TEST – (i)
GENERAL INTELLIGENCE AND REASONING

Directions : *In questions 1 to 8, select the related letters/word/number/figure from the given alternatives.*

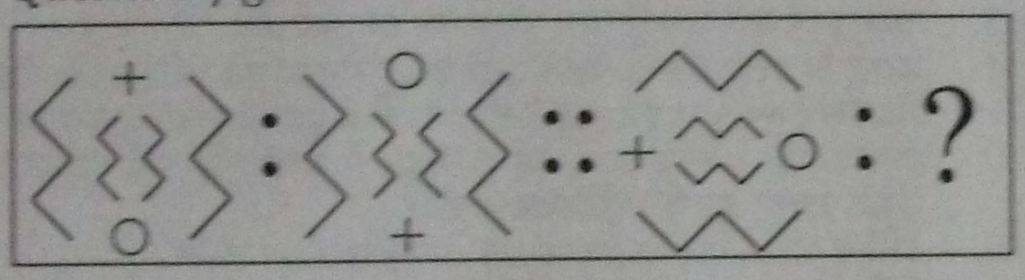
1. 25 : 37 : : 49 : ?
   (A) 42 (B) 56
   (C) 64 (D) 65

2. 9 : 39 : : 45 : ?
   (A) 175 (B) 185
   (C) 195 (D) 205

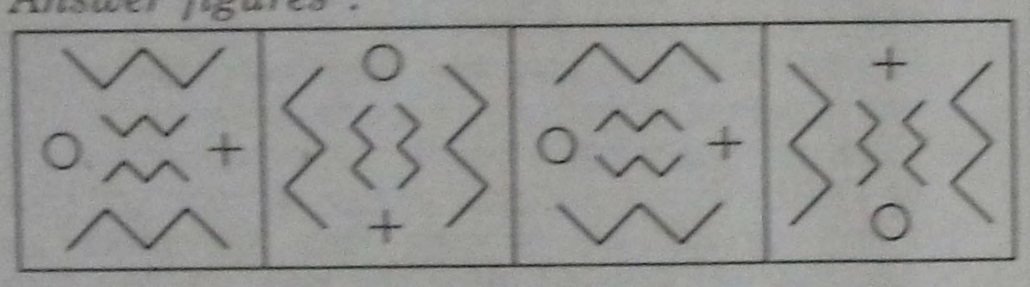
3. ONM : JIH : : TSR : ?
   (A) TSU (B) LMN
   (C) XYZ (D) ONM

4. ZYXW : DCBA : : SRQP : ?
   (A) ZXYP (B) KJIH
   (C) JHIL (D) ABCD

5. *Question figures :*



Answer figures :



(A) (B) (C) (D)

6. Tired : Work : : Happy : ?
   (A) Rest (B) Success
   (C) Eating (D) Exercise

7. Music : Sitar : : ?
   (A) Author : Book
   (B) Literature : Novel
   (C) Guitar : Sound
   (D) Painter : Picture

8. DEA : 10 : : ACE : ?
   (A) 8 (B) 10
   (C) 9 (D) 11

Directions : *In questions 9 to 15, find the odd word/number/letters/word or number pair from the given alternatives.*

9. (A) 36 (B) 64
   (C) 81 (D) 46

10. (A) Apple (B) Mango
    (C) Potato (D) Orange

11. (A) Father – Daughter
    (B) Husband – Wife
    (C) Son – Mother
    (D) Brother – Sister

12. (A) BCD (B) FGH
    (C) NOP (D) IKL

13. (A) DHKM (B) JNPR
    (C) KORT (D) MQTV

14. (A) 4 – 9 (B) 36 – 49
    (C) 16 – 25 (D) 64 – 80

15. (A) 5698 (B) 7894
    (C) 9865 (D) 8793

SPACE FOR ROUGH WORK

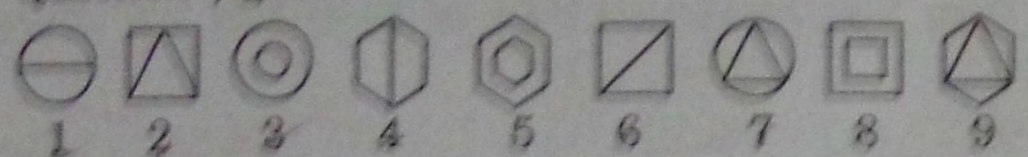
16. Which one of the given responses would be the English dictionary order of the following words ?

1. Protein 2. Problem
3. Proverb 4. Property
5. Project

(A) 2, 1, 4, 3, 5 (B) 1, 2, 3, 4, 5
(C) 3, 4, 5, 2, 1 (D) 2, 5, 4, 1, 3

17. A series of figures is given which can be grouped into classes. Select the group into which the figures can be classified from the given responses.

Question figures :



Answer :

(A) 1, 2, 3; 4, 5, 6; 7, 8, 9
(B) 1, 4, 6; 2, 7, 9; 3, 5, 8
(C) 1, 3, 7; 2, 6, 9; 4, 5, 8
(D) 1, 2, 4; 3, 6, 5; 7, 8, 9

18. Which one of the given responses would be a meaningful order of the following words ?

1. Nation 2. Village
3. Taluk 4. District
5. State

(A) 2, 3, 4, 1, 5 (B) 1, 3, 5, 4, 2
(C) 2, 3, 4, 5, 1 (D) 1, 2, 3, 4, 5

***Directions (Question no. 19)** : Which one set of letters when sequentially placed at the gaps in the given letter series shall complete it ?*

19. b_abbc_bbca_bcabb_ab

(A) acaa (B) cabc
(C) acba (D) cacc

***Directions (Questions no. 20 to 24)** : A series is given with one/two term(s) missing. Choose the correct alternative from the given ones that will complete the series.*

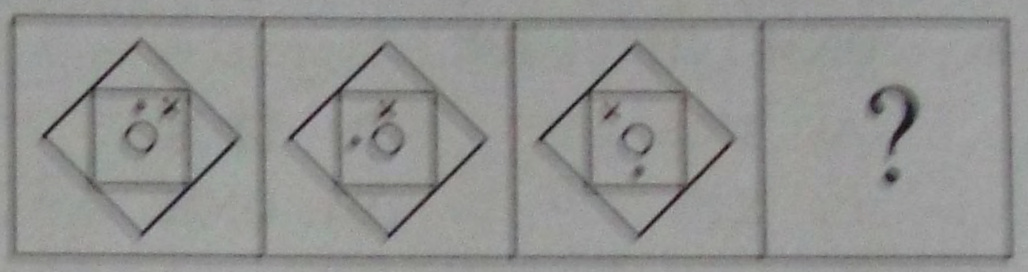
20. 4, 14, 34, ?, 104, 154

(A) 64 (B) 54
(C) 74 (D) 84

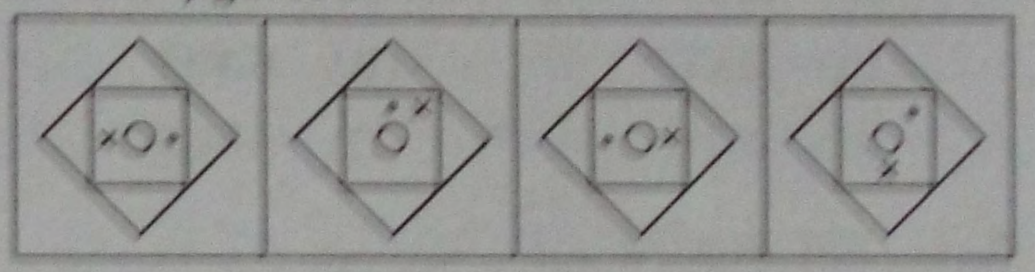
21. 75, 77, 72, 80, 69, 83, ?, ?

(A) 65, 87 (B) 66, 80
(C) 66, 86 (D) 72, 86

22. *Question figures :*



Answer figures :



(A) (B) (C) (D)

23. A, E, I, M, Q, U, ?

(A) V (B) W
(C) Z (D) Y

24. CDF, DEG, EFH, ?

(A) FGI (B) FGH
(C) FHG (D) EFI

25. Which number is ***wrong*** in the given series ?

7, 9, 15, 27, 51, 99

(A) 7 (B) 9
(C) 15 (D) 27

SPACE FOR ROUGH WORK

26. The average age of 10 children in a class is 12 years. If two children aged 14 and 16 years join the class, it will raise the average age by how much ?

(A) 2 months (B) 4 months
(C) 6 months (D) 8 months

27. If in a certain code, TOWER is written as OTEWR, then in that code, which word will be written as RTAIL ?

(A) TRIAL (B) TRAIL
(C) TRLAI (D) TAILR

28. If HARD is coded as 1357 and SOFT is coded as 2468, then 21448 stands for

(A) HSOOT (B) SHOQS
(C) SHOOT (D) RGOQT

29. Choose one word out of the given alternatives, which can be formed from the letters of the word 'DISOBEDIENCE'.

(A) DISTANCE (B) OBEDIENT
(C) BESIDE (D) DEFENCE

30. Sachin walked 10 kms to north, turned left and walked 5 kms. Again he turned south and walked 4 kms. Finally, again he turned left and walked 5 kms. In which direction is Sachin from the starting point ?

(A) East (B) West
(C) North (D) South

31. A boy starts from home, which faces south. He walks a distance of 10 m, turns right and walks 10 m. Then he turns right and walks 10 m, then turns left and walks 10 m and walks back 5 m. What is the distance between the home and the boy ?

(A) 35 m (B) 45 m
(C) 15 m (D) 20 m

32. Five students M, N, O, P and Q are standing in a row.

O, who is the third to the left of P, is to the immediate right of M and second to the left of Q. Q, who is not at any of the ends, is the third to the right of M. P is at one of the ends.

Then who is standing in the middle ?

(A) M (B) N
(C) O (D) Q

33. Among 5 sons of Raghav, Anand is the elder brother of Bhima, and Chandra is the elder brother of Anand. Bhima has younger brothers Dhanu and Ishwar. Who is the eldest son of Raghav ?

(A) Bhima (B) Anand
(C) Chandra (D) Dhanu

34. Amul is Atul's brother. Darly is Atul's mother. Lali is Darly's mother. Prakash is Lali's father. How is Amul related to Prakash ?

(A) Son-in-law (B) Grandson
(C) Great-grandson (D) Son

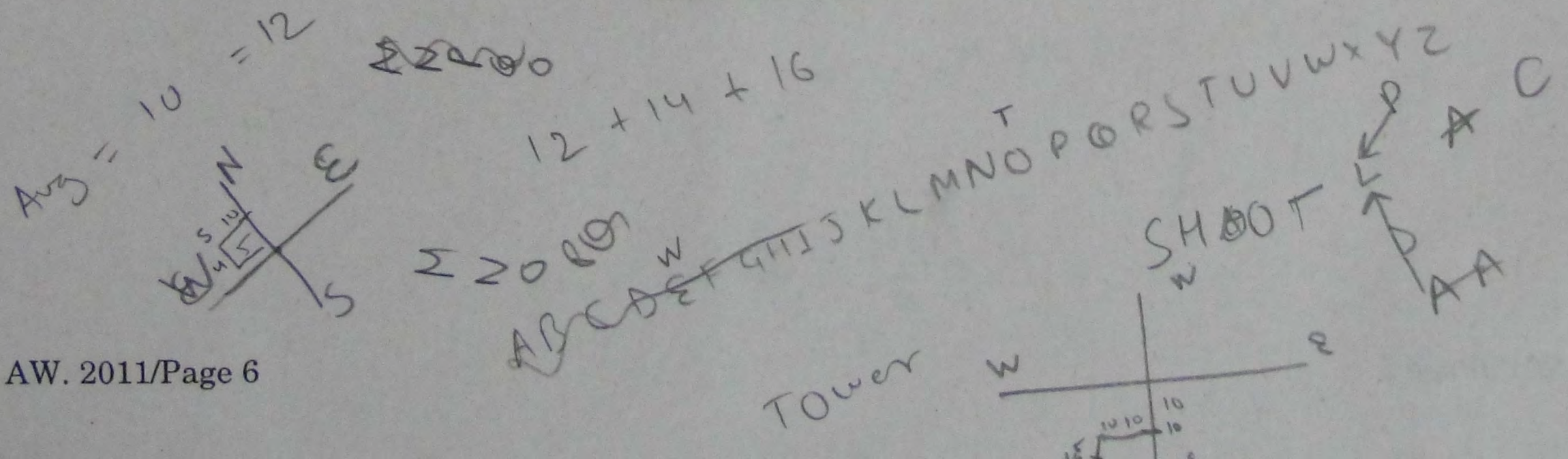
35. A father's age is 3 times of his son's age at present. 10 years back, the father's age was 5 times of his son's age. What is the age of the son at present ?

(A) 20 years (B) 30 years
(C) 25 years (D) 15 years

36. I am twelth in the queue from either end. How many persons are there in the queue ?

(A) 13 (B) 23
(C) 14 (D) 24

SPACE FOR ROUGH WORK



37. Choose one word out of the given alternatives, which ***cannot*** be formed from the letters of the word 'COMMENTATOR'.

(A) MENTOR (B) COMMON

(C) ROTATE (D) MEMBER

Directions : *In questions 38 and 39, two statements are given followed by four/two conclusions respectively. You have to consider the two statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.*

38. *Statements :*

1. Some teachers are students.
2. All students are girls.

Conclusions :

I. All teachers are girls.

II. Some girls are teachers.

III. Some girls are students.

IV. All students are teachers.

(A) Only I follows

(B) Only I and III follow

(C) Only II and III follow

(D) All follow

39. *Statements :*

1. All young ladies are modern.
2. No modern men are religious minded.

Conclusions :

I. No young ladies are religious minded.

II. No young men are religious minded.

(A) Only I follows

(B) Only II follows

(C) Both I and II follow

(D) Neither I nor II follows

Directions : *In question 40, there is an address which has been reproduced against (A), (B), (C) and (D). Three of these have some mistake or the other. The one without any mistake is your answer.*

40. The Manager
R&C Finance Limited
The Metropolitan, 10th Floor, B Block,
Bandra (W)
Mumbai – 400051

(A) The Manager
R&C Finance Limited
The Metropolitan, 10th Floor B Block,
Bandra (W)
Mumbai – 500051

(B) The Manager
R&C Finance Limited
The Metropolitan, 10th Floor, B Block,
Bandra (W)
Mumbai – 400051

(C) The Manager,
R&C Finance Limited
The Metropolitan, 11th Floor, D Block,
Bandra (W)
Mumbai – 400051

(D) The Manager
R&C Finance Limited
The Metropolitan, 10th Floor, B Block
Bandra (W)
Mumbai – 400050

SPACE FOR ROUGH WORK

Directions *: In questions 41 and 42, select the missing number from the given responses.*

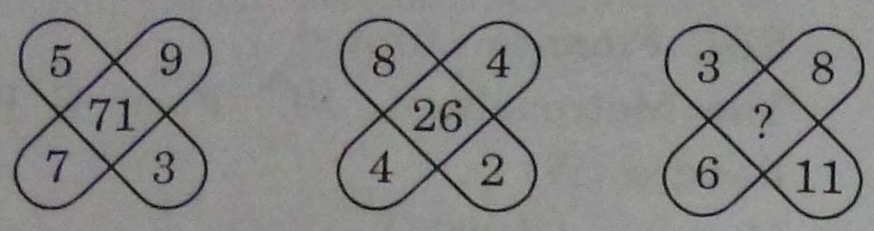
41.

8	3	9
6	4	2
4	8	?
192	96	324

(A) 48 (B) 28

(C) 18 (D) 38

42.



(A) 66 (B) 68

(C) 70 (D) 62

43. If '÷' stands for '×', '–' for '+', '+' for '÷', then which of the following equations is correct ?

(A) $21 - 3 + 9 \div 12 = 51$

(B) $21 + 3 \div 9 - 12 = 75$

(C) $21 \div 9 + 3 - 12 = 51$

(D) $21 - 3 \div 9 + 12 = 75$

44. Some equations are solved on the basis of a certain system. On the same basis, find out the correct answer for the unsolved equation. If 4 + 3 = 25 and 5 + 2 = 29, then 6 + 4 = ?

(A) 52 (B) 100

(C) 50 (D) 48

45. Postal PIN codes of 25 letters are given below. The first digit from the left indicates the zone and the last three digits the delivery Post Office. How many maximum letters are meant for the same delivery Post Office under Zone 2 ?

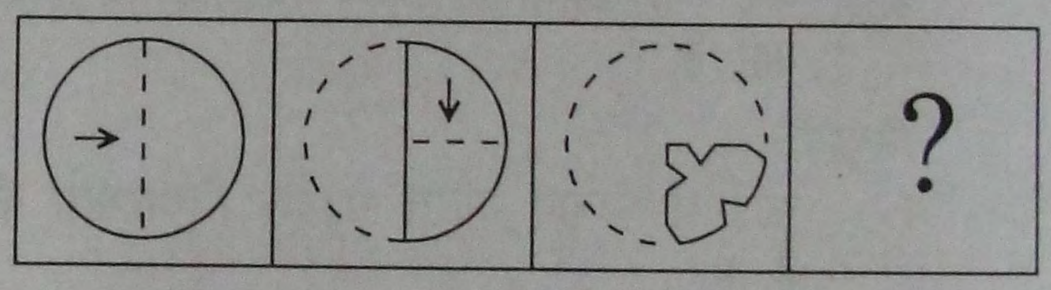
101012	221718	303051	221104	421015
221054	310032	101113	221108	230221
308015	308012	221054	101012	221054
111118	221054	210502	221054	101114
210512	182114	128107	183115	610014

(A) 3 (B) 4

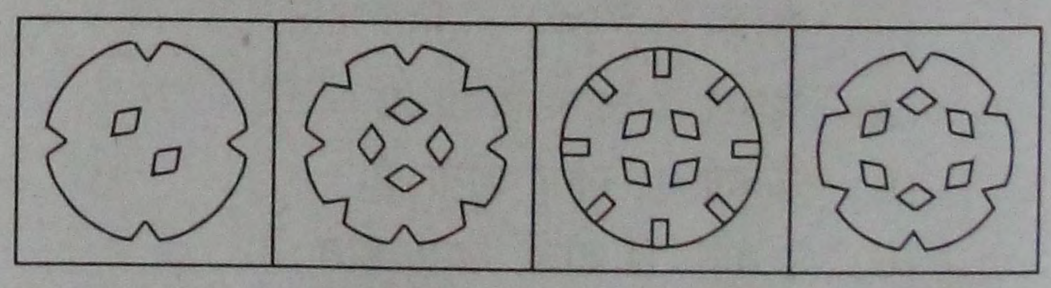
(C) 5 (D) 6

Directions (Question 46) *: A piece of paper is folded and cut as shown below in the question figures. From the given answer figures, indicate, how it will appear when opened.*

46. *Question figures :*



Answer figures :



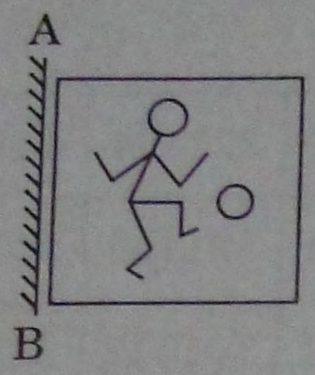
(A) (B) (C) (D)

SPACE FOR ROUGH WORK

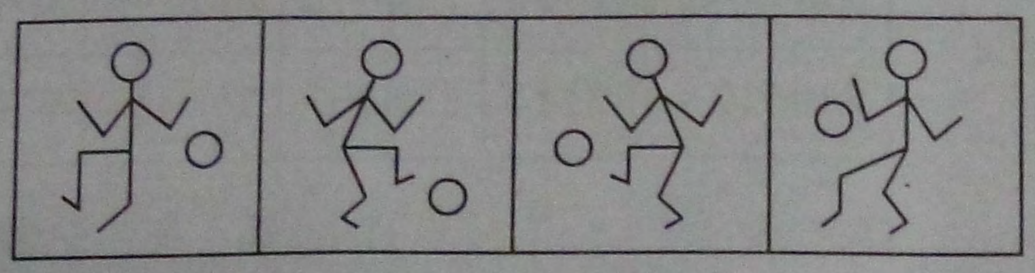
21

47. If a mirror is placed on the line AB, then which of the answer figures is the correct image of the given question figure ?

Question figure :



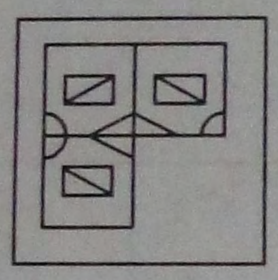
Answer figures :



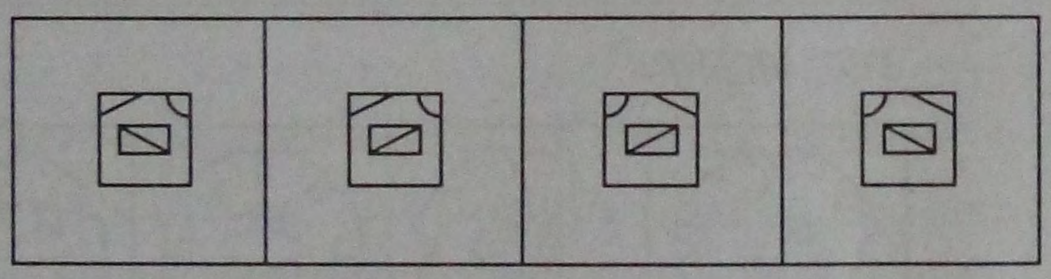
(A) (B) (C) (D)

48. Which answer figure will complete the question figure ?

Question figure :



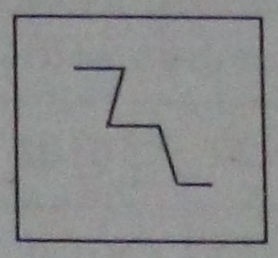
Answer figures :



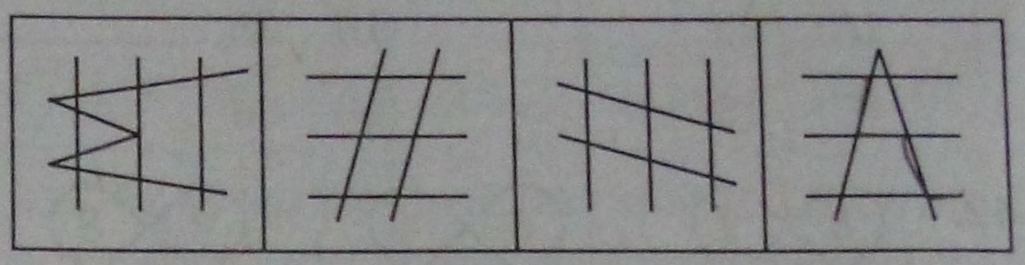
(A) (B) (C) (D)

49. From the given answer figures, select the one in which the question figure is hidden/embedded.

Question figure :



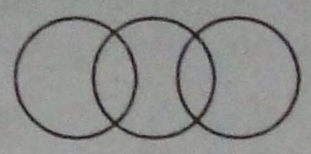
Answer figures :

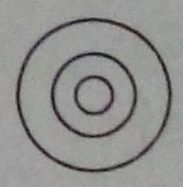


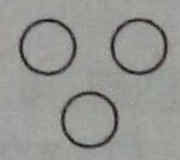
(A) (B) (C) (D)

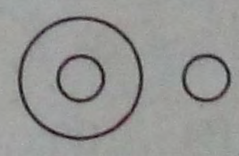
50. Which of the given diagrams correctly represents the relationship among

Mammals, Reptiles and Birds ?

(A) 

(B) 

(C) 

(D) 

SPACE FOR ROUGH WORK

TEST – (ii)
GENERAL AWARENESS

51. Who was the first Mughal ruler to introduce prohibition ?

(A) Babar (B) Akbar

(C) Humayun (D) Jahangir

52. The Congress adopted the 'Purna Swaraj' resolution at Lahore on

(A) 31st April, 1929

(B) 31st December, 1929

(C) 12th March, 1930

(D) 8th August, 1942

53. Which one of the following is ***not*** a basic industry ?

(A) Steel (B) Fertilizer

(C) Paper (D) Cement

54. 'Agmark' seal is issued for commodities like

(A) atta, ghee and honey

(B) biscuit, egg and notebooks

(C) milk, cotton and sweets

(D) cream, vegetables and snacks

55. SEZ stands for

(A) Southern Economic Zone

(B) South European Zone

(C) Special Economic Zone

(D) Special Eastern Zone

56. The Agricultural Prices Commission was set up in the year

(A) 1945 (B) 1955

(C) 1965 (D) 1975

57. Prof. Amartya Sen was awarded Nobel Prize in Economics in 1998 for his work on

(A) Food and Famines

(B) Welfare Economics

(C) Poverty

(D) Empowerment of women

58. Who is the ultimate authority to decide whether a Bill is a Financial Bill or not ?

(A) Finance Minister

(B) Speaker (Lok Sabha)

(C) Prime Minister

(D) President of India

59. The writ that looks into the authority of a person in performing an official act is

(A) Habeas Corpus

(B) Mandamus

(C) Prohibition

(D) Quo warranto

60. Shimla Pact was signed by

(A) India and Pakistan

(B) India and Sri Lanka

(C) India and Nepal

(D) India and China

61. The Vice-President of India is elected by

(A) State Legislatures (Assemblies)

(B) Two Houses of Parliament

(C) State Government

(D) People

62. In addition to Rashtrapati Bhavan at Delhi, where else in India are official residences of the President located ?

(A) Hyderabad, Bengaluru

(B) Hyderabad, Shimla

(C) Hyderabad, Bhopal

(D) Hyderabad, Lucknow

63. Which language was mostly used for the propagation of Buddhism in ancient period ?

(A) Sanskrit (B) Pali

(C) Prakrit (D) Sauraseni

64. In which of the following reptiles is the heart a 4-chambered structure ?

(A) Lizard (B) Turtle

(C) Crocodile (D) Snake

65. Dogs are used for detective work by the police because they

(A) can hear ultrasonic waves of frequency upto 50,000 Hz

(B) can hear infrasonic waves

(C) can hear ultrasonic waves of frequency upto 1,20,000 Hz

(D) can hear sound waves of frequency in the range 20 Hz to 20,000 Hz

66. The working principle of 'Jet engine' is the conservation of

(A) linear momentum

(B) angular momentum

(C) energy

(D) mass-energy

67. Rabindranath Tagore renounced his knighthood as a protest against

(A) Jallianwala Bagh massacre

(B) Partition of Bengal

(C) Execution of Chapekar brothers

(D) Simon Commission

68. Who popularised the slogan 'Jai Jawan, Jai Kisan' and 'Jai Hind' in all platforms ?

(A) Jawaharlal Nehru

(B) Indira Gandhi

(C) Lal Bahadur Shastri

(D) Morarji Desai

69. Rings of Saturn are made up of

(A) ice (B) dust

(C) gas (D) rock

70. What is the name of the Brahmaputra river in Tibet ?

(A) Dihang (B) Dibang

(C) Lohit (D) Tsangpo

71. Which one of the following is referred to as the 'Gold mine of timber' ?

(A) Andaman Islands

(B) Lakshadweep Islands

(C) Meghalaya

(D) Tripura

72. The world's highest road from Manali to Leh has been constructed at an average height of

(A) 4000 m (B) 4500 m

(C) 3500 m (D) 5000 m

73. The raw material for making artificial silk is

(A) Wool (B) Cellulose

(C) Silk (D) Linen

74. The plant which flowers outside and fruit development occurs inside the soil is

(A) Groundnut

(B) Cluster bean

(C) Soyabean

(D) Chick pea

75. The largest flower in the world is

(A) Orchid (B) Rafflesia

(C) Sunflower (D) Musa

76. The number of teeth which grow twice are

(A) 08 (B) 12

(C) 14 (D) 20

77. Which of the following diseases is ***not*** a water-borne disease ?

(A) Cholera

(B) Typhoid

(C) Asthma

(D) Amoebic dysentery

78. Name the bird which can fly backward.

(A) Albatross

(B) Crane

(C) Humming bird

(D) Penguin

79. 'ECOMARC' which is granted to a product having no harmful effect on the environment has a mark of

(A) Sun behind mountains

(B) Lotus flower in full bloom

(C) River flowing in mountains

(D) A clear sky

80. Which of the following is used to disinfect water in a non-chemical way ?

(A) Chlorine dioxide

(B) Ultraviolet light

(C) Ozone

(D) Chloramine

81. According to a decision notified by the Finance Ministry, coins of all denominations below 50 paise coin will cease to be legal currency from the date

(A) March 31, 2011

(B) June 30, 2011

(C) September 30, 2011

(D) December 31, 2011

82. A bird sitting on a live wire does *not* get electrocutied because

(A) no current flows through it

(B) bird is light

(C) bird has no resistance

(D) bird has high resistance

83. Apparent brightness of diamond is due to

(A) reflection of light

(B) refraction of light

(C) total internal reflection

(D) scattering of light

84. Which of these is a component of a presentation graphics software ?

(A) Page (B) Worksheet

(C) Slide (D) Table

85. The main aim of using information technology in business is to

(A) use the latest technology

(B) improve business processes

(C) transfer the duty of decision making to the computing systems

(D) increase the speed of the transactions

86. The aviation fuel used in jet engines is

(A) Coal gas

(B) Refined kerosene

(C) Petrol

(D) Diesel

87. The inert gas produced in the nuclear fusion process is

(A) Helium (B) Argon

(C) Neon (D) Krypton

88. Which of the following is referred to as a 'breathing molecule' ?

(A) Chlorophyll (B) Myoglobin

(C) Nitrogenase (D) Haemoglobin

89. Ethylene glycol is used in car radiators to

(A) facilitate evaporation of water

(B) lower the evaporation of water

(C) lower the freezing point of water

(D) lower the viscosity of water, in the radiator

90. Ganga Action Plan was initiated in

(A) 1982 (B) 1985

(C) 1989 (D) 1992

91. In 1987, use of 'ozone depleting chemicals' was banned in a convention held at

(A) Rio de Janeiro

(B) Montreal

(C) Chicago

(D) Delhi

92. Which one of the following is ***not*** included in the list of the new seven wonders of the world announced in Lisbon, the capital of Portugal, on July 7, 2007 ?

(A) Taj Mahal of India

(B) Petra (Jordan)

(C) The Hanging Gardens of Babylon

(D) Machu Picchu (Peru)

93. India's Intercontinental Ballistic Missile Agni V, proposed to be tested in the year 2011, will have a range of

(A) over 4500 kms

(B) over 5000 kms

(C) over 5500 kms

(D) over 6000 kms

94. The first Indian to win the Hoover Medal is

(A) Dr. Manmohan Singh

(B) Dr. Montek Singh Ahluwalia

(C) Dr. Amartya Sen

(D) Dr. A.P.J. Abdul Kalam

95. A.P.J. Abdul Kalam has co-authored a book with a Jain Monk. The title of the book is

(A) Branding India : An Incredible Story

(B) The Family and the Nation

(C) Getting a Grip on My Body, My Mind, Myself

(D) A Better India, A Better World

96. Which one of the following India's World Heritage Sites included in UNESCO's list has ***not*** been matched correctly with its location ?

(A) Humayun's Tomb – Delhi

(B) Valley of Flowers – Uttarakhand

(C) Airavatesvara Temple – Karnataka

(D) Manas Wildlife Sanctuary – Assam

97. Who of the following is ***not*** associated with Carnatic music ?

(A) Tyagaraja

(B) Muthuswami Dikshitar

(C) Bhatkhande

(D) Shyama Shastri

98. At the 57th National Film Awards for 2009 in Delhi on September 15, 2010, separate awards were announced for 'Best Feature Film on National Integration' and 'Best Film on Other Social Issues'. Which film was adjudged as the 'Best Film on Other Social Issues' ?

(A) Paa

(B) Delhi-6

(C) Well Done Abba

(D) Lahore

99. Who of the following got gold in Women's Freestyle Wrestling (55 kg) in the XIX Commonwealth Games 2010 held at Delhi ?

(A) Anita

(B) Alka Tomar

(C) Geeta Devi

(D) Deepika Kumari

100. As per the decision of the Olympic Council of Asia (OCA) and the Incheon Asian Games Organising Committee (IAGOC), two games to be retained/included in the next edition of the Asian Games in 2014 are

(A) Cricket and Kabaddi

(B) Chess and Cricket

(C) Chess and Kabaddi

(D) Cue sports and Cricket

TEST – (iii)
GENERAL ENGINEERING
(Civil and Structural)

101. The volume of one bag of cement is

(A) 0·0214 cu.m (B) 0·0347 cu.m

(C) 0·0434 cu.m (D) 0·0609 cu.m

102. If t is the thickness of MS plate in mm, the standard weight (in kg) of the MS plate per sq. metre is

(A) 5·87 t (B) 7·85 t

(C) 8·75 t (D) 8·57 t

103. For one cubic metre of concrete (1 : 2 : 4), the number of cement bags required is

(A) 4·5 (B) 5·0

(C) 5·3 (D) 6·3

104. The commonly used lime in white washing is

(A) quick lime

(B) fat lime

(C) lean lime

(D) hydraulic lime

105. Crushing strength of a good building stone should be more than

(A) 50 MPa

(B) 100 MPa

(C) 150 MPa

(D) 200 MPa

106. King closers are related to

(A) doors and windows

(B) king post truss

(C) queen post truss

(D) brick masonry

107. The correction in elevations due to the curvature and refraction is proportional to

(A) D/R (B) D^2/R

(C) R/D^2 (D) R/D

where R is the radius of curvature of Earth and D is the horizontal distance.

108. Relative density of a compacted dense sand is approximately equal to

(A) 0·4 (B) 0·6

(C) 0·95 (D) 1·20

109. Relationship between dry density γ_d, percentage air voids n_a, water content w and specific gravity G of any soil is

(A) $\gamma_d = \dfrac{(1 + n_a)\, G\, \gamma_w}{1 + wG}$

(B) $\gamma_d = \dfrac{(1 + n_a)\, G\, \gamma_w}{1 - wG}$

(C) $\gamma_d = \dfrac{(1 - n_a)\, G\, \gamma_w}{1 + wG}$

(D) $\gamma_d = \dfrac{(1 - n_a)\, G\, \gamma_w}{1 - wG}$

110. The correction for slope in chaining is proportional to

(A) $\sqrt{h}$ (B) h

(C) h^2 (D) h^3

111. The fixed point whose elevation is known, is called

(A) benchmark

(B) change point

(C) reduced level

(D) station

SPACE FOR ROUGH WORK

$\frac{14.8}{1+2+4} = \frac{14.8}{7} = 2$

112. When the flow in an open channel is gradually varied, the flow is said to be

(A) steady uniform flow

(B) steady non-uniform flow

(C) unsteady uniform flow

(D) unsteady non-uniform flow

113. Which of the following is a non-recording raingauge ?

(A) Symon's raingauge

(B) Tipping bucket type raingauge

(C) Weighing type raingauge

(D) Floating type raingauge

114. The discharge capacity required at the outlet to irrigate 2600 ha of sugarcane having a kor depth of 17 cm and a kor period of 30 days is

(A) 2·3 m^3/s (B) 1·71 m^3/s

(C) 14·7 m^3/s (D) 0·18 m^3/s

115. Lining of irrigation canals

(A) decreases the waterlogging area

(B) increases the waterlogging area

(C) does not change the waterlogging area

(D) increases evaporation

116. A shallow foundation is defined as a foundation which

(A) has low bearing capacity

(B) has a depth of embedment less than its width

(C) is resting on the ground surface

(D) causes less settlement

117. Match List I with List II and select the correct answer using the codes given below the lists :

List I (Name of person)		*List II (Field of contribution)*
a.	Stokes	1. Flow through capillary
b.	Darcy	2. Classification of soils
c.	Poiseuille	3. Consistency limits
d.	Atterberg	4. Flow of water through a soil mass
		5. Velocity of settling particle

	a	b	c	d
(A)	5	4	1	3
(B)	4	1	5	2
(C)	1	5	4	2
(D)	3	2	1	5

118. The pressure intensity in kg/cm^2 at any point in a liquid is

(A) w (B) w/h

(C) h/w (D) wh

where w is unit weight of liquid in kg/cm^3, h is the depth of the point from liquid surface.

119. Venturimeter is used to

(A) measure the velocity of a flowing liquid

(B) measure the pressure of a flowing liquid

(C) measure the discharge of liquid flowing through a pipe

(D) measure the pressure difference of liquid flowing between two points in a pipe line

SPACE FOR ROUGH WORK

120. Hardness of water is caused by the presence of the following in water :

(A) Chlorides and sulphates

(B) Calcium and magnesium

(C) Nitrites and nitrates

(D) Sodium and potassium

121. In CBR test, the value of CBR is calculated at

(A) 2·5 mm penetration only

(B) 5·0 mm penetration only

(C) 7·5 mm penetration only

(D) both 2·5 mm and 5·0 mm penetrations

122. The camber for hill roads in case of bituminous surfacing is adopted as

(A) 2·0% (B) 2·5%

(C) 3·0% (D) 3·5%

123. Minimum depth of ballast cushion for a Broad Gauge wooden sleeper of size $275 \times 25 \times 13$ cm with 75 cm sleeper spacing is

(A) 15 cm (B) 20 cm

(C) 25 cm (D) 30 cm

124. The product of H^+ ions and OH^- ions in a strong alkali is

(A) 0 (B) 1

(C) 10^{-1} (D) 10^{-14}

125. The minimum dissolved oxygen which should always be present in water in order to save the aquatic life is

(A) 1 ppm (B) 4 ppm

(C) 10 ppm (D) 40 ppm

126. The ratio of normal stress to volumetric strain is defined as

(A) Young's modulus

(B) Bulk modulus

(C) Rigidity modulus

(D) Tangent modulus

127. The ratio of flexural rigidity of a beam ($b \times d$) to another one ($b \times 2d$) of similar material will be

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$

(C) $\frac{1}{8}$ (D) $\frac{1}{16}$

128. A material is called ductile if it

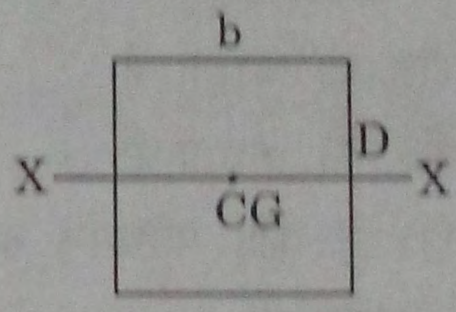
(A) has little plastic elongation range

(B) has long plastic elongation range

(C) could be hammered into a very thin sheet

(D) shows large elastic strain

129. The moment of inertia of the cross-section about X – X axis is



(A) $D^3b/3$ (B) $D^3b/12$

(C) $Db^3/3$ (D) $Db^3/12$

130. Poisson's ratio is defined as

(A) longitudinal strain / lateral strain

(B) lateral strain / longitudinal strain

(C) lateral strain × longitudinal strain

(D) $\frac{1}{2}$ (lateral strain × longitudinal strain)

SPACE FOR ROUGH WORK

131. Le-Chatelier's method can be used to determine

(A) Fineness of cement
(B) Fineness of aggregate
(C) Soundness of cement
(D) Compressive strength of cement

132. Grading of aggregate in a concrete mix is necessary to achieve

(A) adequate workability
(B) higher density
(C) reduction of voids
(D) better durability

133. The purpose of concrete compaction is to

(A) increase the density
(B) increase the weight
(C) increase the voids
(D) decrease the setting time

134. The test strength of the sample is taken as the average of the strength of

(A) 2 specimens (B) 3 specimens
(C) 4 specimens (D) 5 specimens

135. An aggregate is said to be flaky if its least dimension is less than

(A) $\frac{2}{3}$ mean dimension
(B) $\frac{3}{4}$ mean dimension
(C) $\frac{3}{5}$ mean dimension
(D) $\frac{5}{8}$ mean dimension

136. The deflection of a beam may be reduced by

(A) increasing depth of the section
(B) increasing degree of end restraint
(C) increasing width of the section
(D) any one or all of the above

137. Modulus of rigidity is expressed as

(A) compressive stress / compressive strain
(B) tensile stress / tensile strain
(C) shear stress / shear strain
(D) stress / volumetric strain

138. For a rectangular beam, the maximum shear stress is related to average shear stress, τ_{av}, by

(A) τ_{av} (B) $1{\cdot}25\ \tau_{av}$
(C) $1{\cdot}50\ \tau_{av}$ (D) $1{\cdot}75\ \tau_{av}$

139. The standard consistency test is done in a

(A) Blaine's apparatus
(B) Le-Chatelier's apparatus
(C) Vane apparatus
(D) Vicat's apparatus

140. The static modulus of elasticity (E_c) of concrete for short term loading may be derived as

(A) $E_c = 4800\ \sqrt{f_{ck}}$
(B) $E_c = 5000\ \sqrt{f_{ck}}$
(C) $E_c = 5200\ \sqrt{f_{ck}}$
(D) $E_c = 5500\ \sqrt{f_{ck}}$

SPACE FOR ROUGH WORK

141. In limit state of collapse against flexure, the maximum strain in tension reinforcement at failure shall ***not*** be less than

(A) 0·002

(B) $0{\cdot}002 + \frac{f_y}{E_s}$

(C) $0{\cdot}002 + \frac{f_y}{0{\cdot}87\,E_s}$

(D) $0{\cdot}002 + \frac{f_y}{1{\cdot}15\,E_s}$

142. A slab is designed as a two-way slab if the ratio of long span to short span is greater than

(A) 1·0 (B) 1·2

(C) 1·5 (D) 2·0

143. According to IS 456 : 2000, the maximum depth of stress block for balanced section of beam of effective depth d using steel with $f_y = 250$, is given by

(A) 0·43 d (B) 0·53 d

(C) 0·68 d (D) 0·73 d

144. If ϕ is the diameter of a bar in tension, a standard hook is equivalent to the anchorage value of straight length given by

(A) 8 ϕ (B) 12 ϕ

(C) 16 ϕ (D) 24 ϕ

145. The HYSD reinforcement in RC slab shall ***not*** be less than

(A) 0·12 (bd)/100

(B) 0·12 (bD)/100

(C) 0·15 (bd)/100

(D) 0·15 (bD)/100

146. The maximum allowable slenderness ratio for axially loaded member carrying tension only is

(A) 180 (B) 250

(C) 350 (D) 400

147. A strut is a

(A) tension member

(B) compression member

(C) flexural member

(D) torsion member

148. The effective slenderness ratio of laced columns, compared to actual maximum slenderness ratio shall be considered as

(A) 1·05 times (B) 1·10 times

(C) 1·15 times (D) 1·20 times

149. According to Unwin's formula, the relation between diameter of rivet hole (d) in mm, and thickness of plate (t) in mm is given by

(A) $d = t$ (B) $d = 6{\cdot}01\sqrt{t}$

(C) $d = 2t$ (D) $d = 2{\cdot}6\sqrt{t}$

150. The lacing bars in steel columns should be designed to resist

(A) 0·5% of column load

(B) 1·5% of column load

(C) 2·5% of column load

(D) 3·5% of column load

SPACE FOR ROUGH WORK

TEST - (iii)
GENERAL ENGINEERING
(Mechanical)

101. The number of links l and the number of pairs p in a kinematic chain conform to the relation

(A) $l = p - 4$ (B) $l = 2p - 4$

(C) $l = 2p + 1$ (D) $l = 2(p - 1)$

102. For a flat open-belt drive, the belt speed is 880 m/min and the power transmitted is 22·5 kW. What is the difference between the tight side and slack side tensions of the belt drive ?

(A) 9000 N (B) 6450 N

(C) 1540 N (D) 1000 N

103. The power transmitted by means of belt depends upon

(A) velocity of the belt

(B) tension on the belt

(C) arc of contact between the belt and the smaller pulley

(D) All of the above

104. Herringbone gears are

(A) spur gears

(B) single helical gears

(C) double helical gears

(D) bevel gears

105. For an involute gear, the ratio, pitch circle radius / base circle radius =

(A) $\cos \phi$ (B) $\sin \phi$

(C) $\sec \phi$ (D) $\text{cosec } \phi$

where ϕ is the pressure angle.

106. A structure made up of several bars, rivetted or welded together, is known as

(A) Strut (B) Column

(C) Frame (D) Tie

107. The coupling which is the inversion of the double slider crank chain is

(A) Flange coupling

(B) Oldham's coupling

(C) Universal coupling

(D) Box coupling

108. The difference between tensions on the tight and slack slides of a belt drive is 3000 N. If the belt speed is 15 m/sec, the transmitted power, in kW, is

(A) 45 (B) 22·5

(C) 90 (D) 100

109. The maximum efficiency of worm and worm wheel system is

(A) $\eta_{max} = \dfrac{1 - \cos \phi}{1 + \cos \phi}$

(B) $\eta_{max} = \dfrac{1 - \sin \phi}{1 + \cos \phi}$

(C) $\eta_{max} = \dfrac{1 - \sin \phi}{1 + \sin \phi}$

(D) $\eta_{max} = \dfrac{1 - \tan \phi}{1 + \tan \phi}$

where ϕ is the friction angle.

110. In gear drive, addendum equals

(A) diametral pitch

(B) circular pitch

(C) module of the gear

(D) 1·57 times the module of the gear

SPACE FOR ROUGH WORK

111. The deformation per unit length in the direction of the force is known as

(A) linear stress

(B) shear stress

(C) linear strain

(D) lateral strain

112. Which material has the highest value of Poisson's ratio ?

(A) Rubber (B) Copper

(C) Steel (D) Concrete

113. In order to produce bending and shear stresses of equal magnitudes at the extreme fibres of a circular cross-section under the action of combined bending and torsion, the ratio of bending to twisting moments must be

(A) 1/4 (B) 1

(C) 2 (D) 1/2

114. The ratio of Euler's buckling loads of columns with same parameters having (i) both ends fixed (ii) one end fixed and the other end free, is

(A) 1 (B) 4

(C) 8 (D) 16

115. A hollow pipe of OD = 80 mm and thickness = 16 mm is used as a simply supported beam over a span of 2 m. What maximum point load can be applied at the center of the span if the permissible bending stress is 800 N/mm^2 ?

(A) 4·021 N (B) 40·21 N

(C) 8·042 N (D) 80·42 N

116. The longitudinal stress in a thin (thickness t) cylinder pressure vessel of diameter d and internal pressure p, is

(A) $\frac{pd}{t}$ (B) $\frac{pd}{2t}$

(C) $\frac{pd}{4t}$ (D) $\frac{pd}{8t}$

117. For a thermodynamic cycle to be irreversible, it is necessary that

(A) $\oint \frac{dQ}{T} = 0$ (B) $\oint \frac{dQ}{T} < 0$

(C) $\oint \frac{dQ}{T} > 0$ (D) $\oint \frac{dQ}{T} \geq 0$

118. The critical temperature for water is

(A) 323° C (B) 347° C

(C) 374° C (D) 373° C

119. A solid shaft transmits a torque T. The allowable shear stress is τ. The diameter of the shaft is

(A) $\sqrt[3]{\frac{16\,T}{\pi\tau}}$ (B) $\sqrt[3]{\frac{32\,T}{\pi\tau}}$

(C) $\sqrt[3]{\frac{4\,T}{\pi\tau}}$ (D) $\sqrt[3]{\frac{64\,T}{\pi\tau}}$

120. A machine part is designed as a strut, when it is subjected to

(A) an axial tensile stress

(B) an axial compressive stress

(C) a tangential force

(D) any one of the above

SPACE FOR ROUGH WORK

121. The steam in boiler drum is always

(A) saturated (B) dry

(C) superheated (D) wet or dry

122. Curtis turbine is an example of

(A) velocity compounded impulse steam turbine

(B) pressure compounded impulse steam turbine

(C) pressure-velocity compounded impulse steam turbine

(D) reaction steam turbine

123. The recommended cycle for a steam power plant is

(A) Brayton cycle

(B) Rankine cycle

(C) Carnot cycle

(D) Otto cycle

124. First law of thermodynamics asserts that the following is a thermodynamic property :

(A) Entropy

(B) Internal Energy

(C) Temperature

(D) Pressure

125. For a closed system, the difference between heat added to and work done by the system is equal to

(A) enthalpy

(B) internal energy

(C) Gibbs function

(D) flow work

126. The process of removing the burnt gases from the combustion chamber of the engine cylinder using fresh charge is called

(A) Knocking

(B) Supercharging

(C) Detonation

(D) Scavenging

127. Number of working strokes per minute for a two stroke cycle engine as compared to speed of the engine in rpm, is

(A) half (B) double

(C) same (D) four times

128. Quality of ignition of petrol is measured by

(A) Octane number

(B) Calorific value

(C) Specific fuel consumption

(D) Cetane number

129. Function of blow-down cock in a boiler is

(A) to maintain water level by draining excess water

(B) to empty the water drum of the boiler

(C) to remove sludge and sediments collected in drum

(D) to blow off steam to maintain safe pressure

130. Lancashire boiler is a

(A) vertical fire tube boiler

(B) horizontal fire tube boiler

(C) vertical water tube boiler

(D) horizontal water tube boiler

SPACE FOR ROUGH WORK

131. In general, the vanes of a centrifugal pump are

(A) curved forward
(B) curved backward
(C) radial
(D) twisted

132. Hydrostatic law states that the rate of increase of pressure in vertical direction is equal to

(A) fluid density
(B) fluid specific weight
(C) fluid weight
(D) fluid specific gravity

133. Pascal's law states that pressure at a point is equal in all directions

(A) in a liquid at rest
(B) inside a solid
(C) in a laminar flow
(D) in a turbulent flow

134. The flow of fluid through a pipe is laminar when

(A) the fluid is ideal
(B) the fluid is viscous
(C) Reynolds number is less than 2000
(D) there is a considerable lateral dispersion of smoke or dye injected into the flow stream

135. Each term of Bernoulli's equation stated in the form $\frac{p}{w} + \frac{v^2}{2g} + y = \text{constant}$ has units of

(A) N (B) mN/kg
(C) m (D) mN/s

136. Orifice meter is used to measure

(A) discharge
(B) average velocity
(C) velocity at a point
(D) pressure at a point

137. Select the correct sequence of the following parameters in descending order of influence on tool life :

1. Feed rate
2. Depth of cut
3. Cutting speed

(A) 1, 2, 3 (B) 3, 1, 2
(C) 2, 3, 1 (D) 3, 2, 1

138. Which welding process uses a consumable electrode ?

(A) Laser welding
(B) Thermit welding
(C) TIG welding
(D) MIG welding

139. Specific speed of a turbo machine

(A) is the speed of a machine having unit dimensions
(B) relates the shape rather than size of the machine
(C) remains the same under different conditions of operation
(D) depends only upon the head under which the machine operates

140. Which type of turbine should be used if the head on the turbine is more than 300 m ?

(A) Kaplan (B) Francis
(C) Pelton (D) Propeller

SPACE FOR ROUGH WORK

141. Which one of the following manufacturing processes requires the provision of "flash gutter" ?

(A) Closed die forging

(B) Centrifugal casting

(C) Investment casting

(D) Impact extrusion

142. Solder is essentially a

(A) tin-lead base alloy

(B) silver-lead base alloy

(C) bismuth-lead base alloy

(D) tin-silver base alloy

143. Hot tears are the result of which of the following ?

(A) Lower permeability

(B) Lower green strength

(C) More fins

(D) Restraint of contraction

144. In a taper turning operation, maximum and minimum diameters of the job are 'D' and 'd' respectively. What is the taper angle, if the job length is L ?

(A) $2 \tan^{-1}\left(\frac{D-d}{2L}\right)$

(B) $\tan^{-1}\left(\frac{D-d}{L}\right)$

(C) $\tan^{-1}(D-d)$

(D) $2 \tan^{-1}\left(\frac{D-d}{L}\right)$

145. Welding process using a pool of molten metal is

(A) Carbon arc welding

(B) Submerged arc welding

(C) TIG welding

(D) MIG welding

146. Orthogonal cutting system is also called

(A) one-dimensional cutting system

(B) two-dimensional cutting system

(C) three-dimensional cutting system

(D) None of these

147. In a shaper, metal is removed during

(A) forward stroke only

(B) return stroke only

(C) both the forward and the return strokes

(D) neither the forward stroke nor the return stroke

148. Quick return mechanism is incorporated in a

(A) Lathe machine

(B) Milling machine

(C) Drilling machine

(D) Shaping machine

149. For which machines, are very large speed ranges required ?

(A) Drilling (B) Shaping

(C) Grinding (D) Planing

150. Which of the following is an example of semi-automatic welding process ?

(A) TIG welding

(B) MIG welding

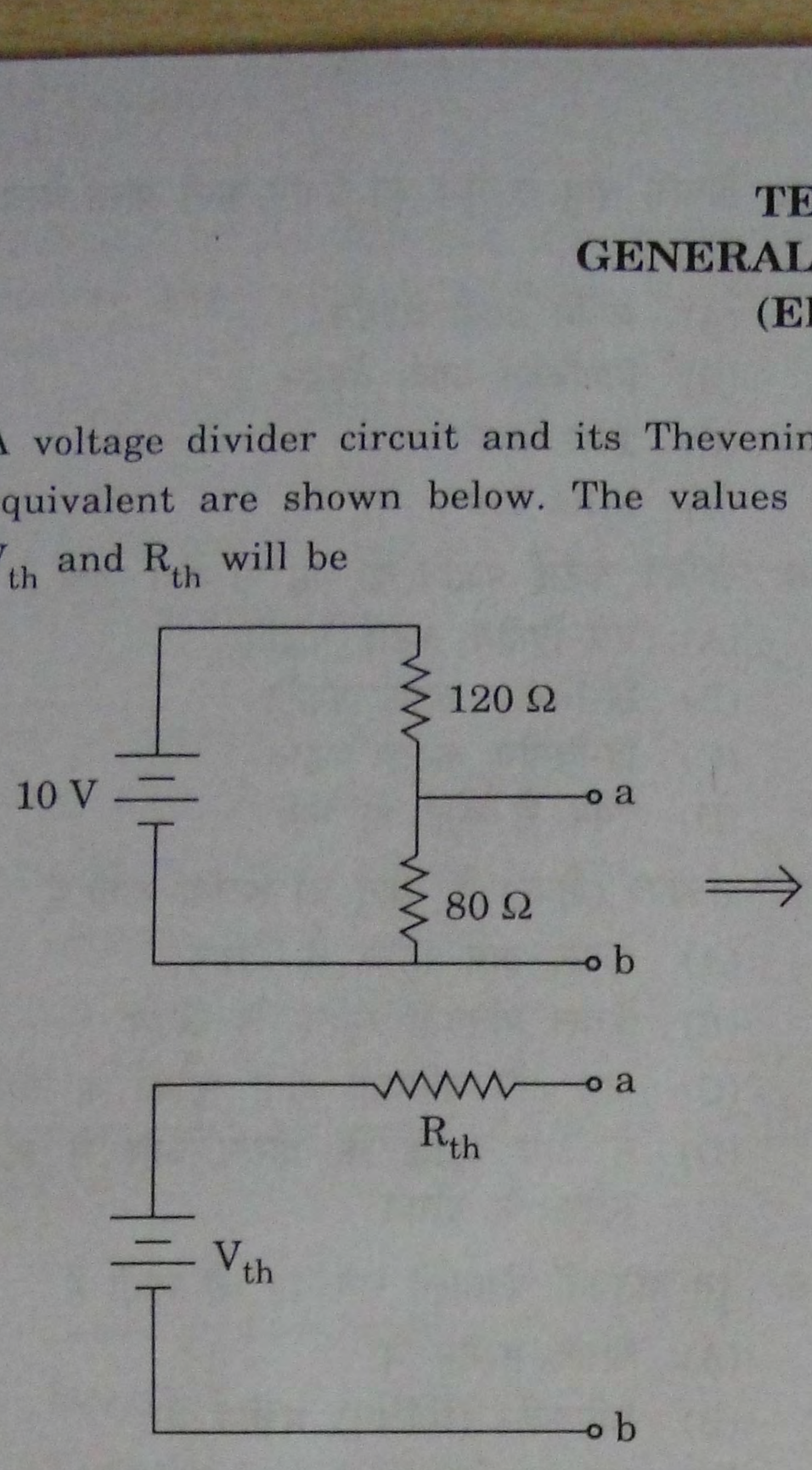
(C) Submerged arc welding (SAW)

(D) Resistance welding

SPACE FOR ROUGH WORK

TEST – (iii)
GENERAL ENGINEERING
(Electrical)

101. A voltage divider circuit and its Thevenin's equivalent are shown below. The values of V_{th} and R_{th} will be



(A) 10 V, 80 Ω (B) 4 V, 80 Ω

(C) 4 V, 48 Ω (D) 5 V, 50 Ω

102. Two coils with self-inductances 1 H and 2 H having a mutual inductance of 1 H between them carry currents of 2 A and $\sqrt{2}$ A respectively. The total energy stored in the field, in joules, is

(A) $2(1 + \sqrt{2})$ (B) $2(2 + \sqrt{2})$

(C) $3(1 + \sqrt{2})$ (D) $3(2 + \sqrt{2})$

103. In dynamometer wattmeter the compensating coil

(A) has equal number of turns of voltage coil and is connected in series with current coil

(B) has equal number of turns of current coil and is connected in series with voltage coil

(C) has equal number of turns of current coil and is connected in series with current coil

(D) has equal number of turns of voltage coil and is connected in series with voltage coil

104. Megger is an instrument by which we can measure

(A) high resistance

(B) low resistance

(C) high current

(D) high voltage

SPACE FOR ROUGH WORK

105. With the decrease in the strength of the permanent magnet in an insulation Megger due to ageing, the Megger reading will

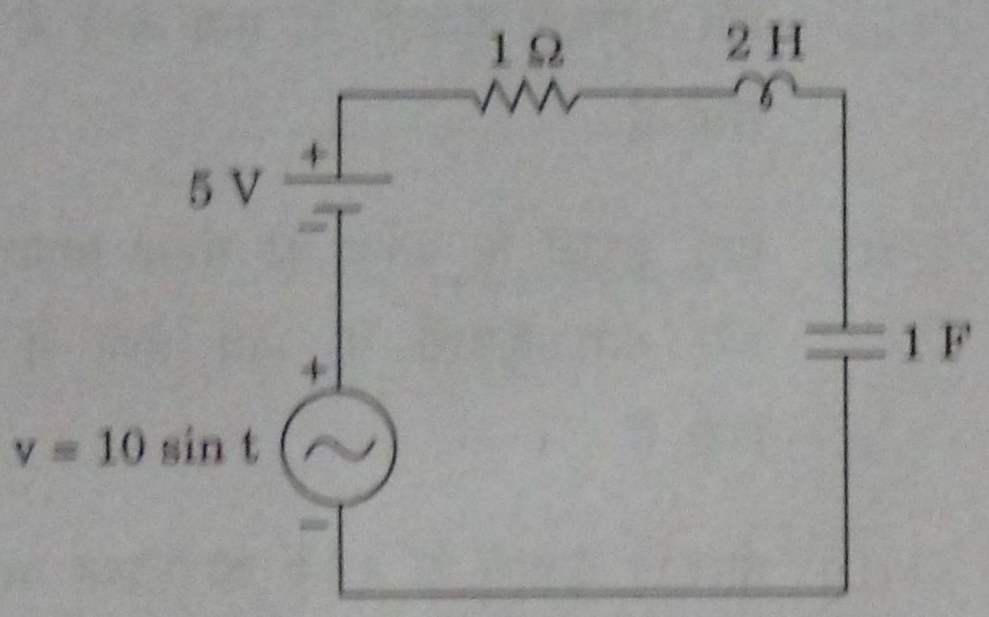
(A) be lower than actual

(B) be higher than actual

(C) remain unaffected

(D) fluctuate rapidly

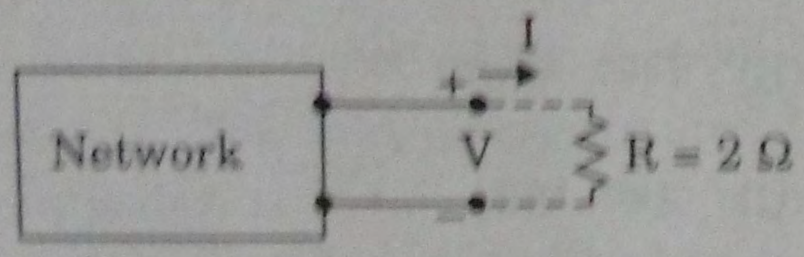
106. In the circuit shown in the figure given below, instantaneous current i(t) under steady state is given by



(A) zero (B) 5

(C) 7·07 sin t (D) 7·07 sin (t – 45°)

107. The V –I relation for the network shown in the given box is V = 4I – 9. If now a resistor R = 2 Ω is connected across it, then the value of I will be



(A) – 4·5 A (B) – 1·5 A

(C) 1·5 A (D) 4·5 A

108. The burden of current transformers is expressed in

(A) watt

(B) VA

(C) rated secondary current

(D) voltage rating of secondary

109. A wattmeter is being tested under phantom-loading condition. If the wattmeter reading is 60 W, the actual power consumed from the supply, is

(A) much higher than 60 W

(B) 60 W

(C) much less than 60 W

(D) 30 W

110. In an induction type energy meter, everything else remaining same, if the radial distance of the brake magnet poles from the spindle is decreased by 10%, the rotational speed of the disc will _____ approximately.

(A) increase by 23·5%

(B) decrease by 10·6%

(C) decrease by 19·4%

(D) increase by 11%

111. Guard electrodes are used in capacitance measurement to minimize

(A) fringing of electric field

(B) thermo-emf

(C) dielectric loss

(D) eddy current

SPACE FOR ROUGH WORK

112. In Swinburne's method of testing dc machines, the shunt machine is run as a

(A) motor at full load at rated speed and rated voltage

(B) generator at full load at rated speed and rated voltage

(C) generator at no load at rated speed and rated voltage

(D) motor at no load at rated speed and rated voltage

113. A 20 kVA, 2000 V / 200 V, 2-winding transformer, when used as an autotransformer with constant voltage source of 2000 V, is capable of handling

(A) 20 kVA

(B) 220 kVA

(C) 320 kVA

(D) None of the above

114. The ratio of no load current to full load current of a single phase induction motor is

(A) 0·1 (B) 0·2

(C) 0·4 (D) 0·8

115. Voltage regulation of an alternator may be negative where

(A) the load power factor is lagging

(B) the load power factor is leading

(C) it is loaded beyond its full load capacity

(D) the machine is run at very low loads

116. A static combination of control coil and compensating coil is used in Megger to minimize the effect of

(A) stray capacitance

(B) surface leakage

(C) stray magnetic field

(D) aging of magnet

117. Megger is an instrument used for measurement of

(A) high resistance

(B) medium resistance

(C) low resistance

(D) leakage current

118. Power transformers are designed such that maximum efficiency occurs at

(A) half of the full load

(B) near full load

(C) $1/4^{th}$ of full load

(D) $3/4^{th}$ of full load

119. The brushes of a dc machine should be physically placed on the

(A) armature in the polar axis

(B) armature in the interpolar axis

(C) commutator in the polar axis

(D) commutator in the interpolar axis

SPACE FOR ROUGH WORK

120. V-curves for isolated, 3-phase synchronous motor show

(A) the variation of mechanical power with field excitation at constant speed

(B) the variation of armature voltage with field excitation at constant mechanical power

(C) the variation of armature voltage with mechanical power at constant field excitation

(D) the variation of armature current with field excitation at constant mechanical power

121. A dc shunt generator is delivering 500 A at 220 V. The shunt field current is 10 A. The armature resistance is 0·01 Ω. The stray power is 5000 W. The efficiency of the generator is

(A) 91·09% (B) 95·82%

(C) 95·64% (D) 91·82%

122. Which one of the following is correct ?

(A) Synchronous motor is supplied with dc voltage in the armature winding

(B) Synchronous motor is supplied with ac voltage in the field winding

(C) Synchronous motor is supplied with rectified voltage in the armature winding

(D) Synchronous motor is supplied with dc voltage in the field winding

123. During starting of a three-phase induction motor, the machine may refuse to start at all. This phenomenon is called

(A) Single phasing (B) Cogging

(C) Stalling (D) Crawling

124. A fault involving all the three phases of a power system is known as

(A) line to line to ground fault

(B) symmetrical fault

(C) unsymmetrical fault

(D) unbalanced fault

125. A single phase radial distributor is fed at one end at 220 V and is loaded with unity power factor loads as under :

Distance from feeding point in metres	Load current in amperes
100	22
220	17
260	20
300	25

If the total resistance for go and return of the distributor is 0·1 Ω, the voltage at the far end is

(A) 213·79 V (B) 216·89 V

(C) 207·57 V (D) 215·8 V

126. The capacity factor of a plant is given by

(A) maximum load / average load

(B) average load / maximum load

(C) average load / plant capacity

(D) maximum load / plant capacity

127. In a power supply system, "demand factor" is defined as

(A) $\frac{\text{Average demand}}{\text{Maximum demand}}$

(B) $\frac{\text{Maximum demand}}{\text{Installed capacity}}$

(C) $\frac{\text{Average demand}}{\text{Installed capacity}}$

(D) $\frac{\text{Maximum demand}}{\text{Connected load}}$

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128. In the Merz-Price system of protection of alternator, if i_1 and i_2 are the CT secondary currents, and n_r and n_o are the number of restraining coils and operating coils respectively, then the torque-balance equation is

(A) $\frac{i_1 + i_2}{(i_1 - i_2)/2} = \frac{n_r}{n_o}$

(B) $\frac{i_1 + i_2}{(i_1 - i_2)/2} = \frac{n_o}{n_r}$

(C) $\frac{i_1 - i_2}{(i_1 + i_2)/2} = \frac{n_r}{n_o}$

(D) $\frac{i_1 - i_2}{(i_1 + i_2)/2} = \frac{n_o}{n_r}$

129. The presence of earth in case of overhead lines

(A) increases the capacitance of the line

(B) increases the inductance of the line

(C) decreases the capacitance of the line

(D) decreases the inductance of the line

130. In arc welding, the voltage required to maintain the arc is in the range of

(A) 200 – 250 volts

(B) 1000 – 1200 volts

(C) 2 – 5 volts

(D) 20 – 30 volts

131. In designing lighting scheme, utilization factor is used. It is defined as

(A) utilization factor = $\frac{\text{total lumens utilized on working plane}}{\text{total lumens radiated by lamp}}$

(B) utilization factor = $\frac{\text{total lumens utilized on working plane}}{\text{illumination when everything is clean}}$

(C) utilization factor = $\frac{\text{illumination under normal working condition}}{\text{illumination when everything is clean}}$

(D) utilization factor = $\frac{\text{total lumens radiated by lamp}}{\text{total lumens utilized on working plane}}$

132. Which of the following equipments has the lowest power factor ?

(A) Fully loaded induction motor

(B) Immersion heater

(C) Incandescent lamp

(D) Arc lamp

133. Two generators each of capacity 10 MVA and reactance 5% are feeding a common bus bar. A transmission line of reactance 2·5% is connected with the bus bar to transmit power to the consumer end. The contribution of each generator to a three-phase fault at the consumer end is

(A) 200 MVA (B) 80 MVA

(C) 100 MVA (D) 40 MVA

SPACE FOR ROUGH WORK

134. Low head plants generally use

(A) Pelton turbines

(B) Francis turbines

(C) Kaplan turbines

(D) both (A) and (B)

135. The mmf produced by interpole is proportional to

(A) field current

(B) armature current

(C) armature voltage

(D) 1 / field current

136. During arcing ground conditions, the phase voltage of the system rises to

(A) 15 times its normal value

(B) 10 times its normal value

(C) 5 to 6 times its normal value

(D) $\sqrt{3}$ times its normal value

137. Location of lighting arrester should be near a

(A) generator

(B) transformer

(C) bus-bar

(D) circuit breaker

138. Isolators are capable of breaking

(A) fault current

(B) no current

(C) load current

(D) charging current

139. An equipment has an impedance of 0·9 p.u. to a base of 20 MVA, 33 kV. To the base of 50 MVA, 11 kV, the p.u. impedance will be

(A) 4·7 (B) 20·25

(C) 0·9 (D) 6·75

140. In a system, if the base load is the same as the maximum demand, the load factor will be

(A) 1·0 (B) 0·5

(C) zero (D) infinity

141. The recovery voltage that appears across the circuit breaker contacts will be maximum for power factor of

(A) zero (B) 0·5

(C) 0·707 (D) unity

142. The sag of the conductors of a transmission line is 2·5 m when the span is 250 m. Now if the height of the supporting towers is increased by 25%, the sag will

(A) reduce by 25%

(B) increase by 25%

(C) reduce by 12·5%

(D) remain unchanged

143. At times of peak loads, a power system needs

(A) injection of lagging vars

(B) injection of leading vars

(C) none of (A) and (B)

(D) both of (A) and (B) alternately

SPACE FOR ROUGH WORK

144. Match the items in List I with those of List II and select your answers using the codes given in the lists :

List I *(Type of duty)*	*List II* *(Applications)*
a. Continuous duty	1. Machine tools
b. Short time duty	2. Sirens
c. Continuous duty with intermittent periodic loading	3. Blowers
d. Continuous duty with starting and braking	4. Conveyors

	a	b	c	d
(A)	1	4	3	2
(B)	3	2	4	1
(C)	4	1	2	3
(D)	2	3	1	4

145. If t is the thickness of the sheet, the tip diameter for spot welding is usually

(A) $2t$ (B) $\sqrt{t}$

(C) t (D) $\frac{1}{t}$

146. The colour of light emitted by sodium vapour discharge lamp when glowing steadily, is

(A) pink (B) yellow

(C) bluish green (D) blue

147. The inner surface of a fluorescent tube is coated with a fluorescent material which

(A) absorbs ultraviolet rays and radiates visible rays

(B) reduces glare

(C) improves life

(D) absorbs infra-red rays and radiates visible rays

148. A transistor has a current gain of 0·99 in common base mode. Its current gain in common emitter mode is

(A) 0·99 (B) 99

(C) 10·1 (D) 100

149. In arc welding, once the arc is struck, the voltage required to maintain it will be

(A) (20 – 30) V (B) (100 – 120) V

(C) (200 – 220) V (D) (500 – 1000) V

150. Which of the following surfaces has the lowest reflection factor for white light ?

(A) Aluminium sheets

(B) White plaster work

(C) Blue curtains

(D) White oil paint

SPACE FOR ROUGH WORK

SK 242493 **AV 2011**

GENERAL ENGINEERING / सामान्य इंजीनियरी

PAPER – II / प्रश्न-पत्र – II

Time Allowed : Two Hours] [Maximum Marks : 350
निर्धारित समय : दो घण्टे] [अधिकतम अंक : 350

Attention :

1. *This paper consists of 3 Sections, namely, Section – I (Civil and Structural), Section – II (Mechanical) and Section – III (Electrical). Only one Section is to be attempted as per option given in the Application Form. 12 questions are given in each Section. Candidates should attempt 10 questions in the Section as per their option given in the Application Form. Each candidate will be given one Answer Book.*
2. *Answers to all questions must be written in one language, i.e., either in English or in Hindi according to the option given by the candidate in his/her Application Form. Candidates are not allowed to write the answers partly in English and partly in Hindi.*
3. *Candidates must write their Name, Roll No., Ticket No., Name of the Examination and Subject, at the prescribed place, on the cover page of the Answer Book correctly. Candidates must also put their signature on the cover page at the prescribed place. The above instructions must be fully complied with failing which the Answer Book will not be evaluated and zero mark will be awarded.*
4. *No credit will be given for answers written in a language other than the one opted by the candidate.*
5. *Necessary tables of IS 456 : 2000 Code of Practice are given at the end of Section – I for use of candidates attempting Civil and Structural Section.*

ध्यान दीजिए :

1. इस प्रश्न-पत्र में 3 खंड नामत: खंड – I (सिविल एवं संरचनात्मक), खंड – II (यांत्रिक) और खंड – III (वैद्युत) शामिल हैं। आवेदन के प्रपत्र में दिए गए विकल्प के अनुसार सिर्फ एक खंड का ही उत्तर दिया जाना है। प्रत्येक खंड में 12 प्रश्न दिए गए हैं। अभ्यर्थियों को आवेदन प्रपत्र में दिए गए विकल्प के अनुसार उस खंड में 10 प्रश्नों के उत्तर देने चाहिए। प्रत्येक अभ्यर्थी को एक उत्तर पत्रक दिया जाएगा।
2. सभी प्रश्नों के उत्तर अभ्यर्थी द्वारा अपने आवेदन-पत्र में दिए गए विकल्प के अनुसार किसी एक भाषा में अर्थात् अंग्रेजी या हिन्दी में, दिए जाने चाहिए। अभ्यर्थियों को कुछ उत्तर अंग्रेजी में और कुछ उत्तर हिन्दी में लिखने की अनुमति नहीं है।
3. अभ्यर्थी उत्तर-पुस्तिका के आवरण पृष्ठ पर निर्धारित स्थान में अपना नाम, रोल नंबर, टिकट नंबर, परीक्षा का नाम तथा विषय सही-सही अवश्य लिखें। अभ्यर्थी आवरण पृष्ठ पर निर्धारित स्थान में अपने हस्ताक्षर भी अवश्य करें। उपर्युक्त अनुदेशों का पूरी तरह अनुपालन किया जाए, अन्यथा उत्तर-पुस्तिका को नहीं जाँचा जाएगा और शून्य अंक दे दिया जाएगा।
4. अभ्यर्थी द्वारा दिए गए विकल्प की भाषा के अतिरिक्त किसी अन्य भाषा में दिए गए उत्तरों के लिए कोई अंक नहीं दिए जाएँगे।
5. सिविल एवं संरचनात्मक खंड की परीक्षा देने वाले अभ्यर्थियों के प्रयोग के लिए आई.एस. 456 : 2000 प्रेक्टिस कोड की आवश्यक सारणियाँ खंड – I के अन्त में दी गई हैं।

[P.T.O.

SECTION – I
(Civil and Structural)

1. (a) An embankment is 16 m wide with side slopes 2 : 1. Assume the ground to be level in the direction transverse to the centre line. Calculate the volume contained in a length of 100 m, the centre height at 20 m intervals being in m 2·0, 4·5, 4·0, 3·5, 2·5, 1·5. Use trapezoidal rule. 20

   (b) State the Principal requirements of an Ideal Permanent way. 15

2. (a) Give a list on preventive measures of Water-logging and explain any two of them in detail. 15

   (b) A saturated soil stratum 5 m thick lies above an impervious stratum and below a pervious stratum. It has a compression index of 0·25 and a co-efficient of permeability of $3{\cdot}2 \times 10^{-4}$ cm/sec. Its void ratio at a stress of 1·5 kg/cm^2 is 1·9. Compute : (i) change in void ratio due to increase of stress to 2 kg/cm^2 (ii) settlement of the soil strata due to the above increase in stress (iii) time required for 50% consolidation, and the time factor for 50% consolidation may be assumed to be 0·2. 20

3. (a) Time taken for construction of a building above ground level was from April 2004 to September 2005. In September 2008, the average settlement was found to be 6 cm. Estimate the settlement in January 2010 if it was known that ultimate settlement will be 15 cm. 20

   (b) An oil of kinematic viscosity 0·4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 lit/sec. Find the head lost due to friction for a length of 50 m of the pipe. 15

4. (a) List down any eight important air pollutants and their principal sources. 20

   (b) Write a brief note on different forms of Water pollution. 15

5. (a) Estimate the quantity and cost of earthwork for a road between two stations *A* to *B* with the following data :

   Width of the road is 10 m at formation surface and side slope 2 : 1. Rate for earthwork in banking and cutting may be taken as ₹ 10.00 per cu. m. including a lead up to 150 m with a condition that portion of earthwork available from cutting is to be utilized for banking within the same lead of 150 m. The data of field book for the portion of road are as below :

Chainage	0	1	2	3	4	5	6
Reduced level	123·90	125·00	124·60	122·90	121·60	121·00	120·40
Formation level	123·20	123·60	124·00	123·60	123·20	122·80	122·40

   (*Note* : one chain = 30 m) 20

   (b) Define Valuation and explain the difference between Value and Cost. 15

6. (a) Write a brief note on Kiln and Water seasoning of timber. 20

   (b) What is Industrial timber ? Mention the various forms of industrial timber and highlight the uses of each form. 15

7. (a) What are the factors needed to be considered in the design of concrete mixes ? 20

   (b) Why is curing important ? Describe in brief various methods of curing. 15

8. (a) Make an account on classification of aggregates. 15

(b) Design a rectangular beam at midspan having 3 m simply supported clear span. It is subjected to a dead load of 20 kN/m and a live load of 25 kN/m. Assume suitable data. 20

9. (a) Design a beam of effective span 6 m to support a total design load of 12 kN/m including the self weight of the beam using limit state method of design. Width of the beam is to be limited to 250 mm. Load factor for live load and dead load is 1·5. M 15 concrete and Fe 415 steel are to be used. 20

(b) List the qualities of an Ideal aggregate. 15

10. (a) An unequal angle section 200 mm × 150 mm × 15 mm is to be used in a truss as a strut of length 4·5 m. The cross-sectional properties of the section are as follows :

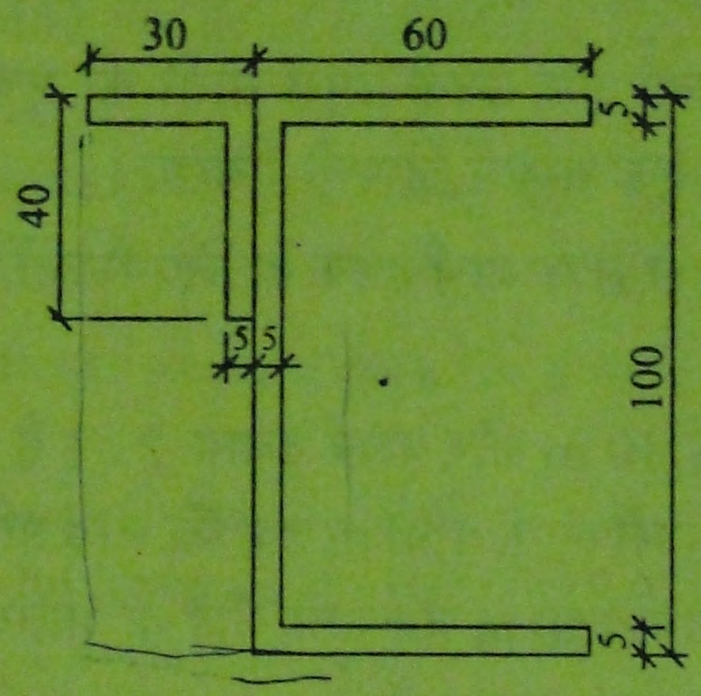
Area of cross-section = 5025 mm^2

$I_{xx} = 2 \times 10^7\ mm^4$; $I_{yy} = 9{\cdot}7 \times 10^6\ mm^4$; $I_{xy} = -8{\cdot}3 \times 10^6\ mm^4$ using the table of permissible compressive stresses given below, determine the safe load on the number. 20

Slenderness Ratio	10	11	12	13	14	15	16	17	18
Permissible Compressive Stress (MPa)	80	72	64	57	51	45	41	37	33

(b) Explain the concept of under-reinforced, over-reinforced and balanced RCC section. 15

11.

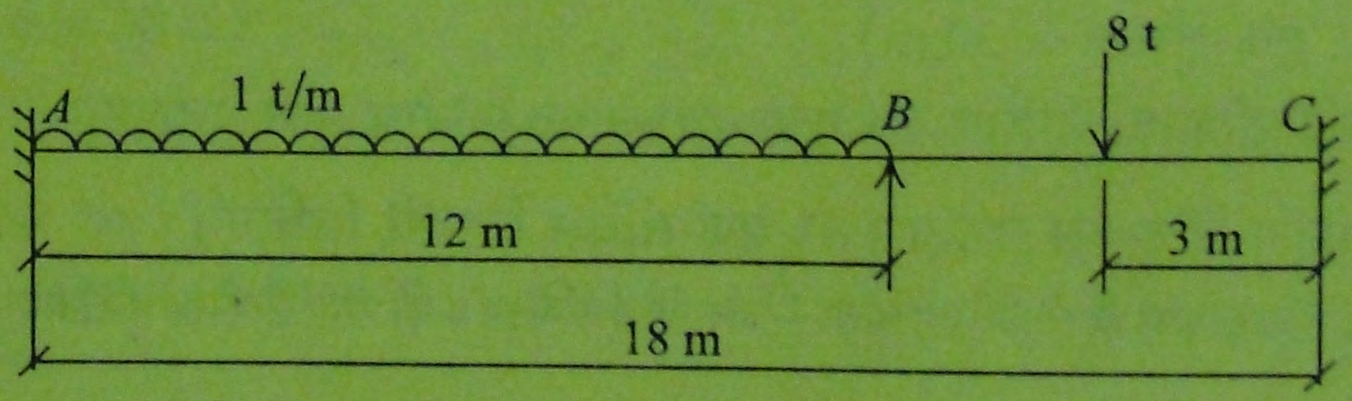


The combined angle and channel section shown in the above figure forms part of a crane runway beam. For that calculate :

(i) Coordinates of the centroid (ii) Second moment of area about X-X

(iii) Second moment of area about Y-Y (iv) Product of inertia about O 35

12.



In the continuous beam *ABC* shown in the above figure, the support *B* sinks by 10 mm relative to *A* and *C*. Calculate the support moments using moment distribution method and sketch the moment diagram. Assume $EI = 6000\ tfm^2$. 35

SECTION – II
(Mechanical)

1. (a) 3 kg of an ideal gas is compressed adiabatically, from $p_1 = 1\ kg_f/cm^2$ and $t_1 = 20°C$ to a final pressure of $4\ kg_f/cm^2$; calculate :

   (i) Initial volume

   (ii) Final volume

   (iii) Final temperature

   (iv) Work performed

   (v) Heat transfer from the system. 20

   (b) 300 kJ/s of heat is supplied at a constant fixed temperature of 290°C to a heat engine. The heat rejection takes place at 8·5°C. The following results were obtained :

   (i) 215 kJ/s are rejected

   (ii) 150 kJ/s are rejected

   (iii) 75 kJ/s are rejected

   Classify which of the result report a Reversible cycle or Irreversible cycle or Impossible cycle. 15

2. (a) Explain working of the Cochran Boiler, showing its constructional details. 15

   (b) Using Steam table, determine the mass of $0·15\ m^3$ of wet steam at a pressure of 4 bar and dryness factor 0·8. Also calculate the heat of $1\ m^3$ of steam. 20

3. (a) Explain Diesel power cycle, showing various Processes, Heat added, Heat rejected and Work done on P-V and T-S diagram. 20

   (b) What is Normal combustion in IC engines ? Also explain, Combustion phenomenon of SI engines. 15

4. (a) Showing various processes of the Rankine cycle, explain its working. 15

   (b) What are the parameters with which performances of the following (working between two temperature limits), are measured.

   (i) Heat engine,

   (ii) Refrigerator, and

   (iii) Heat pump.

   Also find out relationship, if any, between this parameter of Refrigerator and that of Heat pump (working between two temperature limits). 20

5. (a) What is Pressure measurement ? Differentiate between

(i) Atmospheric Pressure,

(ii) Gauge Pressure,

(iii) Absolute Pressure, and

(iv) Vacuum Pressure,

with example. 20

(b) What is Hydraulic Turbine ? Show important Classifications of Turbines, based on various consideration. 15

6. (a) What is the principle of Centrifugal pump ? What are the important components of a Centrifugal pump ? Showing their arrangement, explain the functions of these components in brief. 20

(b) What is Stream line and Path line in a Fluid flow ? Explaining importance of Reynold's number, differentiate between Laminar and Turbulent flow. 15

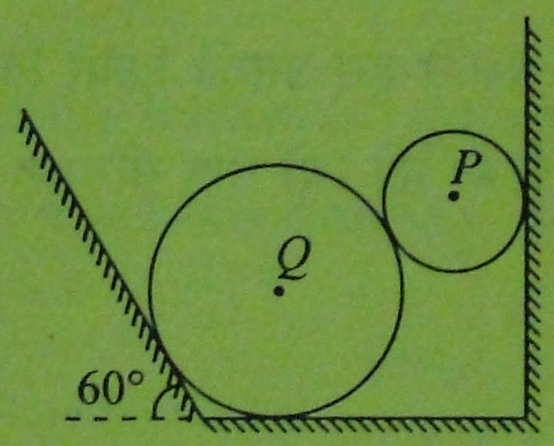
7. (a) Explain the Lame's Theory and its assumptions for stress distribution in thick cylinder shells. 15

(b) A solid shaft of aluminium of length 1·5 m and of 60 mm diameter is to be replaced by a tubular steel shaft of the same length and the same outside diameter, such that each of the two shafts have the same angle of twist per unit torsional moment over the total length. Determine the inner diameter of the tubular steel shaft, if the modulus of rigidity of steel is three times that of aluminium. 20

8. (a) Determine Euler's crippling load for a structural element of an I-section 8 m long that is used as a strut with both end fixed.

(Take $E = 2 \times 10^5$ N/mm^2, the section $I_{xx} = 23426{\cdot}7$ cm^4, $I_{yy} = 1388{\cdot}0$ cm^4) 20

(b)



Two cylinders P and Q rest in a channel as shown in the above figure. The cylinder P has diameter of 100 mm and weighs 200 N, whereas the cylinder Q has diameter of 180 mm and weighs 500 N. If the bottom width of the channel is 180 mm and with one side vertical and other side inclined at 60°, determine the pressure at all the four points of contact. 15

9. (a) Write brief note on Normalizing heat treatment process. 15

(b) With the help of neat sketch describe Metal inert gas welding process. 20

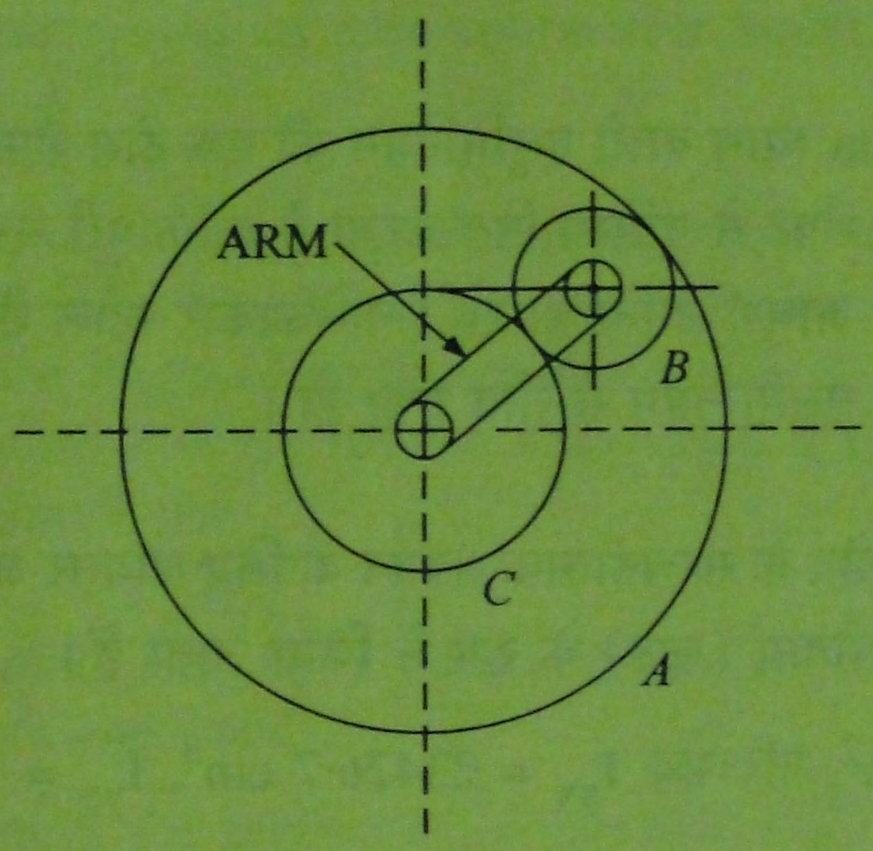
10. (a) Describe Die casting process and with the help of neat sketch differentiate among cold chamber, hot chamber and injection moulding processes. 20

(b) Discuss the different defects in butt welding and various bend tests for welded specimen. 15

11. (a) An axial thrust on a flat bearing is 7500 N. The coefficient of friction between the contacting surfaces is 0·10. If the diameter of the shaft is 150 mm and it rotates at 180 rpm what frictional power is lost at the bearing when, (a) the pressure is assumed to be uniform, and (b) rate of wear is assumed to be uniform ? 20

(b) Compare between a flywheel and mechanical governor. 15

12. (a)

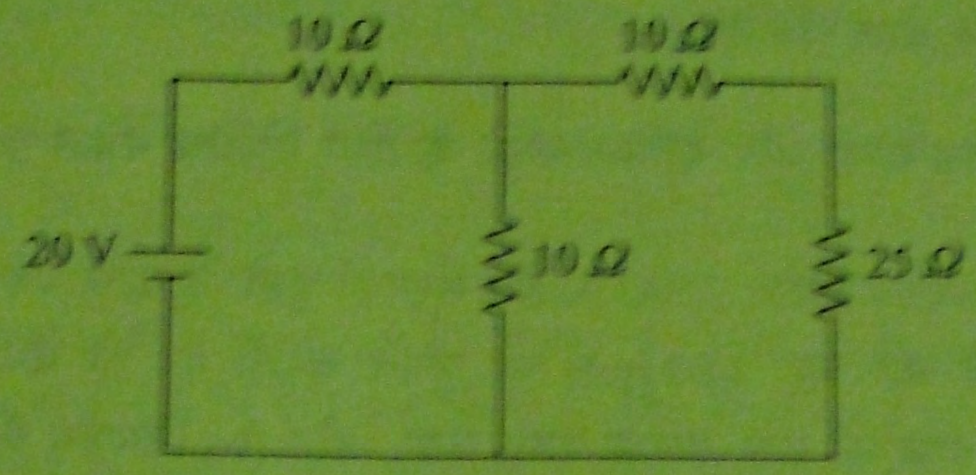


An Epicyclic gear train consist of three wheels; *A*, *B* and *C* as shown in the above figure. Wheel *A* has 72 internal teeth, *C* has 32 external teeth. The gear *B* gears with both *A* and *C* which is carried on arm that rotates about the centre of *A* at 18 rpm. If the wheel *A* is fixed, determine the speed of wheel *B* and *C*. 20

(b) Classify the cam followers on the basis of their shape of contact end with the cam and also compare the merit and demerit of each other. 15

SECTION – III
(Electrical)

1.



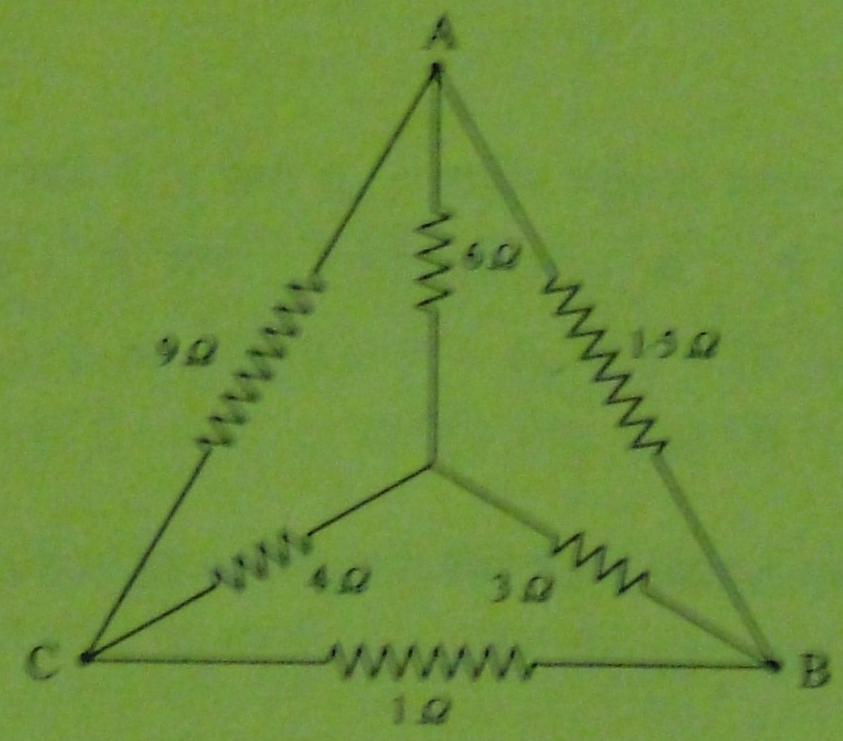
State Thevenin's Theorem. Determine the current through and voltage across the 25 Ω resistor as shown in the above figure using Thevenin's Theorem. 35

2. A coil of 500 turns and resistance of 20 Ω 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. The relative permeability of the material is 800.

Find (i) MMF (ii) Magnetising force (iii) Total flux (iv) Reluctance 35

3. Derive an expression for the resonant frequency of parallel resonant circuit, one branch consisting of inductance L and resistance R and the other branch capacitor C. Also draw the phasor diagram for the same. 35

4.



A network of resistors is shown in the above figure. Find the resistance between terminals *A* and *B*. 35

5. Two wattmeter method is used for the measurement of total power in a balanced circuit supplied from 400 V, 50 Hz, 3 phase balanced supply. Calculate the total power, line current, power factor of the load. If

   (i) both readings are 4 kW each.

   (ii) both readings are 4 kW but have opposite signs.

   (iii) one reading is 4 kW and other reading is zero. 35

6. Two ammeters, one with a current scale of 10 A and resistance of 0·01 Ω and the other with a current scale of 15 A and resistance of 0·005 Ω are connected in parallel. What can be the maximum current carried by this parallel combination so that no meter reading goes out of scale ? 35

7. Derive the e.m.f. equation of D.C. machine. Also explain the significance of back e.m.f. 35

8. A single phase transformer working at unity power factor has an efficiency of 90% at both half load and at the full load of 500 W. Determine the efficiency at 75% full load and the maximum efficiency. 35

9. Explain the principle of operation of single phase induction motor. Why single phase induction motor is not self starting ? 35

10. Define and explain the following terms as applied to protective relaying :

   (i) Pick-up value

   (ii) Current setting

   (iii) Plug setting multiplier

   (iv) Time setting multiplier 35

11. A generating station has a maximum demand of 25 MW, a load factor of 60%, a plant capacity factor of 50%, and a plant use factor of 72%. Find (i) the reserve capacity of the plant (ii) the daily energy produced (iii) maximum energy that could be produced daily if the plant while running as per schedule, were fully loaded. 35

12. Discuss the laws of illumination and its limitations in actual practice. 35