

**SECTION – A**

There are **FOUR** questions in this section. Answer any **THREE**.

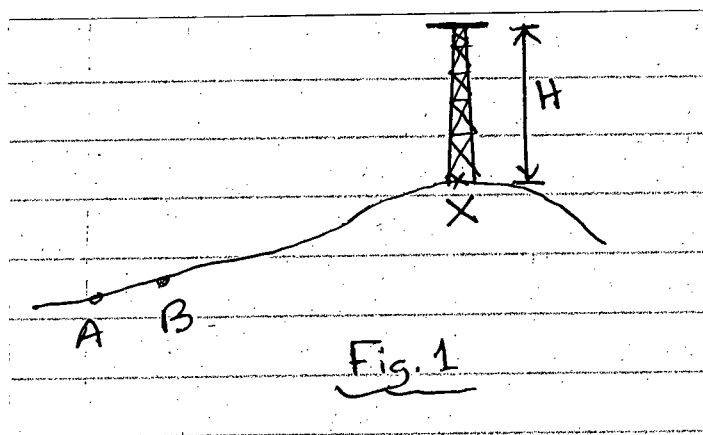
Assume reasonable value of missing data, only if necessary.

1. (a) Distinguish between (answer any two) (8×2=16)
- (i) Apparent solar day & sidereal day
  - (ii) Celestial north pole & North point
  - (iii) Spherical side and spherical angle
- Show neat sketches where applicable.
- (b) What is the shortest distance between two points on the surface of earth? Calculate the shortest distance between two point A(80°E, 70°N) and B(100°W, 20°S). (8)
- (c) The altitude of the sun's lower limb at local apparent noon (LAT = 12 pm) was measured to be 80°45'30". Apply all necessary astronomical corrections (assuming no instrumental corrections) to determine the true altitude of the sun. The sun is located to the south of Zenith. Hence, determine the latitude of the place of observation. Also show the lower transit of sun in your figure. Nautical Almanac gives the following information for the time of observation: (16)
- Declination of sun = 20°S, semi-diameter of sun = 16'0", Horizontal parallax of sun = 8.8".
- (d) With neat sketches, describe the coordinate system which is independent of observer's position. (6<sup>2</sup>/<sub>3</sub>)
2. (a) Why do you need to apply prismatic correction? Derive an expression of prismatic correction for two-level section. Show neat diagram. (16<sup>2</sup>/<sub>3</sub>)
- (b) Staff readings are taken at station C from two theodolite stations A and B. Also vertical angles are taken to the top and bottom of a transmission tower at X. If horizontal distance AB = 100 ft and points A, B, X lie in same vertical plane, determine the height of tower 'H' (Fig. 1) using the information below. Also mention the differences of elevation between points C and X. (18)

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**Contd... Q. No. 2(b)**

Theodolite Station	Vertical Angle	Object	Staff Reading (ft)
A	0°	Staff at C	3.2
A	30°	Top of Tower at X	—
A	18°	Base of Tower at X	—
B	0°	Staff at C	4.7
B	33°	Top of Tower at X	—



- (c) State Pappus theorem. Hence derive an expression for curvature correction to volume. Is it positive or negative? Discuss. How do you apply this correction when cross-sectional area varies? (12)
3. (a) With the help of a schematic diagram, define level surface, horizontal plane, vertical line, elevation. (8)
- (b) Compare between the relative merits of self-reading staff and target staff. What are the defects of using a single lens as the objective lens of a telescope? (6+5=11)
- (c) List the characteristics of contours. (10 <sup>2</sup>/<sub>3</sub>)
- (d) Write down the sources of natural and personal errors in levelling. With the help of required figures, show that error in staff reading due to curvature of earth surface is approximately 8 inches for first mile. (5+12=17)
4. (a) Describe the basic principles of GPS with proper sketches. (6)
- (b) Define (answer any four): (4×3=12)
- (i) Compensating error (ii) Residual error (iii) Sounding (iv) Magnetic declination
- (v) Open traverse (vi) Departure.
- (c) Describe any two methods briefly of plane tabling with proper sketches. (14 <sup>2</sup>/<sub>3</sub>)

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**Contd... Q. No. 4**

(d) A tacheometer is set up at an intermediate point on a traverse course PQ and the following observations are made on a vertically held staff? (14)

Staff station	Vertical angle	Staff intercept (m)	Axial hair readings, (m)
P	+ 8°36'	2.350	2.105
Q	+ 6°	2.055	1.895

Compute the length PQ and R.L. of Q. R.L. of P is 321.5 m. The tacheometric constants are 100 and 0.3.

**SECTION – B**

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What are the functions of a Transition Curve? Make a list of the elements of a Circular Curve. (4+5=9)
- (b) What are the important considerations in selecting the stations for Chain-Survey? Write short notes on chaining along sloping ground. (7+6=13)
- (c) Make a list of various sources of errors in Chain survey. A steel tape of 100 ft length, standardized at 30 lb pull, was used in the field with a pull of 40 lbs. The cross sectional area of the tape and Young's Modulus of steel are 0.025 sq. inch and  $30 \times 10^6$  psi respectively. A ground distance was measured as 450 ft with this tape. What is the accurate ground distance? (4+8=12)
- (d) To test the line of collimation of a Dumpy level, the instrument was placed at C, exactly at mid-way between two points A and B, 250 ft apart. The staff readings at A and B were 5.82 ft and 3.46 ft respectively. The instrument was then placed at D, 50 ft behind B, in the same straight line and the staff readings at A and B were 5.12 ft and 2.86 ft respectively. Find the correct staff readings at A and B from level station D. (12  $\frac{2}{3}$ )
6. (a) Define Photogrammetry. What are the three most important requirements during flying of an aircraft for the purpose of Aerial Photogrammetry? (2+3=5)
- (b) In case of Terrestrial Photogrammetry, briefly describe the principle involved in plotting of a point whose images have been taken from two camera stations. (13)

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**Contd... Q. No. 6**

(c) An area is 25 miles long and 20 miles wide. It is to be photographed with a lens having 10 inch focal length for the purpose of compiling a topographic map. The photograph is 7 inch by 7 inch. The average scale is to be 1 : 8000 effective at an average elevation of 500 ft above sea level. The overlaps of the images are to be at least 60%. Determine the flying height, Exposure interval rounded to integer number of seconds and Ground distance between exposures.

(12)

(d) The following is a page of a Level Book. The level was set at a chainage of 00-10,000. First, calculate the missing data in the table. Then, apply only curvature correction and complete the entire table with corrected values. Show necessary calculations and checks. All data are in feet unit.

(16<sup>2</sup>/<sub>3</sub>)

Chainage (ft)	Back Sight	Intermediate Sight	Fore Sight	Rise	Fall	Reduce Level	Remarks
00+00	4.65					100.00	B.M.
00+1000		3.52					
00+2000						103.50	
00+3000	6.20		7.90				T.P
00+4000						101.50	
Total							

7. (a) What is local attraction? Give a short description of a method for detecting local attraction.

(2+5=7)

(b) the following fore and back bearings were observed in traversing with a compass in place where local attraction is suspected. Find the corrected fore and back bearings and the true bearing of each line given that the magnetic declination was 10°W.

(15)

Line	F.B.	B.B.	Line	F.B.	B.B.
AB	38°30'	219°15'	CD	25°45'	207°15'
BC	100°45'	278°30'	DE	325°15'	145°15'

(c) What is closing error? Plot the following compass traverse with suitable scale and adjust it for closing error by graphical method.

(15<sup>2</sup>/<sub>3</sub>)

Line	Length (m)	Bearing
AB	130	S 88° E
BC	158	S 6° E
CD	145	S 40° W
DE	308	N 81° W
EA	337	N 48° E

(d) How will you determine the tacheometric constants by field observations?

(6)

(e) What do you mean by Remote Sensing and GIS?

(3)

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8. (a) The following lengths and bearings were recorded in running a Theodolite traverse in the counter clockwise direction. The length of CD and Bearing of DE are missing. Determine the missing data. (10 <sup>2</sup>/<sub>3</sub>)

Line	Length (m)	R.B.
AB	281.4	S 69°11' E
BC	129.4	N 21°49' E
CD	??	N 19°34' W
DE	144.5	??
EA	168.7	S 74°24' E

- (b) Two sets of tacheometric readings were taken from an instrument station A to a staff station B. The reduced level of A is 100.06 m. (14)

Instrument P- Constants are 100 and 0.06 m; staff held vertically to the line of sight

Instrument Q- Constants are 90 and 0.06 m; staff held vertically to the line of sight

Instrument	At	To	Height of Instrument, m	Stadia readings, m	Vertical Angle
P	A	B	1.5	0.755, 1.005, 1.255	26°
Q	A	B	1.45	?, ?, ?	26°

- (c) Make a list of various methods of measuring a linear distance directly. With the help of a figure, show that for an Optical Square to perform its function, two internal mirrors are to be placed at an angle of 45°. (3+9=12)

- (d) List the factors influencing the location and configuration of the alignment of a horizontal curve. What are the principle requirements of a Magnetic Needle? (6+4=10)

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**SECTION-A**

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Explain the statement "Charge is conserved". (9)
- (b) Define electric field and an electric dipole. Derive an expression for the electric field at a point on the axis of a circular ring of charge 'q'. (20)
- (c) Calculate the intensity of the m (i) along its axis and (ii) on the perpendicular bisector of the axis from the centre of the dipole. ( $\epsilon_0 = 8.9 \times 10^{-12} \text{ C/N}^{-\text{m}^2}$ ). (6)
  
2. (a) Derive the expressions for electric field due to an electric dipole of dipole moment  $4.5 \times 10^{-10} \text{ C-m}$  at a distance of 1.0 the growth and decay of charges when a capacitor is charged by a DC source and discharged respectively through a resistor. What is capacitive time constant? (28)
- (b) A  $1.0 \mu\text{F}$  capacitor is allowed to discharge through an unknown resistor. If the charge on the capacitor takes 34.65 s to drop to half of its original value, calculate the value of the resistor. (7)
  
3. (a) State and explain Biot-Savart law. How does this law differ from Ampere's law? (12)
- (b) Find magnetic field induction 'B' due to a current  $i$  in a long cylindrical wire applying Biot-Savart law. (16)
- (c) A long straight wire carries a current of 20A. An electron traveling at  $1 \times 10^7 \text{ m/s}$  is 2.0 cm from the wire. What force acts on the electron if its motion is (i) towards the wire and (ii) parallel to the wire. ( $\mu_0 = 4\pi \times 10^{-7} \text{ wb/A-m}$ ). (7)
  
4. (a) Classify Bravais lattices in three dimensions. (15)
- (b) What do you understand by Miller indices? Describe the procedure to find out Miller indices of a lattice plane. (10)
- (c) In an orthorhombic type of crystal the primitive vectors are  $1.31\text{\AA}$ ,  $2.15\text{\AA}$  and  $1.26\text{\AA}$ . What are the intercepts of a plane (32T) along x- and y-axis? (10)

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**SECTION-B**

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Derive Bragg's law for X-ray diffraction. Why normal light cannot be used instead of X-ray photons to characterize a crystal? (15)
- (b) The Bragg angle for the 3<sup>rd</sup> order reflection from the (101) plane of a bcc crystal is 16.7°. If the lattice parameter of the crystal is 3.21 Å, what will be the wavelength of X-ray's? (10)
- (c) Distinguish between ionic and metallic bonds in solid. (10)
6. (a) Describe briefly different types of crystal defects. Write down the name of some physical properties which are influence by defects. (15)
- (b) Explain different types of semiconductors. (15)
- (c) A material has an fcc type of crystal structure with the atomic mass 26.98 a.m.u. and the lattice constant 2.863 Å. Find out the density of the material in C.G.S. unit. (5)
7. (a) Explain the term relativity of simultaneity. (7)
- (b) Using Michelson-Morley experiment show that there is no existence of ether. (20)
- (c) A radioactive substance contain 2 mg of Th<sup>232</sup>. It emits  $2 \times 10^6$   $\alpha$ - particles per second in all directions. Calculate the half-life of thorium. (8)
8. (a) Write a short note on 'automatic bell alarm circuit' with diagram. (8)
- (b) Show that the wavelength of a scattered photon is greater than that of incident photon in Compton effect. (22)
- (c) Calculate the wave number of a moving electron through a potential difference of 100V. (5)
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**SECTION – A**There are **FOUR** questions in this section.Answer any **THREE** including **Q. No. 1** as compulsory.

1. (a) Explain with reference to the context any one of the following: (8)
- (i) "I despise freedom and life and health, and all that in your books is called the good things of the world."
- (ii) They not only refrained from attacking my men, but rose on their hind legs to caress them.
- (b) Answer any one of the following questions: (10)
- (i) Who is responsible for the disaster of the family in "The Diamond Necklace", Mr. Or Mrs. Loisel? Justify your stand.
- (ii) What changes do you find eventually in the two main characters of the story "The Bet"?
- (c) Answer any three of the following: (12)
- (i) How do you find Odysseus as a leader?
- (ii) 'All these things which another women of her situation would not have noticed, tortured and angered her'— why?
- (iii) How did Circe exercise her magic power?
- (iv) What was the lawyer's opinion about capital punishment?
- (v) Who is Mrs. Forestier? What role does she play in "The Diamond Necklace"?
2. Recast and correct any ten of the following sentences: (20)
- (i) Rizwan likes to swim, playing tennis, and riding.
- (ii) The mechanic tuned the motor up.
- (iii) Soup and salad are too light a lunch.
- (iv) It was a proved answer to the problem.
- (v) The high jumper put forth an extra strong effort.
- (vi) That picture is highly invaluable.
- (vii) Lobster tails are the first item on the menu.
- (viii) Its a long way home.
- (ix) Our teacher told us that in France they eat horsemeat.
- (x) Hasib played good in every game.
- (xi) The guard didn't barely touch the player.
- (xii) We are certain that he will get over his illness.



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3. (a) Write down meaning of any ten of the following words: (10)  
Admonish, brittle, castigate, commend, deride, diffidence, dispatch, enervate, exasperate, fret, hoe, indictment.
- (b) Make sentences with any ten of the following words: (10)  
Limpid, intricate, meticulous, perilous, precept, quell, quest, reiterate, relapse, sinuous, skim, surmise.
4. (a) Write a precis of the following passage with a suitable title: (20)  
The man who is perpetually hesitating which of the two things he will do first, will do neither. The man who resolves, but suffers his resolution to be changed by the first counter-suggestions of a friend, who fluctuates from opinion to opinion, from plan to plan, and veers like a weather-cock to every point of the compass, with every breath of caprice that blows — can never accomplish anything great or useful. Instead of being progressive in anything, he will be at best stationary, and more probably retrograde in all. It is only the man who first consults wisely, then resolves firmly, and then executes his purpose with flexible perseverance, undismayed by those petty difficulties which daunt a weaker spirit, that can advance to eminence in any line. Take your course wisely, but firmly; and having taken it, hold upon it with heroic resolution, and the Alps and Pyrenees will sink before you.

**SECTION – B**

There are **FOUR** questions in this section.

Answer any **THREE** including **Q. No. 5** as compulsory.

5. Read the following passage carefully and answer the questions that follows: (30)  
Dreams have always held an universal fascination. Some primitive societies believe that the soul leaves the body and visits the scene of the dream. Generally, however, dreams are accepted to be illusions, having much in common with daydreams the fantasies of our waking life. When dreaming, however, one tends to believe fully in the reality of the dream world, however inconsistent, illogical and odd it may be.  
Although most dreams apparently happen spontaneously, dream activity may be provoked by external influences. 'Suffocation' dreams are connected with the breathing difficulties of a heavy cold, for instance. Internal disorders such as indigestion can cause vivid dreams, and dreams of racing fire engines may be caused by the ringing of an alarm bell.

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**Contd... Q. No. 5**

Experiments have been carried out to investigate the connection between deliberately inflicted pain and dreaming. For example, a sleeper pricked with a pin perhaps dreams of fighting a battle and receiving a severe sword wound. Although the dream is stimulated by the physical discomfort, the actual events of the dream depend on the associations of the discomfort in the mind of the sleeper.

People differ greatly in their claims to dreaming. Some say they dream every night, others only very occasionally. Individual differences probably exist, but some people immediately forget dreams and others have good recall.

Superstition and magical practices thrive on the supposed power of dreams to foretell the future. Instances of dreams which have later turned out to be prophetic have often been recorded, some by men of the highest intellectual integrity. Although it is better to keep open mind on the subject, it is true that the alleged power of dreams to predict future events still remains unproved.

Even one knows that a sleeping dog often behaves as though he/she were dreaming, but it is impossible to tell what his whines and twitches really mean. By analogy with human experience, however, it is reasonable to suppose that at least the higher animals are capable of dreaming.

According to Freud, we revert in our dreams to the modes of thought characteristic of early childhood. Our thinking becomes concrete, pictorial and non-logical, and expresses ideas and wishes we were no longer conscious of. Dreams are absurd and unaccountable because our conscious mind, not willing to acknowledge our subconscious ideas, disguises them. Some of Freud's interpretations are extremely fanciful, but there is almost certainly some truth in his view that dreams express the subconscious mind.

Questions:

- (i) Why are dreams absurd and unaccountable?
- (ii) To what do we revert in our dreams?
- (iii) What do superstition and magical practices do?
- (iv) What does one believe when dreaming?
- (v) Why have experiments been carried out?

6. (a) As the Manager of a big departmental store you have received from one of your customers, a letter of complain about incivility and inattention when he visited your store. Draft a reply, expressing regret and promising full investigation. (10)

(b) Write phonetic transcription of the following words (any five) (10)

unique, local, student, nature, think, human

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7. (a) Write a dialogue between you and your friend about the gradual decline of moral values and ethics from our society. **(10)**
- (b) Write a short composition on any one of the following: **(10)**
- (i) World Heritage Sites located in Bangladesh.
  - (ii) Recreation: a tension-free life.
  - (iii) Your favourite author.
8. (a) Transform the following sentences as directed (any five): **(10)**
- (i) He finished his exercise and put away his books. ( Simple)
  - (ii) The moment which is lost is lost for ever. (Simple)
  - (iii) You have succeeded beyond your hopes. (Compound)
  - (iv) Waste not, want not. (Complex)
  - (v) If you do not hurry, you will miss the train. (Compound)
  - (vi) We must eat to live. (Compound)
- (b) Write short notes on any two of the following: **(10)**
- (i) Paragraph Developers;
  - (ii) The Diphthongs;
  - (ii) Adjustment letter.
-

**SECTION - A**

There are **FOUR** questions in this section. Answer any **THREE**.

All symbols have their usual meanings.

1. (a) Find  $v_x(t)$  for the following circuit:

(20)

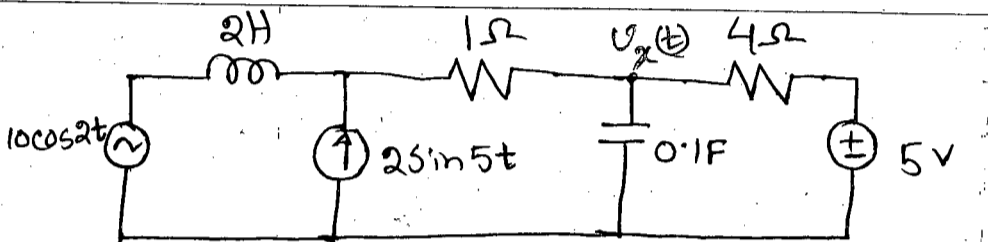


Fig. for Ques. no. 1(a)

(b) The waveforms of voltage and current of a series AC circuit is given below. Find out the impedance, resistance, reactance, real power, reactive power and apparent power of the circuit.

(15)

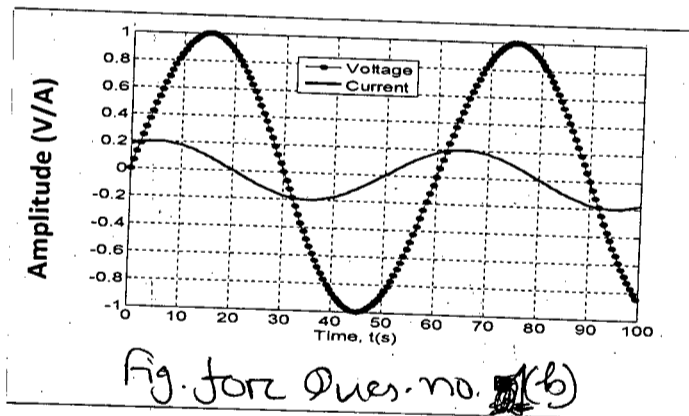


Fig. for Ques. no. 1(b)

2. (a) Determine the load impedance  $Z_L$  that would maximize the average power drawn from the circuit. Find the maximum average power.

(20)

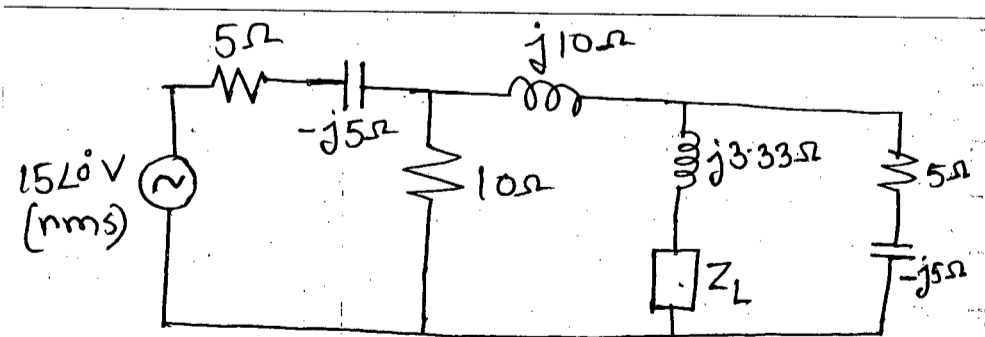
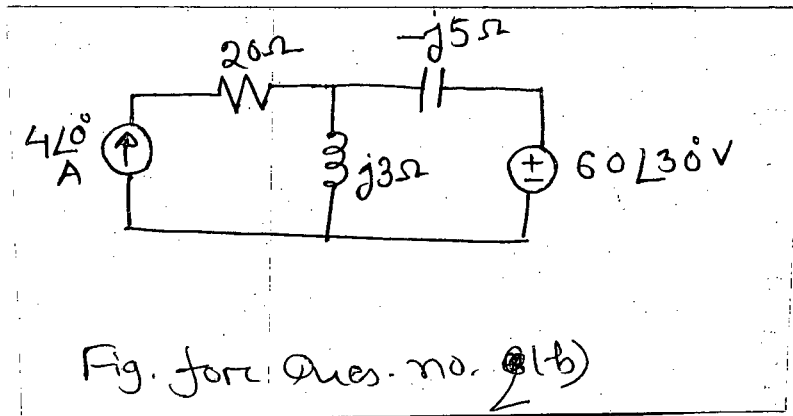


Fig. for Ques. no. 2(a)

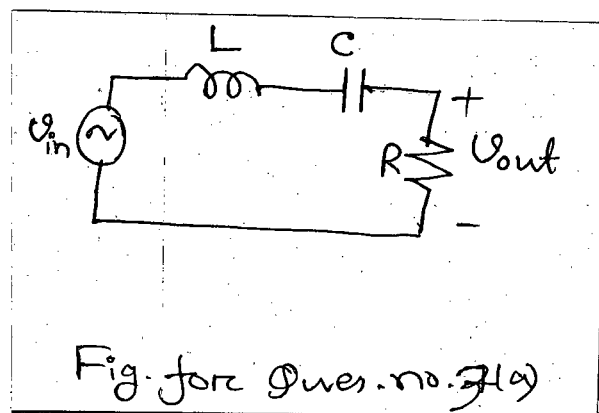
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**Contd... Q. No. 2**

(b) For the following circuit, determine real and reactive power for all the active and passive elements. Hence show that both real and reactive power are conserved. (15)



3. (a) For the following circuit, find the expression of voltage gain as a function of frequency. Sketch gain vs frequency plot. (15)



Also, prove that  $\omega_0 = \sqrt{\omega_1 \omega_2}$ , where  $\omega_0$  = Center frequency,  $\omega_1$  = Lower cutoff frequency,  $\omega_2$  = Higher cutoff frequency

(b) It is required to design a notch filter to eliminate the power line hum at 50 Hz. If the desired quality factor is 25, determine the value of all the parameters of the notch filter. (10)

(c) Show that, a three phase three wire system is 25% more economical in terms of copper saving compared to a similar single-phase two wire system. (10)

4. (a) For the following Y-Δ system, determine— (15)

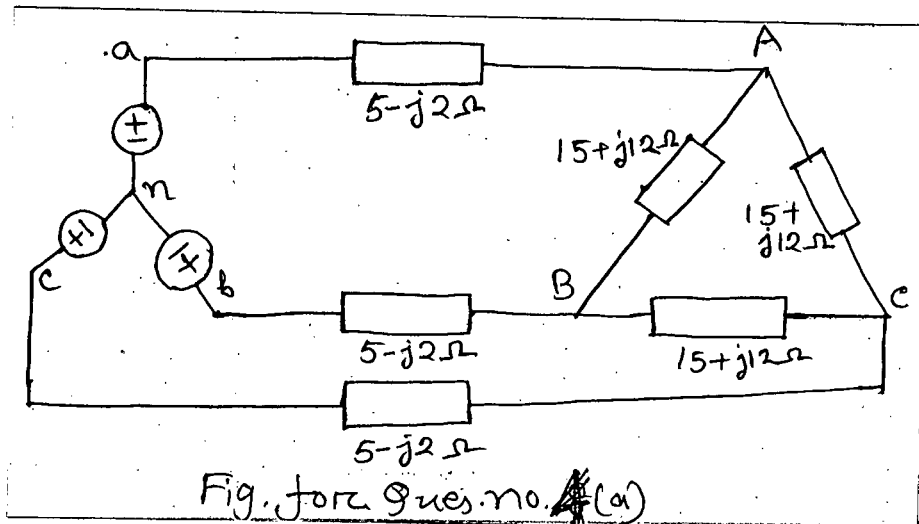
(i) Sending end line voltage,  $V_{ab}$ ,  $V_{bc}$ ,  $V_{ca}$

(ii) Receiving end line voltage,  $V_{AB}$ ,  $V_{BC}$ ,  $V_{CA}$ .

Assume, abc phase sequence and  $V_{an} = 230\angle 0^\circ$  V.

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**Contd... Q. No. 4(a)**



(b) A 3-phase motor takes 10 KVA at 0.6 power factor lagging from a source of 220 V. It is in parallel with a balanced delta load having  $16-j12 \Omega$  impedance in each phase. Find the power factor of the combined load, line current and total complex power. Determine the value of the reactive components required to improve the overall power factor to 0.988. What will be the line current at improved power factor condition?

(20)

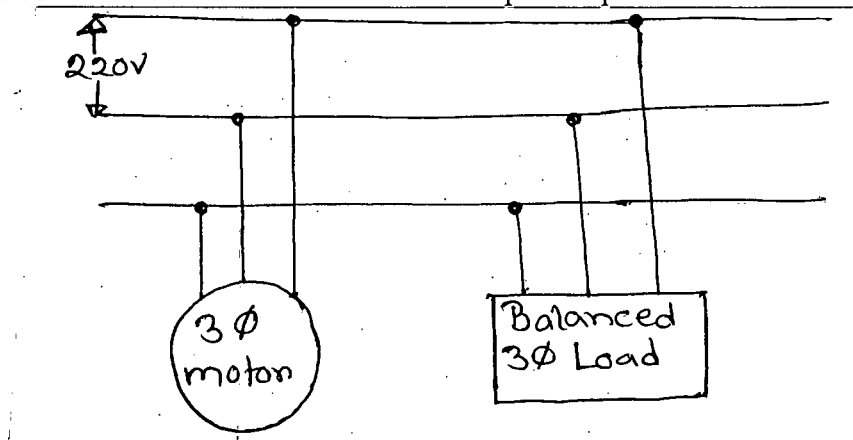


Fig for Ques no. 4(b)

**SECTION - B**

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Derive exact equivalent circuit of a single phase transformer. Draw the phasor diagram of a transformer operating at leading power factor referred to the secondary side.

(15)

(b) A 75 KVA, 60 Hz, 4160/240 V, single phase transformer operating in step down mode is feeding a load  $Z_L = 1.45 \angle -38.74^\circ \Omega$  at 270 V. The transformer parameters are-

(20)

$$R_2 = 0.0072 \Omega \quad X_2 = 0.0128 \Omega$$

$$R_1 = 2.16 \Omega \quad X_1 = 3.84 \Omega$$

- (i) What is the input voltage required for existing condition?
- (ii) Find out voltage regulation.

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6. (a) Draw approximate equivalent circuit of a transformer referred to primary and secondary sides. Explain why it is possible to move the excitation branch to the front of the circuit. Describe how the parameters of the equivalent circuit can be determined. (15)
- (b) Why is open circuit test carried out on the low voltage side and short circuit test on the high voltage side? (20)

Open circuit test data	Short circuit test data
$V_{OC} = 230 \text{ V}$	$V_{SC} = 513 \text{ V}$
$I_{OC} = 5.4 \text{ A}$	$I_{SC} = 3.6 \text{ V}$
$P_{OC} = 260 \text{ W}$	$P_{SC} = 465 \text{ W}$

These above tests are performed on a 25 KVA, 6900/230 V, 60 Hz transformer. Draw the approximate equivalent circuit of the transformer referred to the low voltage side.

7. (a) Derive the relationship between phase voltage and line voltage of a wye connected balanced load for 'acb' sequence. Draw the corresponding phasor diagram showing all line and phase voltages. (15)
- (b) A three phase wye connected generator is supplying power to a balanced three phase load (also wye connected) with phase impedance of  $5-j3 \text{ ohm}$ . Line voltage is 230 V and phase sequence is 'acb'. Find the real and reactive power of the load. (20)
8. (a) Starting from the production of rotating magnetic field, derive the equivalent circuit of a 3- $\phi$  induction motor for a particular phase. (15)
- (b) A 480 V, 60 Hz, 50 Hp, 3- $\phi$  induction motor is drawing 60 A at 0.85 p.f. lagging. The stator copper loss is 2 KW, rotor copper loss is 700 W, the friction and windage loss is 600 W, the core loss is 1800 w and other losses are neglected. Find the following— (20)
- (i) The air gap power,  $P_{AG}$
  - (ii) The power converted,  $P_{conv}$
  - (iii) The output power
  - (iv) Efficiency of motor

If the losses are not given as exact values, can we still find out these powers? If yes, write the corresponding equations with appropriate figure.

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**SECTION – A**There are **FOUR** questions in this section. Answer any **THREE**.

1. Solve the following differential equations:

(a)  $y^2 dx + (x^2 - xy) dy = 0$  (10)

(b)  $\frac{dy}{dx} = \frac{3y - 7x + 7}{3x - 7y - 3}$  (15)

(c)  $\frac{dy}{dx} + y = xy^3$  (10)

2. (a) Find the integrating factor of the differential equation (11)

$$(2x^3 y^2 + 4x^2 y + 2xy^2 + xy^4 + 2y) dx + 2(y^3 + x^2 y + x) dy = 0$$

and solve it.

(b) Using the method of variation of parameter solve the differential equation (12)

$$\frac{d^2 y}{dx^2} + 4y = \sec 2x$$

(c) A generator having emf 100 V is connected in series with a 10  $\Omega$  resistor and an inductor of 2 H. If the switch k is closed at time  $t = 0$ , obtain a differential equation for the current and determine the current at time  $t$ . (12)3. (a) Solve:  $(D^2 + 2D + 4)y = e^x \sin 2x$  (13)(b) Solve:  $(x^3 D^3 + 2x^2 D^2 + 2)y = x + \frac{1}{x}$  (12)

(c) Find the differential equation arising from (10)

$$\phi \left( \tan x + \cos^{-1} y - \log z, \frac{e^x}{x} - \sec y + z^3 \right) = 0$$

4. (a) Solve:  $(z^2 - 2yz - y^2)p + (xy + zx)q = xy - zx$  (12)

(b) Find the complete solution of the following PDE's

(i)  $pxy + pq + qy - yz = 0$ . (10)

(ii)  $px + qy = z\sqrt{1 + pq}$ . (13)



**MATH 139/CE**

**SECTION – B**

There are **FOUR** questions in this section. Answer any **THREE**.

Symbols used have their usual meaning.

5. Solve the following:

(a)  $(D_x^2 - 5D_x D_y + 4D_y^2)z = \cos(3x - y)$  (11)

(b)  $(12D_x^2 - 5D_x D_y - 3D_y^2)z = y^2 \sin(x - 3y)$  (12)

(c)  $(D_x^2 - 3D_x + 3D_y - D_y^2)z = xy + e^{x+2y}$  (12)

6. (a) A west coast publishing company keeps accurate records of its monthly expenditure for advertising and its total monthly sales. For the first ten months of 2014, the records showed the following (note that units are in dollars): (15)

Advertising (in thousands):	43	44	36	38	47	40	41	54	37	46
Sales (in millions):	74	76	60	68	79	70	71	94	65	78

- (i) Find the least-squares prediction equation appropriate for the data.
- (ii) If the company plans to spend \$80,000 for advertising next month, what is their predicated sale? (Assume that all other factors can be neglected)

(b) Define Bernoulli process and derive the mean and variance of the frequency function for the Bernoulli distribution. (10)

(c) It is known that 5% of the bulbs produced by MKC Co. are defective. Find the probability that a box of 300 of these bulbs contains at most 6 defective bulbs. (10)

7. (a) Following are the marks obtained by two students A and B in 10 tests of 100 marks each:

Test number:	1	2	3	4	5	6	7	8	9	10
Marks obtained by A:	55	82	78	44	50	72	78	56	62	55
Marks obtained by B:	52	76	55	62	61	63	74	54	59	85

Compute:

- (i) Pearson's coefficient of skewness and Bowley's coefficient of skewness and comment on the shape of the marks obtained by B only. (10)
- (ii) If the consistency of performance is the criterion for awarding a prize, who should get the prize? (10)

(b) The mark in a test is assumed to be normally distributed. It is known that 15% of the students have marks under 50 and 20% exceed 75, what percentage of students have marks between 70 and 90? (Necessary chart 1 is attached) (15)

**MATH 139/CE**

8. (a) Suppose that the measured voltage in a certain electric circuit has a normal distribution with mean 125 and standard deviation 3. If 3 independent measurements of the voltage are made, what is the possibility that all three measurements will lie between 120 and 128? **(10)**
- (b) The probability that a married man watches a certain TV show is 0.30 and the married woman watches the show is 0.35. A study revealed that for couples where the husband watches the program regularly, 80% of the wives also watch regularly. Find **(15)**
- (i) the probability that a married couple watches the show
  - (ii) the probability that a husband watches the show given that his wife does not.
- (c) The mean weekly sale of the AHK chocolate bar in candy stores was 163.7 bars per store. After an advertising campaign, the mean weekly sale in 27 stores for a typical week increased to 169.4 and showed a standard deviation of 16.7. Was the advertising successful? Use a 1% level of significance. (Necessary chart 2 is attached). **(10)**
-

# Chart 1 for a. no. 7(b)

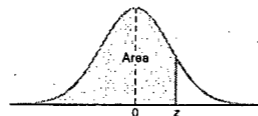


Table A.3 Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

(continued) Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

= 4 =

Chart 2 for Q. no. 8(c)

Student *t*-Distribution Probability Table

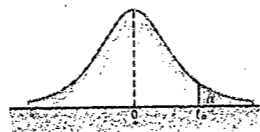


Table A.4 Critical Values of the *t*-Distribution

<i>v</i>	$\alpha$						
	0.40	0.30	0.20	0.15	0.10	0.05	0.025
1	0.325	0.727	1.376	1.963	3.078	6.314	12.706
2	0.289	0.617	1.061	1.386	1.886	2.920	4.303
3	0.277	0.584	0.978	1.250	1.638	2.353	3.182
4	0.271	0.569	0.941	1.190	1.533	2.132	2.776
5	0.267	0.559	0.920	1.156	1.476	2.015	2.571
6	0.265	0.553	0.906	1.134	1.440	1.943	2.447
7	0.263	0.549	0.896	1.119	1.415	1.895	2.365
8	0.262	0.546	0.889	1.108	1.397	1.860	2.306
9	0.261	0.543	0.883	1.100	1.383	1.833	2.262
10	0.260	0.542	0.879	1.093	1.372	1.812	2.228
11	0.260	0.540	0.876	1.088	1.363	1.796	2.201
12	0.259	0.539	0.873	1.083	1.356	1.782	2.179
13	0.259	0.538	0.870	1.079	1.350	1.771	2.160
14	0.258	0.537	0.868	1.076	1.345	1.761	2.145
15	0.258	0.536	0.866	1.074	1.341	1.753	2.131
16	0.258	0.535	0.865	1.071	1.337	1.746	2.120
17	0.257	0.534	0.863	1.069	1.333	1.740	2.110
18	0.257	0.534	0.862	1.067	1.330	1.734	2.101
19	0.257	0.533	0.861	1.066	1.328	1.729	2.093
20	0.257	0.533	0.860	1.064	1.325	1.725	2.086
21	0.257	0.532	0.859	1.063	1.323	1.721	2.080
22	0.256	0.532	0.858	1.061	1.321	1.717	2.074
23	0.256	0.532	0.858	1.060	1.319	1.714	2.069
24	0.256	0.531	0.857	1.059	1.318	1.711	2.064
25	0.256	0.531	0.856	1.058	1.316	1.708	2.060
26	0.256	0.531	0.856	1.058	1.315	1.706	2.056
27	0.256	0.531	0.855	1.057	1.314	1.703	2.052
28	0.256	0.530	0.855	1.056	1.313	1.701	2.048
29	0.256	0.530	0.854	1.055	1.311	1.699	2.045
30	0.256	0.530	0.854	1.055	1.310	1.697	2.042
40	0.255	0.529	0.851	1.050	1.303	1.684	2.021
60	0.254	0.527	0.848	1.045	1.296	1.671	2.000
120	0.254	0.526	0.845	1.041	1.289	1.658	1.980
$\infty$	0.253	0.524	0.842	1.036	1.282	1.645	1.960

= 5 =

(continued) Critical Values of the *t*-Distribution

<i>v</i>	$\alpha$						
	0.02	0.015	0.01	0.0075	0.005	0.0025	0.0005
1	15.894	21.205	31.821	42.433	63.656	127.321	636.578
2	4.849	5.643	6.965	8.073	9.925	14.089	31.600
3	3.482	3.896	4.541	5.047	5.841	7.453	12.924
4	2.999	3.298	3.747	4.088	4.604	5.598	8.610
5	2.757	3.003	3.365	3.634	4.032	4.773	6.869
6	2.612	2.829	3.143	3.372	3.707	4.317	5.959
7	2.517	2.715	2.998	3.203	3.499	4.029	5.408
8	2.449	2.634	2.896	3.085	3.355	3.833	5.041
9	2.398	2.574	2.821	2.998	3.250	3.690	4.781
10	2.359	2.527	2.764	2.932	3.169	3.581	4.587
11	2.328	2.491	2.718	2.879	3.106	3.497	4.437
12	2.303	2.461	2.681	2.836	3.055	3.428	4.318
13	2.282	2.436	2.650	2.801	3.012	3.372	4.221
14	2.264	2.415	2.624	2.771	2.977	3.326	4.140
15	2.249	2.397	2.602	2.746	2.947	3.286	4.073
16	2.235	2.382	2.583	2.724	2.921	3.252	4.015
17	2.224	2.368	2.567	2.706	2.898	3.222	3.965
18	2.214	2.356	2.552	2.689	2.878	3.197	3.922
19	2.205	2.346	2.539	2.674	2.861	3.174	3.883
20	2.197	2.336	2.528	2.661	2.845	3.153	3.850
21	2.189	2.328	2.518	2.649	2.831	3.135	3.819
22	2.183	2.320	2.508	2.639	2.819	3.119	3.792
23	2.177	2.313	2.500	2.629	2.807	3.104	3.768
24	2.172	2.307	2.492	2.620	2.797	3.091	3.745
25	2.167	2.301	2.485	2.612	2.787	3.078	3.725
26	2.162	2.296	2.479	2.605	2.779	3.067	3.707
27	2.158	2.291	2.473	2.598	2.771	3.057	3.689
28	2.154	2.286	2.467	2.592	2.763	3.047	3.674
29	2.150	2.282	2.462	2.586	2.756	3.038	3.660
30	2.147	2.278	2.457	2.581	2.750	3.030	3.646
40	2.123	2.250	2.423	2.542	2.704	2.971	3.551
60	2.099	2.223	2.390	2.504	2.660	2.915	3.460
120	2.076	2.196	2.358	2.468	2.617	2.860	3.373
$\infty$	2.054	2.170	2.326	2.432	2.576	2.807	3.290