explain with its circuit diagram.

(c) A DC chopper (step-down) has a resistive load R = 10 Ω and input voltage V_S = 200 V. Calculate the average output voltage if duty cycle is 0.6.

(d) Draw input and output waveform of cycloconverter to produce $1/4^{th}$ of input frequency. Show the firing sequence of thyristors in the relevant waveform.

(e) Describe the operation of single phase circulatory current mode dual converter with labelled diagram.

5. Attempt any TWO of the following : **12**

(a) Describe the working of closed loop speed control method for AC servomotor.

(b) Identify a suitable AC voltage stabilizer that uses solid state. Describe its operation with diagram.

(c) Explain with neat sketch the working of DC static circuit breaker.

6. Attempt any TWO of the following : **12**

(a) Justify IGBT as a voltage controlled device with characteristics.

(b) Identify a suitable inverter in which load is connected in parallel with commutating components. Explain its operation with circuit diagram.

(c) Explain the operation of McMurray Bedford inverter with circuit diagram.

22627

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Draw the symbol for

i) Exhaust fan

ii) intermediate switch

b) State any four IE rules for electrical installation.

c) Differentiate between non-industrial and industrial load.

d) State the purpose of guarding wire used in distribution lines.

e) Write the aim of public lighting installation.

f) State the purpose of estimating and costing.

g) State the factors to be considered in selecting the type of wiring.

Marks

2. Attempt any THREE of the following: **12**

a) Two lamp points, one ceiling fan and one 5A socket to be controlled by individual switches.

Draw

i) Wiring diagram

ii) Schematic diagram

b) A residential unit is having following load

i) 4 lamps of 60 W each

ii) 6 lamps of 40 W each

iii) 4 ceiling fans of 60 W each

iv) 6 sockets of 6A having 100 W each

v) 4 sockets of 16 A having 1000 W each.

Calculate -

(1) total lighting load

(2) total power load

(3) size of distribution board

(4) No. of subcircuit for L and F and power

c) Compare overhead and underground service connection on any eight points.

d) Draw wiring diagram and single line diagram of 3 phase, 415 V, 5 HP induction motor installation.

3. Attempt any THREE of the following: **12**

a) Explain two envelop method for tender.

b) State the general requirements of electrical installation.

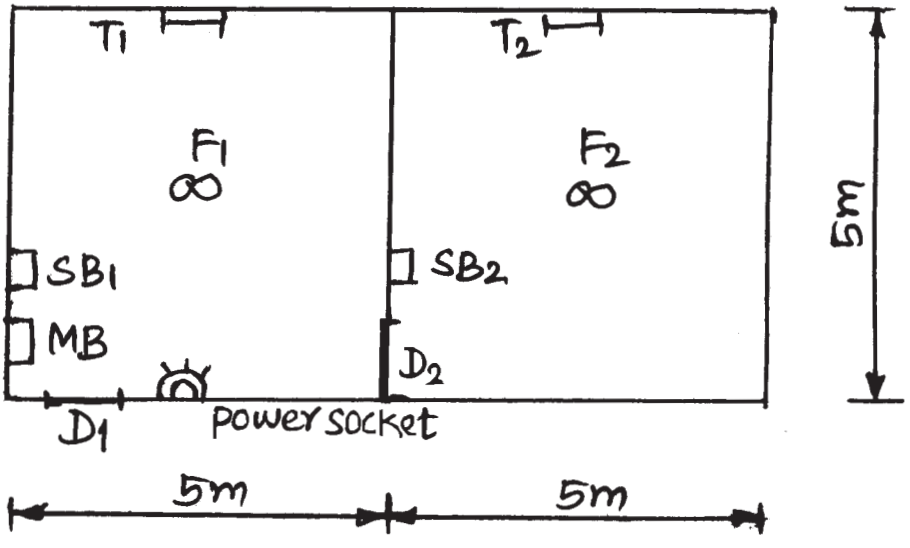
c) Decide the rating of main switch, motor switch, distribution board and cable for a industrial installation of having 2 motors of 3 HP and 5 HP.

d) Estimate the main material requirement for a 600 m, 415/240 V, 3 phase line with 4 wires in vertical configuration. The line emanate from a substation to feed a load of 30 kW. Consider span between two poles as 60 meter.

Marks

4. Attempt any <u>THREE</u> of the following: **12**

a) Calculate the length of phase wire and neutral wire for the residential installation as shown in Fig. No. 1.



$T_1 - T_2$ Tube
$F_1 - F_2$ Fan
$SB_1 - SB_2$ Switch Board
$D_1 - D_2$ Door
MB Main board.

<u>Fig. No. 1</u>

Assume one 5A socket on each switch board. Assume height of rooms as 3m.

Marks

b) Prepare the schedule of material for industrial installation as shown in Fig. No. 2.

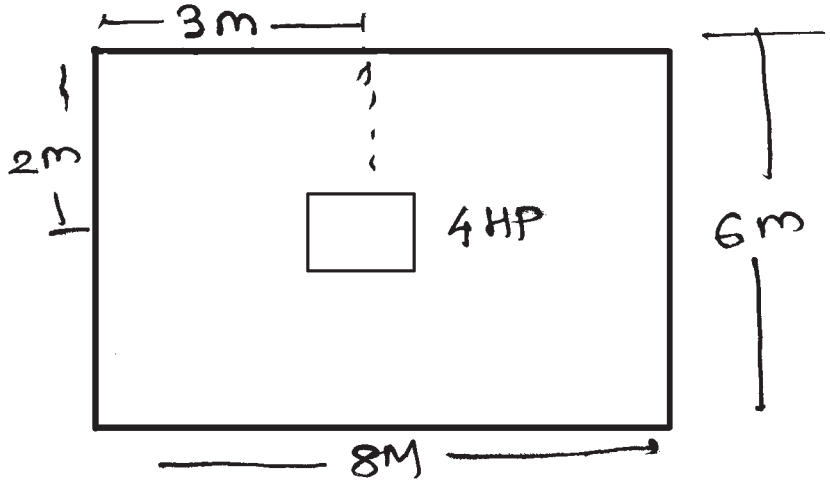


Fig. No. 2

c) State the methods of laying underground cables and write the list of material required for laying underground cable.

d) Draw the single line diagram of HT (11kv) substation.

e) Explain the on-off control used for the street light installation.

5. Attempt any TWO of the following: **12**

a) State the design considerations in case of industrial installation.

b) Estimate the main material required for a 2 km overhead line to extend from existing line. Assume a span of 50 m.

c) Prepare the list of materials and devices required for street lighting installation.

6. Attempt any TWO of the following: **12**

a) Prepare tender notice and quotation for supply for 3 ϕ, 200 kVA, 11 kV/415 V transformer for a polytechnic.

b) A road 300 m long is required to be illuminated by providing 40 W fluorescent lamps with 222 candle power, the width of road is 4 m. Design a street lighting scheme and estimate the material required if the scheme is to be estimated for obtaining minimum level of illumination of 0.8 lux.

Marks

c) A commercial hall of dimensions 12 m × 8 m is to be fitted with an electric installation. Estimate the quantity of material required. Assume the height of ceiling to be 4 m. The wiring is running at a height of 3 m from the floor. The load in the hall is 12 fluorescent lamps of 40 W each, 6 fans of 60 W each and 8 no. of 5 A sockets and 2 no. of ISA sockets outlets.

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22627

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define wiring and schematic diagram.

b) Sketch an electrical symbols for 5A and 15 A socket points.

c) List out various requirements of electrical installations for residential building.

d) Distinguish non industrial and industrial loads in industrial electrical installations.

e) State types cables used for distribution line installations.

f) General guidelines for selection of size of cables used in outdoor/street lighting installation.

g) State type of contracts used in contracting works.

Marks

2. Attempt any THREE of the following: **12**

a) Draw wiring diagram for wiring installation of 2 lamps and ceiling fan and 1 socket outlet on switch board with proper electrical symbols and labels in it and convert this wiring diagram into single line diagram.

b) Explain with suitable sketch types of service connections for residential building.

c) Enlist and calculate material quantity required for service connection of overhead type for a distance of 7.5 meter between supply service pole to meter board location.

d) Explain design considerations for industrial electrical installations particularly for main supply switch board (or Meter board).

3. Attempt any THREE of the following: **12**

a) Describe step by step the procedure of Estimation and Costing of residential installation with suitable example.

b) Explain design considerations and guidelines for the electrical installations in commercial buildings.

c) Draw neat sketch of 11 KV HT substation and enlist the material required in the substation.

d) Explain role of contractor in electrical installation works with qualities of good contractor.

Marks

4. Attempt any THREE of the following: 12

a) For a residential building prepare list of electrical wiring installations material required alongwith electrical apparatus used in the residential building.

b) In an industry having 25 HP induction motor, 3 phase as shown in Fig No. 1. Prepare electrical installation LT design scheme and list of quantity of material required.

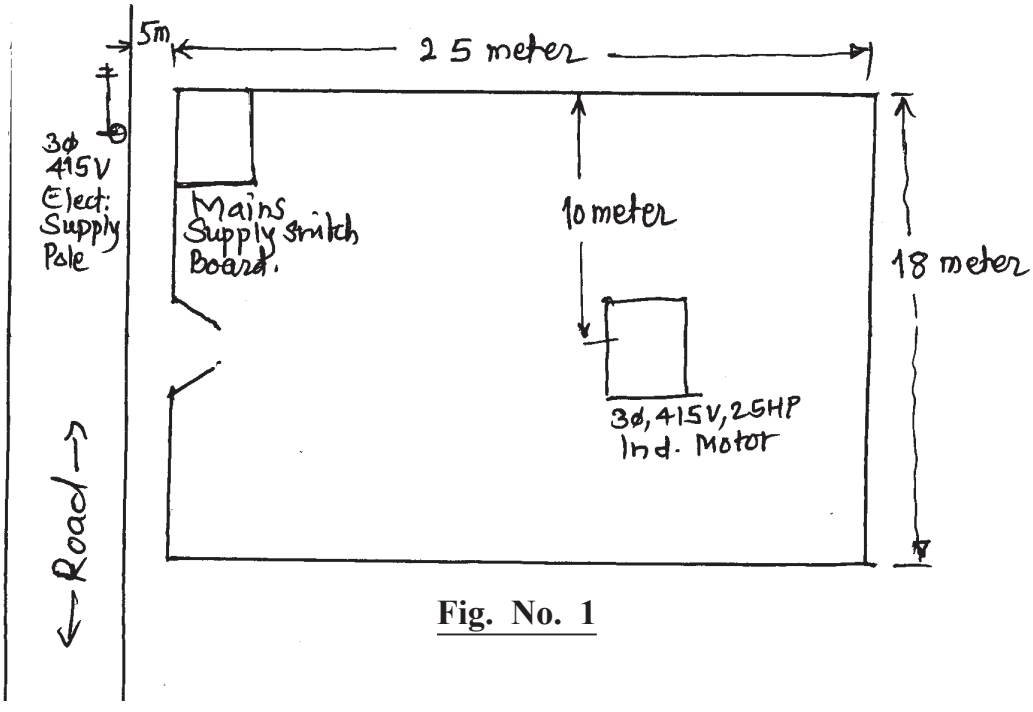

Fig. No. 1

c) Explain with suitable example selection procedure of power cables in HT - distribution including their termination of cables in underground cabling.

d) Draw single line diagram for LT substation.

e) Describe design considerations for street light estimation, prepare their list of material required.

Marks

5. Attempt any TWO of the following: **12**

a) Explain criteria for selection of starter for motor. Draw wiring diagram for λ/Δ starter with motor and main switch.

b) Explain earthing provision using suitable neat sketch for HT/LT distribution lines installation.

c) Prepare estimation of material required for public street lighting installation typically any one of the following

i) Market

ii) Garden

iii) Temple

iv) Institute

(Consider no. of lighting poles = 10 Nos.) (Total load 10 KW)

6. Attempt any TWO of the following: **12**

a) Prepare estimation of material required for Auditorium (Commercial complex) having lighting circuits of 40 Nos., Power circuits = 20 Nos. and three phase induction motors - 1 HP - 5 Nos., 3 HP - 2 Nos., 10 HP - 2 Nos.

b) Explain design considerations like lumens required type of luminaries, layout of roads standards for public-street light electrical installation.

c) Explain with suitable example quotation, format, tender, comparative statement format and order format in briefly.

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22627

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answer with neat sketches wherever necessary.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Draw the symbol for –

i) Earthing

ii) Fuse

b) Define the terms with reference to I.S.

i) Circuit diagram

ii) Wiring diagram

c) Compare residential and industrial installation on any two points.

d) State the classification of cable on voltage levels.

e) Define terms :–

i) Tilt Angle

ii) Light output ratio (LOR).

f) State any four qualities of good contractor.

g) State the types of service connection.

Marks

2. Attempt any THREE of the following: **12**

a) Draw the wiring diagram and single line diagram for control of two fan and two lamp by individual switches.

b) Explain the procedure of estimation of electrical wiring of residential installation with suitable example.

c) A residential unit is newly constructed having following load –

i) 7 lamp of 30 w

ii) 5 ceiling fan 65 w

iii) 5 socket of 6 Amp having 200 watt

iv) 1 socket of 16 Amp having 2 kw.

Calculate :–

(1) Total light load

(2) Total power load

(3) Size of conductor

(4) Number of sub circuit.

d) What are the different types of wiring system? State suitable application for each.

3. Attempt any THREE of the following: **12**

a) State methods of opening of tender and explain any one method.

b) How insulation resistance is tested between conductor?

c) Draw single line and wiring diagram of 3 phase, 415 V, 5 HP induction motor installation.

d) List the material required for overhead service connection.

Marks

4. Attempt any THREE of the following: **12**

a) Explain the general requirement of electrical installation as per I.S. 732-1982.

b) Prepare the schedule of material for industrial load as per Figure No. 1.

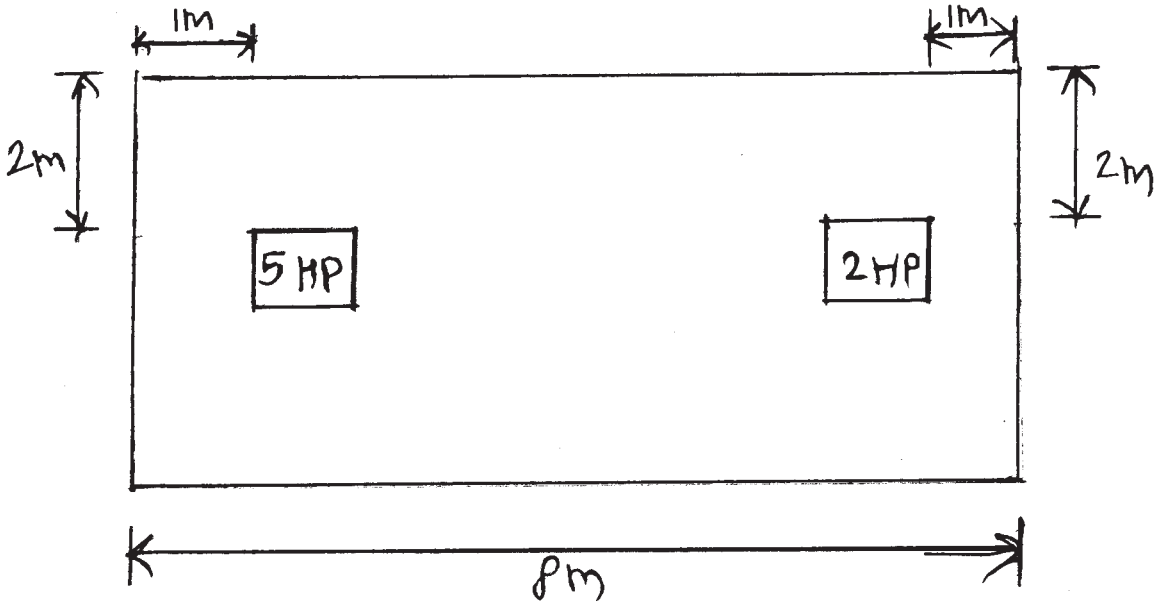

Fig. No. 1

c) List out the material use for H.T. 11 kV and L.T. 415 V overhead line.

d) Draw the single line diagram of L.T. substation (415 V).

e) Explain the following terms regarding street lighting –

i) Glare

ii) Uniformity Ratio

iii) Contrast

iv) Visual comfort.

Marks

5. Attempt any TWO of the following: **12**

a) In a workshop, one 15 HP 400 Volts, three phase 50 Hz motor is to be installed. Prepare the estimate of quantity of material required and its cost with a layout of the wiring. The plan of the workshop is shown in Figure No. 2.

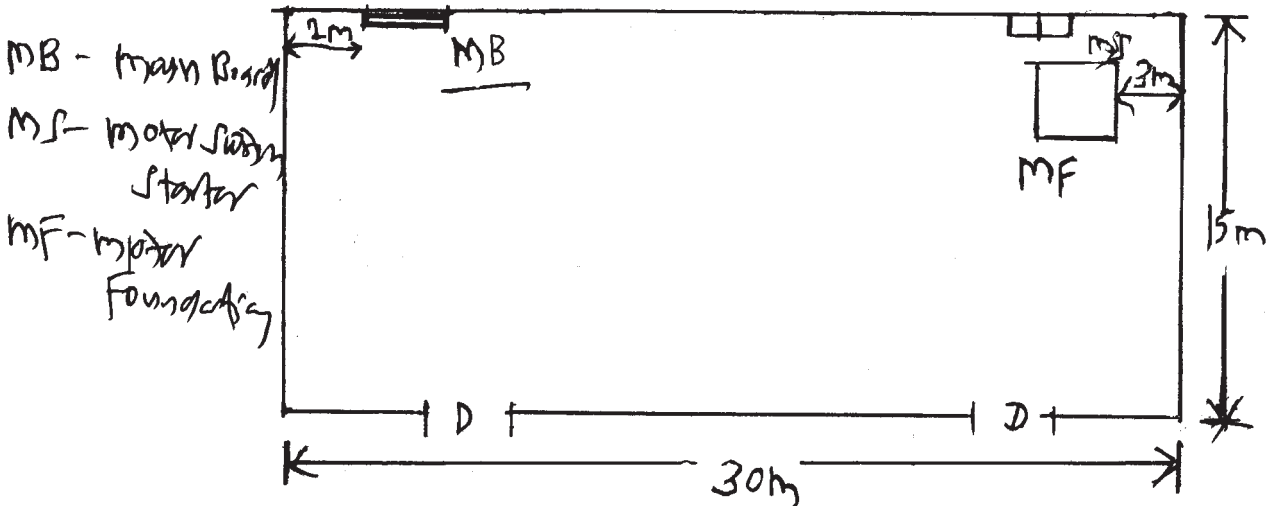

Fig. No. 2

b) Estimate the mash material required for a 750 m, 415/240 V three phase line with four wire in vertical configuration. The line emanate from substation to feed a load of 30 kW. Take the span between two poles as 50 m. The size of conductor is ACSR 6/1 × 2.599 mp.

Plan of overhead line is in Figure No. 3.

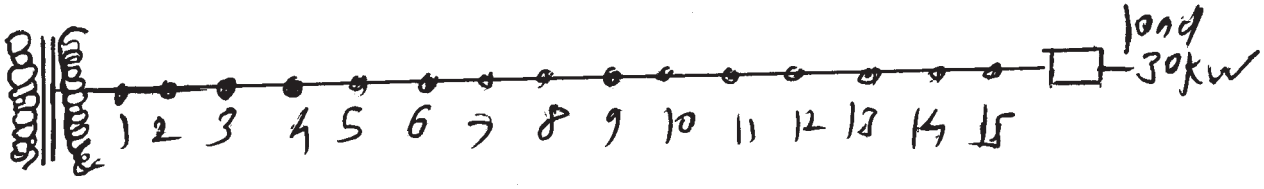

Fig. No. 3

c) Prepare the list of material and device for public lighting installation.

Marks

6. Attempt any TWO of the following: **12**

a) Prepare the contract document for material supply for 11 kV substation installation.

b) i) Explain the characteristic of –

(1) Incandescent lamp

(2) Florescent lamp

(3) High pressure sodium vapour lamp.

ii) State the objectives of outdoor (Exterior) lighting.

c) Figure No. 4 shows the plan of a small flat. The flat is to be provided with electrical connections. The position of light and fan points and switch boards have been shown in the Figure No. 4.

i) Decide the number of sub circuit and show these in the installation plan.

ii) Calculate the size and length of wire required for wiring installation.

iii) Estimate the quantity of material, its cost and labour cost for teak wood batten wiring system.

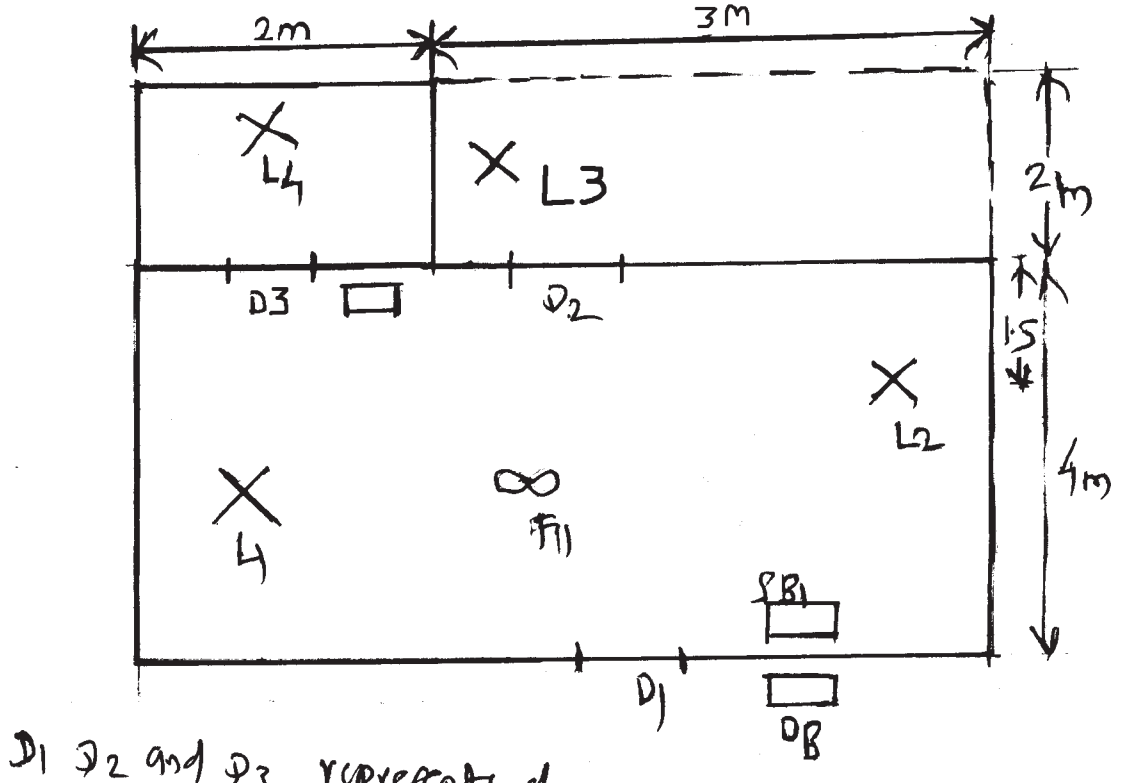

Fig. No. 4

22633

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the typical earth resistance values of 11, 33, 132 and 400 kV substation.

(b) State the need of pole mounted distribution substation.

(c) Illustrate the function of isolator switch.

(d) List out any four protective devices needed in 132/33 kV substation.

(e) List the precaution taken while carrying out routine maintenance of batteries in substation.

(f) State the need of gas insulated substation.

(g) Why SF6 gas is used as an electrical insulating medium in Gas Insulated substation ?

2. Attempt any THREE of the following : **12**

(a) Explain any four general safety rules to be followed to minimize the risk of electrical hazards in substation.

(b) Describe the procedure to measure insulation resistance for pole mounted substation.

(c) Distinguish between System Earthing and Equipment Earthing.

(d) Explain working and need of Capacitor Voltage Transformer (CVT) with neat sketch.

3. Attempt any THREE of the following : **12**

(a) Explain the factors governing the selection of site for the substation.

(b) State the function and rating of

(i) 3 phase distribution transformer

(ii) Lightning Arrester

(iii) Bus bar

(iv) DO fuse for 11 kV substation

(c) Draw schematic (single line) diagram of a 33 kV/11 kV substation and enlist any eight equipments of it.

(d) Explain with neat sketch functioning of (i) Wave trap (ii) PLCC.

4. Attempt any THREE of the following : **12**

(a) Describe the construction and working of swing out (Drop out) fuse.

(b) Explain any four methods of improving earth resistance.

(c) Describe the procedure followed to undertake breakdown maintenance of dry type power transformer.

(d) List precaution to be taken while carrying out preventive maintenance of Gas Insulated Substation.

(e) Define partial discharge and explain its effect on performance of GIS.

5. Attempt any TWO of the following : **12**

(a) Prepare a schedule to carry out the routine, preventive & Breakdown maintenance of 11 kV pole mounted substation.

(b) With neat labelled diagram, illustrate standard procedure to be carried out of Break Down Voltage (BDV) test on power transformer oil.

(c) Solve the following :

(i) Differentiate between mat earthing and plate earthing

(ii) List the merits of mast protection.

6. Attempt any TWO of the following : **12**

(a) Explain the Fire-fighting equipment used for the different situation in the 33 kV/11 kV substation.

(b) Describe the causes of hot spot formation in transformer and state the methods of identification.

(c) Draw single line diagram of 132 kV GIS substation and write advantages and disadvantages of GIS over conventional substation.

22633

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Classify substations based on constructional features.

(b) Write any four advantages of neutral grounding.

(c) State function of CT and PT in 33/11 kV substation.

(d) Write any four needs of 132 kV/33 kV substation.

(e) Suggest the suitable method of neutral grounding in 132 kV/33 kV substation with its any two specific reasons.

(f) Enlist any four advantages of Gas Insulated Substation (GIS).

(g) Illustrate application of high speed Earthing Switch in Gas Insulated Substation (GIS).

2. Attempt any THREE of the following : **12**

(a) Draw symbols of Relay, Bus-bar, CT and PT used in single line diagram.

(b) Draw the layout of a pole mounted 11 kV/400 V substation and enlist any eight equipments of it.

(c) List out any eight routine maintenance activities in 33 kV/11 kV substation.

(d) Illustrate any eight reasons of major fire risks within 132 kV/33 kV substation.

3. Attempt any THREE of the following : **12**

(a) State purpose of circuit breaker, isolator and earthling switch. Explain their operational co-ordination in substation.

(b) Draw and explain working diagram of Earth Tester.

(c) Draw schematic (single line) diagram of a 33 kV/11 kV substation and enlist any eight equipments of it.

(d) Define the terms Touch Potential, Step Potential, Mesh Potential and Transferred Potential in associated with substation.

4. Attempt any THREE of the following : **12**

(a) State the function and rating of

(i) AB switch

(ii) CT

(iii) PT

(iv) DO for 11 kV substation

(b) Enlist any eight routine tests to be carried out on 11 kV / 400 V distribution transformer.

(c) Illustrate standard procedure to be carried out of Break Down Voltage (BDV) test on power transformer oil.

(d) Explain operation of circuit breaker and disconnecting switch in Gas Insulated Substation (GIS).

(e) Distinguish between Air Insulated Substation (AIS) and Gas Insulated Substation (GIS).

5. Attempt any TWO of the following : **12**

(a) Write any six precautions to be taken while maintaining 11 kV/400 V distribution transformer.

(b) Suggest any six preventive maintenance activities for

(i) Circuit breaker

(ii) Isolator in 33 kV substation

(c) Explain with neat sketch functioning of

(i) Wave trap

(ii) PLCC

6. Attempt any TWO of the following : **12**

(a) Illustrate need of (i) Station Transformer (ii) Battery charging unit and (iii) Capacitor bank in a 33 kV/11 kV substation.

(b) Draw and explain single line diagram of 132 kV/33 kV substation indicating major equipments.

(c) Illustrate visual, minor and major maintenance plan of Gas Insulated Substation (GIS).

22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Figures to the right indicate full marks.

(4) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the value of Earth Resistance as per IE Rule for :

(1) 11 kV substation (small)

(2) Powerstation (32, 220 kV)

(b) State the need of 33/11 kV substation.

(c) List any two safety rules followed during breakdown maintenance on 11 kV sub-station.

(d) State any one type of battery trouble, its cause, maintenance, remedy to be taken.

(e) State the type of LA used for 132 kV / 33 kV sub-station. Give its rating.

(f) Name the material used in a firefighting equipment for GIS.

(g) List any two properties of the SF_6 gas used in GIS.

2. Attempt any THREE of the following : **12**

(a) Explain any four factors to decide the selection of site for the sub-station.

(b) Draw a neat sketch of 11 kV/400 V, 250 kVA pole mounted sub-station. State function of each part.

(c) Describe the procedure to locate and record the hot spots in a 132 kV/33 kV sub-station.

(d) Compare equipment earthing and system earthing on any four points.

3. Attempt any THREE of the following : **12**

(a) List any four safety rules to be followed while working in a sub-station.

(b) With a neat sketch explain any one method to measure insulation resistance in 11 kV substation.

(c) Explain any four firefighting equipment used in a 33 kV sub-station.

(d) Illustrate with relevant figures the following :

(i) Touch potential

(ii) Make potential

(iii) Transfer potential

4. Attempt any THREE of the following : **12**

(a) Explain the procedure to be followed for shut down of 11 kV substation and power lines.

(b) State the purpose and location of following in 33 kV/11 kV sub-station – (i) Capacitor bank (ii) Relay panel (iii) Battery charging unit (iv) SCADA

(c) Explain partial discharge & describe the method of monitoring it.

(d) Explain maintenance schedule of GIS substation.

(e) Sketch the following layout Diagrams in 11 kV substation

(1) Floor mounted

(2) Pole mounted

5. Attempt any TWO of the following : **12**

(a) Prepare a tabular form to show maintenance schedule of a power transformer above 1000 kVA capacity.

(b) Give rating and type of following components used in pole mounted sub-station of your institute campus.

3ϕ transformer, CT, PT, LA, DO, CB

(c) Illustrate with a neat sketch the Dielectric test cell with proper explanation.

6. Attempt any TWO of the following : **12**

(a) Explain Partial-discharge phenomenon in detail.

(b) Describe the following used in 33 kV substation

(1) Capacitor bank

(2) CB and voltage transformer

(c) State the function of the following in 132 kV/33 kV sub-station CVT, HT fuse, Wave trap, PLCC, Insulator, Isolator.

22629

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the need of electric drives.

(b) Draw block diagram of the basic elements of electric drives.

(c) List the advantages of converter controlled drives.

(d) Draw the circuit diagram of single phase half wave controlled converter drive.

(e) Draw the circuit diagram of rotor resistance control method of Induction motor.

(f) State the advantages of microcontroller based system over electronic speed control systems.

(g) State the functions of microprocessor in drives.

2. Attempt any THREE of the following : **12**

(a) Describe the four quadrant operation of a hoist with speed torque characteristics.

(b) Compare single phase and three phase full converter drives (Any four points).

(c) State the role of drives in sugar mills.

(d) Draw labelled block diagram of Phase Lock Loop (PLL) control DC motor drive. State the function of each block.

3. Attempt any THREE of the following : **12**

(a) Draw speed torque characteristics of Induction motor showing all regions.

(b) Draw the circuit diagram of single phase dual converter drive and explain its operation.

(c) Compare Class A and Class B chopper drive (Any four points).

(d) Describe the working of V/F control method for speed control of Induction motor with neat block diagram.

4. Attempt any THREE of the following : **12**

(a) Identify type of Chopper for forward motoring and forward braking of DC motor. Justify your answer with neat sketch.

(b) State the sequence of stages involved in Textile mill and the types of drive used for it.

(c) Describe with diagram the operation of centrifugal solar powered pump drives.

(d) Draw and explain microprocessor based control of synchronous motor drives.

(e) Draw the block diagram of microprocessor based control of DC motor.

5. Attempt any TWO of the following : **12**

(a) A separately excited dc motor is fed from 230 V, 50 Hz supply via a 1ϕ half controlled bridge rectifier. Armature parameters are L = 0.06 H, R = 0.3 Ω, Ka = 0.9 V/A rad/s and Rf = 104Ω. The field current is also controlled by a semiconvertor and is set to a maximum possible value. T_L = 50 N-m at 800 rpm. The inductances of armatures and field circuits are sufficient enough to make the armature and field currents continuous and ripple free. Compute :

(i) Field current I_f ,

(ii) Firing angle of the converter in the armature circuit

(b) Draw and describe four Quadrant Chopper Drive.

(c) State the rating and specification of stepper motor. If there are 4 pairs of stator phases and 6 teeth on rotor, calculate step angle.

6. Attempt any TWO of the following : **12**

(a) Draw the circuit diagram and waveforms of 3ϕ semiconverter drive. State the equation of average armature voltage.

(b) Classify choppers based on quadrant of operation with neat diagram and waveform, explain the operation of basic chopper circuit using SCR.

(c) Compare between the stator voltage control, constant V/F control and rotor resistance control (Any four points).

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22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the types of electric drives.

(b) Draw the basic block diagram of electric drive.

(c) Draw a neat circuit diagram of single phase semi converter.

(d) State the types of SCR controlled drives.

(e) List out any four applications of electric drives.

(f) Write any four specifications of stepper motor.

(g) State any four advantages of microprocessor based drives.

2. Attempt any THREE of the following : **12**

(a) List out the selection criteria of electric drives.

(b) Describe the operation of single phase full wave converter with a neat circuit diagram.

(c) Draw a neat circuit diagram of class B chopper and give its operation with waveforms.

(d) Explain stator voltage control method of 3ϕ induction motor with a neat diagram.

3. Attempt any THREE of the following : **12**

(a) List the duty class of motor and describe continuous duty class.

(b) Compare semi-converter drives and full converter drives on the basis of

(i) Quadrant operation

(ii) Regenerative braking

(iii) Power flow

(iv) Harmonic contents

(c) Draw a neat circuit diagram of basic chopper circuit using SCR and explain.

(d) Describe the operation of rotor resistance control method of 3ϕ induction motor with a neat diagram.

4. Attempt any THREE of the following : **12**

(a) Describe the operation of class D chopper and explain with waveforms.

(b) Compare DC and AC drives.

(c) Describe the working of constant $\left(\frac{v}{f}\right)$ control of 3ϕ induction motor with a neat diagram.

(d) Draw labelled block diagram of Phase Locked Loop (PLL) control of DC motor drive. State the function of each block.

(e) Draw the block diagram of synchronous motor drive and state the function of each block.

5. Attempt any TWO of the following : **12**

(a) A single phase full converter fed from 230 V, 50 Hz supply provides a variable voltage supply to the armature of a separately excited DC motor. The specification of motor are 10 HP, 230 V, 1200 rpm, Ra = 0.25 Ω. Rated motor current is 40 A and motor voltage constant, Ka. ϕ = 0.182 V/rpm. The firing angle is 30°. For the rated motor current, calculate ;

(i) Motor torque

(ii) Speed of the motor

(b) Draw and describe class E chopper drive.

(c) Describe the operation of stepper motor drives employing microcontroller with a neat diagram.

6. Attempt any TWO of the following : **12**

(a) Draw a circuit diagram of 1ϕ dual converter and describe its operation with quadrant diagram.

(b) Explain with sketches the operation of chopper controlled dc drive in solar and battery operated vehicles.

(c) State the stages involved in textile mills and types of drives used for it.

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) State the need of electric drive.

(b) Draw speed-torque characteristic of DC motors.

(c) Compare Single phase SCR drives and Three phase SCR drives with any two performance parameters.

(d) Draw circuit diagram of single phase semi-converter drive.

(e) List different speed control methods used for three phase induction motors.

(f) State the ratings & specifications of stepper motor drive.

(g) State the selection criteria of microcontroller for electric drives.

2. Attempt any THREE of the following : **12**

(a) Explain the block diagram of basic elements of electric drives.

(b) Compare half wave converter drive & full wave converter drive with four factors / points.

(c) Draw and describe class B chopper drive.

(d) With neat diagram explain stator voltage control method using thyristor circuit of three phase induction motor.

3. Attempt any THREE of the following : **12**

(a) State the selection criteria for the given type of electric drive.

(b) Draw the circuit of a three phase full converter drive. Draw the output waveform for voltage & current.

(c) Draw and describe class A chopper drive.

(d) Which type of drives are suitable for steel rolling mill ? Justify your answer.

4. Attempt any THREE of the following : **12**

(a) Explain the operation of basic chopper circuit using SCR.

(b) Which type of drives are used in sugar mill ? Explain with different stages.

(c) With neat diagram explain the operation of roto resistance control using chopper for speed control method of AC motors.

(d) With neat diagram explain the operation of stepper motor drive employing microcontroller.

(e) Describe microprocessor based speed control method used for DC motor with neat diagram.

5. Attempt any TWO of the following : **12**

(a) Draw the circuit diagram of single phase dual converter using SCR and describe its operation with waveforms.

(b) Draw and describe four quadrant operation of chopper drive with waveforms.

(c) State any two advantages of microcontroller based drive. Draw labelled block diagram of Phase Lock Loop (PLL) control DC motor drive and state function of each block.

6. Attempt any TWO of the following : **12**

(a) Compare stator voltage control, constant V/F control and rotor resistance control. (Any 4 points)

(b) Explain with diagram/sketch the operation of chopper controlled D.C. drive in solar and battery powered vehicles.

(c) The single phase dual converter operated from 230-V, 50 Hz supply and the load resistance is R = 10 Ω. The circulating inductance is $L\gamma$ = 40 mH; delay angle is $\alpha_1 = 60°$. Calculate the peak circulating current and the peak current, I_P of this converter circuit.

22625

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

a) List out any four precautions to be taken to avoid fire caused by Electrical reason.

b) State the concept of predictive maintenance.

c) Define the following terms in connection with safety.

i) Hazard

ii) Accident

d) State the meaning of special test. Give one example of special test.

e) List the different methods of drying of insulation.

f) List out the routine tests to be carried out on transformer as per IS-2026. (any four)

g) State the use of following.

i) Bearing puller

ii) Growler

P.T.O.

Marks

2. Attempt any THREE of the following : **12**

a) Differentiate between Equipment Earthing and Neutral Earthing.

b) Explain moisture proofness test conducted on single phase Induction motor.

c) List any four External causes for abnormal operation of electrical equipment.

d) List the eight agents which contaminates the insulating oil.

3. Attempt any THREE of the following : **12**

a) Distinguish between routine and break down maintenance of electrical equipment.

b) Explain with neat diagram impulse test on a power transformer.

c) List out Do's and Don'ts to achieve safety for electrical supervisor while working in substation (any four points).

d) Describe the factors affecting the preventive maintenance schedule.

4. Attempt any TWO of the following : **12**

a) With the help of neat diagram, explain phasing out test to be carried on transformer.

b) State factors involved in designing a rotating machine foundation.

c) Prepare trouble shooting chart of three phase induction motor for any three faults.

5. Attempt any TWO of the following : **12**

a) Explain with neat circuit diagram back to back test on single phase transformer to determine efficiency and regulation.

b) Draw and explain the circuit diagram to perform no load and Blocked Rotor test on three phase Induction Motor.

c) Draw and explain vacuum impregnation method of varnishing.

Marks

6. Attempt any THREE of the following : **12**

a) Explain the sequence to be followed in operating any one type of fire extinguisher.

b) Enlist routine test and type test performed on three phase alternator.

c) Distinguish between O.C. test and S.C test performed on Transformer (any four points).

d) Describe the procedure for conducting polarity test of a single phase transformer with the necessary circuit diagram.

e) Give different factors affecting the life of insulating materials.

22625

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) List out any four factors influencing severity of electric shock.

b) Define : Routine and Preventive maintenance

c) Explain predictive maintenance.

d) List any two advantages of indirect testing of electrical machine.

e) Name any four contaminating agents of transformer oil.

f) State use of following maintenance tools:

i) Bearing puller

ii) Growler

g) List different methods of cleaning of insulation.

Marks

2. Attempt any THREE of the following: **12**

a) State types of fire extinguishers with one application of each of them.

b) Write any four electrical and magnetic fault that occur in electrical equipment.

c) Explain the need to conduct reduced voltage running up test on three phase induction motor with neat diagram.

d) State the requirements of foundation of a transformer installation.

3. Attempt any THREE of the following: **12**

a) Compare installation earthing and neutral earthing on any four points.

b) List any eight factors that affect preventive maintenance schedule.

c) Explain with diagrams the synchronous impedance method of finding voltage regulation test on 3 ph alternator.

d) Prepare trouble shooting chart for 3 ph transformer with possible reasons and remedies for following troubles:

i) No output voltage

ii) Overheating of oil

4. Attempt any THREE of the following: **12**

a) State the procedure to rescue a victim who has received an electric shock.

b) Explain the steps involved to conduct no load test and blocked rotor test on 3ph induction motor with neat circuit diagram.

c) Explain with neat circuit diagram high voltage test conducted on a distribution transformer.

d) Explain dielectric strength test and flash point test on transformer oil with neat diagram.

e) i) State the conditions to conduct back to back test on 3 ph transformer.

ii) List all the parameters that are obtained from back to back test.

Marks

5. Attempt any TWO of the following: **12**

a) Draw a neat diagram of foundation for rotating machine and label it.

b) Explain the steps to conduct winding resistance test on 3-phase distribution transformer with neat connection diagram.

c) Prepare preventive maintenance schedule for 3-ph induction motor.

6. Attempt any TWO of the following: **12**

a) Explain the procedure to test electrical machine by direct testing with neat circuit diagram. Write any two merits and de-merits of it.

b) Explain with diagram steps to determine temperature rise test on power transformer by open delta method.

c) i) State need of drying of electrical equipment.

ii) Explain any one method of drying of electrical equipment with neat diagram.

22625

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

a) Classify electrical equipments with regard to protection against electric shock.

b) Explain the term routine maintenance in brief.

c) State any two advantages of preventive maintenance.

d) Explain routine test for measurement of DC resistance of winding in Induction Motor.

e) List out any four contaminating agents of insulating oil.

f) List out the different methods of testing of electrical machines.

g) State the factors affecting life of insulation.

Marks

2. Attempt any THREE of the following : **12**

a) Describe any one method of providing Artificial Respiration.

b) State internal and external causes for failure of equipments. (Four points under each type)

c) With a neat diagram, explain the procedure for blocked rotor test of a single phase induction motor.

d) State the requirements for static machine foundations.

3. Attempt any THREE of the following : **12**

a) State any six precautions to be taken to avoid fire due to Electrical reasons.

b) Write down the factors affecting preventive maintenance schedule and explain them in brief. (any four points)

c) List out any four tools used in maintenance of electrical machines. Also write their function.

d) Explain the meaning and cause for -

i) Mechanical fault

ii) Electrical fault

iii) Magnetic fault

4. Attempt any THREE of the following : **12**

a) List out any four dos and don'ts for electrical supervisors.

b) Explain with diagrams the synchronous impedance method of finding regulation of alternator.

c) Describe with neat diagram, the impulse test on power transformer.

d) State and explain any four important properties of transformer oil.

e) State the meaning of phasing out test ? When is it required ? Explain the method of carrying out this test in brief.

Marks

5. Attempt any TWO of the following : **12**

a) Describe no load test of three phase induction motor with a neat diagram.

b) Prepare Trouble shooting chart for three phase transformer.

c) Write down maintenance schedule of distribution transformer as per ISS10028 – 1981

6. Attempt any TWO of the following : **12**

a) Prepare Trouble shooting chart for 3 phase slip ring induction motor.

b) With a neat diagram explain the procedure to conduct Back-to-Back method on two single phase transformers to find its efficiency.

c) Describe vacuum impregnation method of varnishing with its neat diagram.

22632

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE of the following : **10**

(a) List out any two causes of reactive power imbalance in power system.

(b) Name any two advantages of reactive power compensation in transmission line.

(c) Define : Load flow studies refer to power system operation.

(d) Define the term : SLFE.

(e) Write the condition of power system stability limit.

(f) State the significance of load forecasting in power system.

(g) Define overall stability and dynamic stability.

2. Attempt any THREE of the following : **12**

(a) Explain the need of constant frequency supply for consumers.

(b) Draw the block diagram of Automatic Generation Control (AGC) for generating system.

(c) List out steps in developing static load flow equation – $I_{bus} = Y_{bus} V_{bus}$ for a simple two bus system.

(d) Categorize the data required for load flow studies for following :

(i) Transmission Line

(ii) Transformer

(iii) Bus

(iv) Load

3. Attempt any THREE of the following : **12**

(a) Draw a labelled schematic diagram of Automatic Voltage Control (AVC) used for an alternator.

(b) Explain the functioning of Automatic Load Frequency Control (ALFC) with a labelled schematic diagram.

(c) Identify the significance of load flow analysis for power system.

(d) Differentiate between 'Large Disturbance' and 'Small Disturbance' in power system stability.

4. Attempt any THREE of the following : **12**

(a) Identify the information obtained from load flow studies in power system operation.

(b) List out significant features of Y-bus matrix.

(c) Explain steady state stability of the power system.

(d) Describe any four methods of improving transient state stability of the power system.

(e) State the types of Load Dispatch Centre (LDC) and their locations w.r.t. Indian Power System.

5. Attempt any TWO of the following : **12**

(a) Explain the shunt compensation and series compensation method of reactive power compensation for transmission line.

(b) Describe the working of Turbine Speed Governing System for turbo generator speed control with a labelled schematic diagram.

(c) Explain the adverse effects of power system instability on consumers and utilities.

6. Attempt any TWO of the following : **12**

(a) Describe the functioning of state load dispatch centre in Indian Power System.

(b) Explain any six governing factors with reference to load shedding.

(c) Develop bus admittance matrix for the power system with following data :

Bus Code p-q	**Line Impedance in P.U. Z_{pq}**	**Line charging Admittance in P.U. $Y_{pq/z}$**
1-2	0.09 + j0.32	j0.01
2-3	0.04 + j0.062	j0.03
1-3	0.05 + j0.08	j0.02

22232

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **10**

(a) List out any two causes of Reactive power imbalance in power system.

(b) Suggest type of Reactive power compensation equipment for Load and Line.

(c) State the data required for load flow studies w.r.t. transmission line.

(d) List the information obtained from load flow studies (any two).

(e) State the adverse effects of instability of power system on consumers (any two).

(f) State the various types of stability.

(g) List any two functions of load dispatch center in general.

2. Attempt any THREE of the following : **12**

(a) Explain the relation between Real power flow and frequency.

(b) Explain with schematic diagram; the Automatic Load Frequency Control (ALFC) & its functioning.

(c) Explain the concept of load flow studies and its need.

(d) Develop the following static load flow equation (SLFE) for a simple two bus system

$$I_{bus} = Y_{bus} V_{bus}$$

3. Attempt any THREE of the following : **12**

(a) Draw neat and labelled diagram of Automatic Voltage Control System.

(b) Explain the importance of ALFC and AGC in operation of power system.

(c) Determine the Y_{bus} admittance matrix for the power system with following details.

Bus i – k	**Z line in PU Z_{ik}**	**Charging admittance in PU $Y_{ij/z}$**
1 – 2	0.2 + j 0.85	j 0.02
2 – 3	0.3 + j 0.88	j 0.03
1 – 3	0.25 + j 1.15	j 0.04

(d) Differentiate large disturbance and small disturbance in a power system (4 points).

4. Attempt any THREE of the following : **12**

(a) Interpret the characteristics of the SLFE for simple two bus power system.

(b) State static load flow equation for a two bus system and define it's parameter.

(c) Explain any two methods that can be adopted for the improvement of Trasient stability condition of a power system.

(d) Differentiate between 'Power System Stability', 'Power System Instability'; 'Stability Limit' and 'Overall Stability'.

(e) List out the factors that governs load shedding refer to power system operation.

5. Attempt any TWO of the following : **12**

(a) Derive the equation to prove that the voltage drop across the transmission line is mainly due to Reactive power flow.

(b) Draw a neat labelled diagram of Turbine speed governing system and explain it's functioning.

(c) Explain steady state stability conditions with the help of power angle diagram for the power system.

6. Attempt any TWO of the following : **12**

(a) Determine Y_{BUS} for the 3-bus system shown in fig. 6(a).

Neglect the shunt capacitances of the lines and assume zero charging admittances.

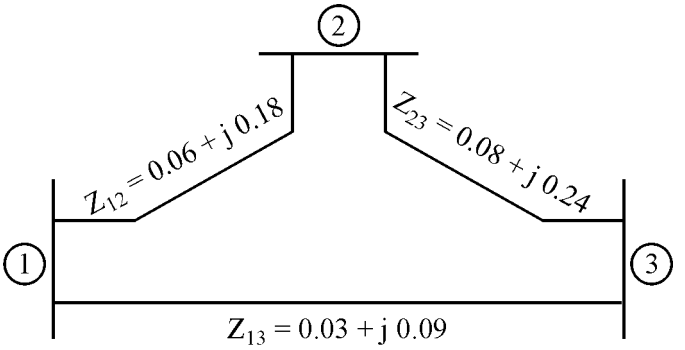

fig. 6(a)

(b) Explain load forecasting based on load curve.

(c) Explain Environmental and Social factors related to load forecasting.

22632

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE : **10**

(a) State any two adverse impacts of frequency variation on supply agencies.

(b) Suggest type of reactive power compensations equipments for the transmission line of a power system.

(c) Define load flow studies referred to power system operation.

(d) State the data required for load flow studies.

(e) Define steady state stability & transient state stability.

(f) Differentiate large disturbance and small disturbance in power system. (any two points)

(g) State the location of central load dispatch centre and its backup center in India.

2. Attempt any THREE : **12**

(a) Explain the effect of change in voltage on consumer side.

(b) Draw schematic diagram of turbine speed governing system and label it.

(c) State the characteristics of Y_{Bus} matrix.

(d) Write SLFE of a simple two bus power system and define its parameters.

3. Attempt any THREE : **12**

(a) State the functions of following systems referred to AGC & ALFC :

(i) Hydraulic amplifier

(ii) Frequency integrator

(iii) Governor

(iv) Comparator

(b) Draw the block diagram of Automatic voltage control and label it.

(c) Identify the significance of Load Flow Analysis for the power system.

(d) Prepare the list of adverse effects of instability of power system at consumer terminals.

4. Attempt any THREE : **12**

(a) State the importance of 'bus' in power system.

(b) List the data required for load flow studies with reference to transformers & transmission lines.

(c) Draw and explain power angle diagram neglecting losses in the system.

(d) Write 'Swing Equation' referred to power system and define it's parameters.

(e) Illustrate significance of load forecasting in power system operation.

5. Attempt any TWO : **12**

(a) Derive the relation between voltage and reactive power flow in the simple two bus power system.

(b) Describe the functioning of the Automatic Load Frequency Control using block diagram for the given type of generator.

(c) List out traditional and new methods of improving transient stability in a power system. Also explain any one traditional technique among them.

6. Attempt any TWO : **12**

(a) Enlist any six factors which govern the load shedding in power system.

(b) Describe the functions of state load dispatch centre & regional load dispatch centre referred to Indian power system scenario.

(c) Develop Y_{Bus} matrix for a 3 bus system with the following details :

Bus Code	**Line Impedance (Pu)**	**Bus code**	**Line Charging admittance (Pu)**
1-2	0.08 + j 0.32	1	j 0.02
2-3	0.06 + j 0.82	2	j 0.01
1-3	0.05 + j 0.06	3	j 0.03

22626

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define the following terms –

(i) Solid angle

(ii) Waste light factor

b) State the various types of reflectors used in industrial lighting fittings.

c) State the classification of electric heating.

d) Enlist the various types of electric drives used in Industry.

e) Draw the speed - time characterstics of suburban services.

f) State the various devices used for power factor improvement.

g) Suggest the type of tariff for -

(i) Domestic consumer

(ii) HT Industrial consumer

P.T.O.

Marks

2. Attempt any THREE of the following: **12**

a) Compare fluorescent lamp and LED lamp on the basis of quality of light; lamp efficiency; Life of lamp and voltage regulation.

b) Explain with neat sketch; the working principle of Dielelctric heating.

c) Recommend relevant motor for the following application with justification.

(i) Rolling mill drives

(ii) Air compressor

d) Draw the block diagram of 25 KV; 1ϕ; 50 Hz A.C. locomotive used for traction system. State the function of each part.

3. Attempt any THREE of the following: **12**

a) A small assembly shop of 16 m long, 10 m wide and 3 m upto trusses is to be illuminated to a level of 200 Lux. The utilization and maintenance factors are 0.74 and 0.8 respectively. Calculate the no. of lamps required to illuminate the whole area if the lumen output of lamp selected is 3000 lumens.

b) Describe with neat sketch; the working principle of spot welding and state its application.

c) Explain with neat sketch, Rheostatic braking for D.C. series motor.

d) An industry has a maximum demand of 200 kW at a power factor of 0.8 lagging and is charged at Rs. 720 per kVA per Annum. If the phase advancing equipment costs Rs. 1200 per KVAR. Determine the most economical power factor at which the industry should operate. Interest and depreciation total 10% of capital investment on the phase advancing equipment.

Marks

4. Attempt any THREE of the following: **12**

a) Explain with neat sketch; the construction and operation of indirect arc furnace.

b) A motor used for mines has following type of Duty cycle :-

(i) Power demand increases from zero to 100 H.P. in 4 minutes.

(ii) Constant running for 50 H.P. for 6 minutes.

(iii) Remains at rest for another 5 minutes.

Estimate the size of motor.

c) Explain with neat sketch; the construction and working of pantograph collector ?

d) Compare D.C. and A.C. system of Railway electrication from the point of main line and suburban line railway service.

e) It is desired that the correct power factor of 0.95 by means of static condensors is connected to each phase of a 3-phase, 400 volt, 50 Hz motor having a maximum load of 50 kVA at a P.f. of 0.75. Determine the capacity of each delta connected condensor.

5. Attempt any TWO of the following: **12**

a) A 20 kW single phase 220 V resistance oven has Nichrome wire heating elements. The wire is designed for maximum temperature of 1150°C and temperature of charge to be 600°C. If radiating efficiency is 0.55; Emissivity is 0.9 and specific resistance is 1.09×10^{-6} ohm-m. Estimate the diameter and length of wire.

b) Enumerate the factors governing selection of Electric drives for a particular service / application.

c) An electric train is to have acceleration and braking retardation of 1.2 Km/hr/sec and 4.8 Km/hr/sec respectively. If the ratio of maximum to average speed is 1.6 and time for stops 35 seconds. Find schedule speed for a run of 3 Km. Assume simplified trapezoidal speed-time curve.

Marks

6. Attempt any TWO of the following: **12**

a) Compare resistance welding and arc welding on the basis of –

(i) Supply requirement

(ii) Voltage

(iii) Power factor

(iv) Additional material requirement

(v) External pressure

(vi) Temperature

b) Select the type of enclosures for the electric drives used in following places with justification.

(i) Drives used in petroleum station / chemical plants.

(ii) Electric drives used in damp situation

(iii) Electric drives used in coal handling plants.

c) Draw speed-time curve and label its various parts for the following services.

(i) main line service

(ii) urban line service

and describe the main features of above train services.

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22626

22223

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) Define the following terms related to illumination

i) Luminous intensity

ii) LUX

b) State Lambert's Cosine law of illumination

c) List modes of heat transfer.

d) State any four factors governing the selection of electric drives.

e) State different types of traction system used in India.

f) State any two desirable characteristics of tariff.

g) List two disadvantages of low power factor.

Marks

2. Attempt any THREE of the following: **12**

a) Distinguish between incandescent lamp and fluorescent lamp on the basis of following.

i) Initial cost

ii) Lumen output

iii) Energy saving

iv) Brightness

b) Explain direct arc furnace method with diagram.

c) An electric motor has load variation as given below.

i) Torque 140 Nm for 20 minutes

ii) Torque 40 Nm for 10 minutes

iii) Torque 200 Nm for 10 minutes

iv) Torque 100 Nm for 20 minutes

If the speed of the motor is 720 rpm, calculate the power rating of the motor.

d) Draw and label the various parts of A.C. electric locomotive.

3. Attempt any THREE of the following: **12**

a) State the various types of lighting schemes used in illumination and explain any two of them.

b) Explain working principle of dielectric heating. State its two application.

c) Explain the factors on which shape and size of car of elevator depends.

d) State any four advantages of high power factor for electric supply system.

Marks

4. Attempt any THREE of the following: **12**

a) Write classifications of electrical welding system.

b) With neat diagram, explain the plugging method applied to d.c. series motor.

c) A consumer has a maximum demand of 250 KW at 50% load factor. If the tariff is Rs. 100 per KW of maximum demand plus 20 paise per KWh. Find the overall cost per KWh.

d) Define average speed and schedule speed in traction system. List any two factors affecting the schedule speed.

e) Write any eight desirable characteristics of traction motors.

5. Attempt any TWO of the following: **12**

a) A 20 KW single phase 220 V resistance oven employs a circular nichrome wire for its heating element. If wire temperature is not exceed 1170°C and temperature of charge to be 500°C. Calculate the diameter and the length of the wire. Take $K = 0.57$, $e = 0.95$ and $\rho = 1.09 \times 10^{-6}$ ohm-meter.

b) Explain electrical braking. State any six requirements of ideal braking system.

c) A trapezoidal time curve of train consists of :

i) Uniform acceleration of 6 kmphps for 25 seconds.

ii) Free running for 10 minutes.

iii) Uniform deceleration of 6 kmphps to stop the train.

iv) A stop time of 5 minutes.

Find the distance between the stations, average and schedule speed.

Marks

6. Attempt any TWO of the following: **12**

a) Differentiate between DC welding and AC welding on the basis of

i) Equipment

ii) Cost

iii) Power factor

iv) Operating efficiency

v) Arc stability

vi) Heating

b) i) List various types of current collection system in electric traction.

ii) State main features of metro rail and monorail traction line services.

c) i) State Bombay Lift Act 1939. (Latest Amendment)

ii) List any four safety and protective devices used in elevator.

22626

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

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(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State Lambert's Cosine Law.

b) Define the following terms:

i) Utilisation factor

ii) Illumination

c) Classify electric heating on basis of power frequency heating.

d) State any two advantages and disadvantages of Group Drive.

e) List any four characteristics of tariff.

f) List various voltage levels used for Electrical Traction.

g) Write any four causes of low power factor.

Marks

2. Attempt any THREE of the following: **12**

a) Describe with a neat labelled diagram working of high-pressure mercury lamp.

b) Compare core type of furnace and coreless type of furnace (Induction) on the following points.

i) Weight and size

ii) Frequency

iii) Leakage flux

iv) Crucible shape

c) Describe with neat sketch regenerative braking applied for d.c. shunt motor.

d) State the types of Track Electrification used in India. Explain any one type.

3. Attempt any THREE of the following: **12**

a) Estimate the number and wattage of lamps which would be required to illuminate a workshop 80 m by 20 m, spaced 60 × 15 m by means of lamps mounted 6 m above the working plane. The average illumination required is about 100 lux, coefficient of utilisation is 0.4, luminous efficiency is 16 lumens per watt. Assume a space height ratio of unity and a candle power depreciation of 20%.

b) Explain with neat labelled diagram construction and working of carbon arc welding.

c) Recommend relevant motor for the following application

i) Refrigerators and air conditioners

ii) Electric clock

iii) Vacuum cleaner

iv) Washing machine

d) Derive the equation for most economical power factor.

Marks

4. Attempt any THREE of the following: **12**

a) Explain with neat labelled diagram construction and working of direct resistance heating.

b) State the factors to be considered for selection of motor.

c) Compare electric locomotive over non-electric locomotive for the following points.

i) Starting Torque

ii) Regenerative braking

iii) Starting Time

iv) Maintenance

d) A single phase 400 V, 50 Hz motor takes a supply current of 50 A at a power factor of 0.8 lag. The motor pf has been improved to unity by confectioning a condenser in parallel. Calculate the capacity of the condenser required.

e) Draw the block diagram of 25 KV, 1ϕ; 50 Hz AC locomotive used for traction system. State the function of each part.

5. Attempt any TWO of the following: **12**

a) Describe with neat sketch Ajax Watt Furnace.

b) Write the function of bearings and its types.

c) A train has a schedule speed of 80 Kmph between are 8 km apart. Determine the crest or maximum speed over the run. Assuming:

i) Duration of stops 50 seconds

ii) Acceleration 2 kmphps

iii) Retardation 3 kmphps

The speed time curve is trapezoidal.

Marks

6. Attempt any TWO of the following: **12**

a) A 40 KW, 3-phase, 400 V resistance oven uses nickel-chromium strip of 0.3 mm thickness. The heating element are star connected. The wire temperature is to be 1127°C and that of charge is to be 727°C, estimate the width and length of the wire required.

Given : radiation efficiency = 0.6, specific resistance of Ni-Cr = 1.03×10^{-6} ohm-m, emissivity = 0.9.

b) Describe the need of load eqilisation in motors.

c) Explain with neat sketch, the construction and working of Faiveley type pantograph.
