

Note: Attempt all questions.

Q.1. How do most people know well about the Law of Right and Wrong but they do not act upon it?

OR

Discuss Orwell's use of irony and satire to bring out the sad plight of the poor. (10)

Q.2. What do you learn of existence and life in general after reading "The Gray Beginnings" by Carson. (10)

OR

Discuss Ross's statement; "Science is empirical, rational, general and cumulative; and it is all four at once."

Q.3. Write an essay on any ONE of the following topics. (15)

- The Place of English in Pakistan
- The Judiciary and our Country
- Tourism in Pakistan
- Social Evils
- Youth is a Period of Stress and Strain

Q.4. Correct any FIVE of the following: (5)

- He talks more pleasant than his brother. Needless to say, he is the more popular of the two.
- When you become a parent, you will think different about children.
- Learning the French isn't easy.
- Spot my dog is the faster runner in the hole neighborhood.
- I am going to hospital to see a friend who has undergone the operation.
- More you read less you understand.
- On a way home, I saw old beggar accompanied by child.

Q.5. Translate the following passage into English. (10)

جو لوگ خود غرض ہیں محض حصول زر کے لئے کوشاں رہتے ہیں ان کا نظریہ صرف پیسہ ہوتا ہے۔ چاہے رشوت سے حاصل کریں یا ملاوٹ سے، ذخیرہ اندوزی سے یا سمگلنگ سے۔ غلط ذرائع سے پیسہ کمانے والے ملک کے دشمن ہیں، عوام کے قاتل ہیں۔ یہ لوگ وطن کے خداریں ہیں، یہ ناقابل معافی ہیں۔ ہر محبت وطن کو ان پر کڑی نظر رکھنی چاہیے۔

سوال نمبر 1۔ مندرجہ ذیل جملوں میں سے کوئی پندرہ لکھ کر ان کا ترجمہ کیجئے؟ (30)

- (1) أكلت الخبز الخادمة (2) كان رأيه موافقا ومطابقا لرأى (3) النظافة تجلب الصحة (4) يوم القيامة يختم الله على الأفواه (5) شرح الله صدرك للإيمان (6) الحمية رأس كل دواء (7) انا واثق من كلامي تماما (8) في الحديقة سبعون زائرا (9) النافذة بعيدة عن السبوره (10) هل شبعت من الطعام (11) البنت تحمل السلة (12) التشاور هو اساس التفاهم بيننا (13) يصد الشيطان عن فعل الخير (14) كدت الخادمة في العمل (15) اربط بقرتي عند الشجرة (16) هل تلك ورقة (17) هذا جدارك (18) سيارة محمود قرب المنزل (19) تلك خريطة باكستان (20) قدمت بنت الى المدرسة (21) مسح يده بالورقه (22) قطفت البنت زهرة (23) انت بدأت عملك في الصباح (24) عتني يحسن الى الفقراء (25) في الفندق ثمانون غرفة (26) هل شبعت من الطعام (28) اشكومن الم في راسي (29) اقدامنا راسخة فوق ارضنا (30) هل صافحت الضيف

سوال نمبر 2۔ مندرجہ ذیل جملوں میں سے کوئی دس جملے لکھیں اور ان کا عربی ترجمہ کریں؟ (30)

- (1) میں کل سکول حاضر ہوں گا (2) تنگ مکان تاریک ہے۔ (3) میرا استاد نیک آدمی ہے۔ (4) یہ سستا قلم ہے۔ (5) دیہات میں رہنے والوں کے دل پاک و صاف ہوتے ہیں (6) میں امتحان لینے والا ہوں بدلہ لینے والا نہیں۔ (7) حامد زمین پر بیٹھا۔ (8) میں نے کتاب حاصل کی۔ (9) استاد کار میں سوار ہوئے۔ (10) میز کے نیچے بلی ہے۔ (11) عورت چھت پر چڑھی (12) یہ تیری تصویر ہے۔ (13) اس نے اپنے ہاتھ کو کاغذ سے صاف کیا۔ (14) لڑکا کھڑکی سے دیکھتا ہے (15) ایک مینیٹ میں تیس دن ہوتے ہیں۔ (20) کیا یہ مزے دار پھل ہے۔ (21) یہ ڈاکٹر کا کلینک ہے (27) میں کل نہیں آؤں گا۔ (28) تیرا بھائی پہنچا۔ (24) سکول کہاں واقع ہے۔ (25) یہ آسان سبق ہے (26) میں نے تصویر کو دیکھا (27) یہ خوبصورت گھر ہے (28) یہ استاد کی گھڑی ہے۔ (29) یہ اللہ کا بندہ ہے۔ (30) وہ اس کا دفتر ہے

سوال نمبر 3۔ اسمائے ثمرہ اور اسم عدد کی تعریفیں ضروری قواعد کے ساتھ لکھیں اور ہر ایک کی پانچ پانچ مثالیں دیں۔ (20)

یا

مندرجہ ذیل الفاظ کو عربی فقروں میں استعمال کریں اور ترجمہ بھی کیجئے۔

- (1) شرب (2) سریر (3) طویلة (4) صديق (5) ورقة
(6) تحت (7) المسجد (8) سبعة (9) سقف (10) شارع

سوال نمبر 4۔ مندرجہ ذیل سوالات لکھیں اور ان کے بلقابل عربی میں جوابات لکھیں؟ (20)

- (1) كم ساعة في اليوم؟ (2) الى أين تنظر؟ (3) ماذا سقط على الأرض؟ (4) هل تلك مرآة؟ (5) لماذا تكتب؟
(6) أين الجامعة؟ (7) ماذا تدرس؟ (8) متى تعود من المدرسة؟ (9) كم قلبا عندك؟ (10) هل عندك كتاب؟

یا

مندرجہ ذیل جملوں کو مکمل کیجئے اور ساتھ ترجمہ کریں۔

- (1) تلك _____ سريعة (2) المنزل مفتوح (3) دراجة _____ قوية
(4) لا _____ الكاذب (5) اختي _____ (6) ابی _____ من السفر (7) محمود مفید
(8) سافر _____ الى الحج (9) الله قريب _____ (10) ياكل _____ الفاكهة

Note: Attempt **Five** questions in all. Section **A** is compulsory. Attempt **Two** questions from section **B**, and **Two** questions from section **C**.

SECTION-A

- Q.1.** Attempt any **FOUR** parts. (2,2,2,2)
- How can we remove completely the excess charge from a small conducting body?
 - Can two different equipotential surfaces intersect?
 - How does the relation $V = IR$ apply to resistors that do not obey Ohm's law?
 - Is there any way to set up a magnetic field other than by causing charges to move?
 - What is the difference between free, damped and forced oscillating circuits?

SECTION-B

- Q.2.** Define ELECTRIC POTENTIAL. Find expression of electric potential along the axis passing perpendicularly through the center, with charge q and radius R , in case of (1,3,4)
- Uniformly charged circular ring.
 - Uniformly charged circular disk.
- Q.3.** What is CAPACITANCE of a capacitor? Derive the relation $U = \frac{1}{2}CV^2$ for the energy stored in a capacitor and deduce the relation for the ENERGY DENSITY in an electric field. (2,4,2)
- Q.4.** What is the REACTANCE? Derive the relations for reactance in
- Inductive Circuit
 - Capacitive Circuit. (2,3,3)

SECTION-C

- Q.5.** (a) Write down the Maxwell's Equations in their differential forms. What modification was made in Ampere's Law?
(b) Prove that the displacement current in a parallel-plate capacitor can be written as
- $$i_d = C \frac{dV}{dt}. \quad (4,4)$$
- Q.6.** (a) At what distance along the axis of a charged disk of radius R is the electric field strength equal to one-half the value of the field at the surface of the disk at the center? (1,3,4)
(b) A charge of 15 nC can be produced by simple rubbing. To what potential would such a charge raise an isolated sphere of 16 cm radius.
- Q.7.** (a) A proton orbits with a speed $v = 294 \text{ km/s}$ just outside a charged sphere of radius $r = 1.13 \text{ cm}$. Find the charge on the sphere.
(b) Two capacitors, $2.12 \mu\text{F}$ and $3.88 \mu\text{F}$, are connected in series across a 328 V potential difference. Calculate the total energy stored in capacitors. (4,4)
- Q.8.** (a) A 120 V power line is protected by a 15 A fuse. What is the maximum number of 500 W lamps that can be simultaneously operated in parallel on this line?
(b) An automobile having radio antenna 110 cm long travels at 90 km/h in a region where Earth's magnetic field is $55 \mu\text{T}$. Find the maximum possible value of the induced emf. (4,4)
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Note: Attempt five questions in all. **Section-A** is compulsory. Attempt **Two** questions from **Section-B** and Two from **Section-C**.

SECTION-A

Q.1. Attempt any four of the following. (2×4)

- (i) In Bohr's model mass of electron of an atom is taken as constant. Is it correct?
- (ii) What are important characteristics of semiconductor?
- (iii) What is limitation in Frank-Hertz experiment?
- (iv) Distinguish between nuclear binding energy and binding energy per nucleon.
- (v) Briefly describe Wien's displacement law.

SECTION-B

- Q. 2.** (a) what is a load line? Discuss its importance in electronics. (4)
(b) How does the concept of energy band in solid explain good conductivity of conductor, poor for insulator and electrical behavior of semiconductor? (4)
- Q.3.** (a) What is radioactive equilibrium? Distinguish between transient and secular equilibrium. (2+2)
(b) What is gamma-decay? Discuss in detail. (3)
- Q.4.** (a) Explain how did Sommerfeld modify Bohr's theory to fit it into experimental data? What conclusion was drawn by him? (4)
(b) What is a vector model? Explain Quantum number of electron in term of vector atomic model. (4)

SECTION-C

- Q.5.** (a) If the De Broglie wavelength of electron 0.01 Pm. (a) What is speed of proton
(b) Through what electrical potential would the proton have to be accelerated from rest to acquire this speed? (8)
- Q.6.** Calculate the distance of closest approach ahead on collision between 5.30 MeV of alpha particles and nucleus of copper atom. (8)
- Q.7.** Calculate ground state energy of electron in hydrogen atom? (8)
- Q.8.** What is NOR Gate? Describe its symbol, Boolean expression, truth table and circuit diagram. (8)
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Subject: Botany
Paper: III

B.A/B.Sc Part-II
Annual/18

Time:03Hrs.
Max. Marks:40

Note: Attempt **FIVE** questions in all. **Section A** is **Compulsory** attempt **TWO** questions from each **Section –B** and from **Section –C**.

Section A

- Q.1.** Differentiate between following terms (2×4=8)
- a) Dominance and incomplete dominance
 - b) Sex linked and Sex limited inheritance
 - c) Mitosis and Meiosis
 - d) Linkage and crossing over

Section B

- Q.2.** Discuss Physico- chemical nature of plasma membrane. (08)
- Q.3.** Briefly describe structure and function of Mitochondria. (08)
- Q.4.** Discuss structure and function of following biomolecule. (2×4=8)
- a) Lipid
 - b) Protein
- Q.5.** Define chromosomal aberration with reference to inversion and translocation (08)

Section C

- Q.6.** What are linkage groups how linkage maps are constructed (08)
- Q.7.** Briefly describe how genetic material is transmitted in bacteria (08)
- Q.8.** Explain law of independent assortment also give its mechanism (08)
- Q.9.** Write down mechanism of transcription (08)

Note: Attempt five questions in all. Section A is compulsory, two questions from section B, and two questions from section C.

SECTION –A

- Q.1.** Write short answers to the following questions (8)
- i) Define cyclosis.
 - ii) What is activation energy?
 - iii) Define photorespiration.
 - iv) Define totipotancy.
 - v) What are biomes?
 - vi) Define biomass.
 - vii) What is salinity?
 - viii) What do you mean by afforestation?

SECTION--B

- Q.2.** a- What is colloidal system? Explain its role in biological system. (3)
b- Define enzymes. Describe the properties of enzymes. (5)
- Q.3.** a- Explain glycolysis in detail. (4)
b- Write a note on the physiological role of auxins (4)
- Q.4.** a- What are nastic movements? Explain the mechanism of nastic movements. (5)
b- What is tissue culture? Explain applications of tissue culture techniques. (3)
- Q.5.** a- What are phytochormes? Explain the mechanism of actions of phytochormes. (4)
b- Explain the methods of breaking seed dormancy. (4)

SECTION – C

- Q.6.** a- Describe the ecophysiological responses of light. (5)
b- What is soil texture? Describe the characteristics of individual soil particles. (3)
- Q.7.** a- What is wind? Describe the direct and indirect effects of wind. (4)
b- Explain the quantitative characteristics of a plant community. (4)
- Q.8.** a- What is biodiversity? Explain its importance. What are the causes of its destruction and how it can be conserved? (5)
b- Explain role of hydrological cycle. (3)
- Q.9.** a- What is water erosion? Describe its types and effects. How soil is conserved from water erosion. (5)
b- Explain the green house effect. (3)
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Note: Attempt **Five** questions in all, **Section-A** is compulsory. Attempt **Four** questions from **Section-B**. Draw neat and clean diagrams where necessary. Each question carries 8 marks.

Section-A

- Q.1.** Write short answer to the following question: (1×8)
- i. Write the name of the classes of urochord data?
 - ii. Define pedomorphosis.
 - iii. Differentiate between anapsid and diapsid.
 - iv. Define estrus cycle.
 - v. Differentiate between hibernation and winter sleep.
 - vi. Define macroevolution.
 - vii. Define countercurrent exchange mechanism.
 - viii. Define Hardy-Weinberg theory.

Section-B

- Q.2.** Explain the evolution of jaws in vertebrates? (8)
- Q.3.** Discuss the origin of mammals? (8)
- Q.4.** Give a brief description of order testudines? (8)
- Q.5.** Explain the mechanism of gaseous exchange in fish?
- Q.6.** Write a note on the evolutionary development in the mode of locomotion in amphibians? (8)
- Q.7.** Compare and differentiate between order cuadata and anura of class amphibia? (8)
- Q.8.** Write a note on the followings?
- a). Genetic drift (4)
 - b). mosaic evolution (4)
- Q.9.** Tooth structure is an important tool in feeding. Discuss tooth structure in different feeding groups of mammalia? (8)

Note: Attempt any five questions. Section-A is compulsory. Attempt any four questions from Section-B.

SECTION -A

- Q.1.** Write very short answers of following Questions. (1×8)
- Differentiate between Sudoriferous and Sebaceous glands.
 - What is role of Saltatory conduction?
 - What is Sarin?
 - Define Blood Pressure.
 - Differentiate between Peristalsis and Segmentation.
 - What is Ovoviviparity?
 - Define Calorie.
 - What are Suspension Feeders ?

SECTION-B

- Q.2.** (a) Compare Hydrostatic-skeleton and Endostatic-skeleton. (4)
(b) Discuss Skeletal System of vertebrates. (4)
- Q.3.** (a) Describe Different types of Neurons. (4)
(b) Explain mechanism of Action Potential generation. (4)
- Q.4.** (a) Enlist some hormones of invertebrates and Discuss some non endocrine hormones of Mammals. (4)
(b) Discuss Pituitary Gland. (4)
- Q.5.** (a) Discuss Respiratory Mechanism of Invertebrates. (4)
(b) Write a detailed note on Vertebrates Respiration by Lung. (4)
- Q.6.** (a) Discuss digestive mechanism of Molluscs support your answer with diagram. (4)
(b) Describe role of Accessory organs in Digestion of Mammals. (4)
- Q.7.** (a) Discuss Protonephridia and Malpighian tubules. (4)
(b) Describe Heat Production in birds and mammals. (4)
- Q.8.** Explain how hormones regulate human male reproductive System. (8)
- Q.9.** What are different Types of Eggs? Discuss different types of Germ Layers. (8)
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Note: Attempt all questions from section (A) and two from each section (B) & (C)

SECTION (A)

- Q.1.** Define the following terms (1x8)
- | | | |
|--------------------------|----------------------|--------------------------|
| (a) Exponential function | (b) Complex number | (c) Mean free path |
| (d) Collision frequency | (e) Enthalpy | (f) Photoelectric effect |
| (g) Surface tension | (h) Osmotic pressure | |

SECTION (B)

- Q.2.** (a) Briefly discuss the effect of temperature on the vapour pressure of a liquid. (4)
(b) What is a unit cell? How will you classify the crystals into crystal systems? (4)
Give example of each crystal system. (4)
- Q.3.** (a) Define critical temperature and critical pressure. Explain the significance of critical temperature by giving a suitable example. (4)
(b) How Charles's and Graham's law of diffusion are deduced from Kinetic gas equation. (4)
- Q.4.** (a) State and explain Heisenberg's uncertainty principle. (4)
(b) What is the zero point energy of a particle in a one dimensional box? (4)
- Q.5.** (a) Discuss the applications of Schrodinger wave equation to H-atom. (4)
(b) Explain the term PARACHORE, how it is used for structure determination of a molecule. (4)

SECTION (C)

- Q.6.** (a) State Le-Chatelier's principle and discuss its application to ammonia synthesis. (4)
(b) Derive the kinetic expression for the FIRST ORDER reaction also explain why the reactions of higher order are rare. (4)
- Q.7.** (a) What is steam distillation? Discuss the principle underlying this process. (4)
(b) Describe the HALF-LIFE method for determining the ORDER of the reaction. (4)
- Q.8.** (a) Define heat of combustion. How it is experimentally determined. (4)
(b) Define GIBB'S FREE ENERGY. Discuss its importance in chemistry. (4)
- Q.9.** (a) What are ppm and ppb solutions? (4)
(b) Distinguish between Isothermal and adiabatic processes. (4)
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Note: Attempt five questions in all. Section-A is compulsory. Attempt two questions from Section-B and two from Section-C.

SECTION-A

- Q. 1. Answer these questions (any four) 1×4
- i) What do you mean by polarizability?
 - ii) How inert gases were discovered?
 - iii) What is water gas? How is it formed?
 - iv) Enlist the limitations of extended form of periodic table?
 - v) What is coordination sphere and coordination number?

SECTION-B

- Q. 2. i) What is meant by Electrochemical Series? Give its three applications? 4
- ii) Describe the ionization potential? Discuss its trends in periods and groups of periodic table? 4
- Q. 3. i) Discuss common features of V.B.T and M.O.T. What are essential points of difference between them? 4
- ii) How molecular orbital theory explains the paramagnetic behavior of O₂. 4
- Q. 4. i) What is Lowry-Bronsted concept about acids and bases? Explain the term conjugate acids and bases. 4
- ii) Arrange the following in order of increasing acidities with reasons. 4
- HCl, H₂SO₄, HClO₃, CH₃COOH
- Q. 5. i) Give the important sources of inert gases. Discuss their essential properties? 4
- ii) Relate the chemical inertness of inert gases with their electronic configuration? 4

SECTION-C

- Q. 6. i) How the boric acid is prepared from Borax and borontrichloride. Explain its general characteristics? 4
- ii) Draw flow sheet diagram and describe various reaction involved in the manufacturing of urea from natural gas? 4
- Q. 7. i) What are electron deficient molecules? Give two methods of Diborane preparation. 4
- ii) Give formula of the following 2+2
- a) Potassium hexachloro Platinuim (IV)
 - b) Tetra cyano diaquoferate (III) ion
- Q. 8. i) How id Tetra thionic acid prepared. Discuss structurally the oxidation of thiosulphat ion to tetrathionate ion. 4
- ii) Describe the industrial preparation of fluorine? 4
- Q. 9. i) Explain the structural aspects of 6 coordinate outer orbital complexes in the light of Velence Bond Theory. 4
- ii) Compare the properties of Carbon and silicon? 4

Note: Attempt five questions. Part-I is compulsory; select any four from part-II.

Part-I

- Q.1.** Explain the following in brief: - (5×2=10)
- a. What is program data-dependence?
 - b. Define an Entity?
 - c. What is meta-data?
 - d. Define foreign key?
 - e. What are DFDs?

Part-II

- Q.2.** What is a relation in Relational Model. Explain the characteristics of relations. (7.5)
- Q.3.** Explain the Components of a typical Database Management System. (7.5)
- Q.4.** Briefly discuss the advantages of an RDBMS over a traditional flat-file system. (7.5)
- Q.5.** Explain the Insert, Update and Deletion anomalies with examples. (7.5)
- Q.6.** Narrate the difference b/w relational algebra and relational calculus? (7.5)
- Q.7.** Write short notes on a) Normalization b) Recovery Techniques (7.5)
- Q.8.** Define Transaction. Explain the ACID properties of the transaction with the help of an example. (7.5)
- Q.9.** Explain the Two Phase Protocol in detail with the help of an example. (7.5)
- Q.10.** Explain the role and function of DBA. (7.5)
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Note: Attempt five questions. Part-I is compulsory, select any four from part-II.

Part-I

- Q.1.** Give short answers to the following:- (5×2=10)
- a) What is TCP/IP?
 - b) What is an interrupt?
 - c) List four conditions that raise a deadlock.
 - d) What is meant by packet switching?
 - e) List four major functions of an OS?

Part-II

- Q.2.** Define Operating System also explain the major parts of an Operating System? (7.5)
- Q.3.** What is meant by topology. Differentiate between star and ring topology. (7.5)
- Q.4.** Write a note on Process Control block. (7.5)
- Q.5.** Define IP address. What are the different classes of IP addresses? (7.5)
- Q.6.** Explain about Segmentation and Paging. (7.5)
- Q.7.** Narrate the message transfer using Simple Mail Transfer Protocol. (7.5)
- Q.8.** Discuss the classification of Operating System in detail. (7.5)
- Q.9.** What is OSI model? Explain Data Link Layer in detail. (7.5)
- Q.10.** Narrate the file attributes, operations, types and structures. (7.5)

Note: Attempt five questions in all. Section-A is compulsory. Select any Four Questions from Section-B. Use of calculator is allowed.

SECTION-A

- Q.1. Attempt any Eight parts.** (08)
- What is meant by sampling? vi) Define consistency?
 - ii) What is sampling frame? vii) What do you know about null hypothesis?
 - iii) What do you know about estimation of parameters? viii) What are the assumptions to use t test?
 - iv) Define interval estimate? ix) What is meant by simple random sampling?
 - v) What do you know about type second error? x) Define sampling bias?

SECTION-B

- Q.2.** a) A population consist of numbers 0, 3, 6, 9, 12. Draw all possible samples of size 3 without replacement and verify the results. $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n} \left(\frac{N-n}{N-1} \right)$ (05)
- b) A normal population has a mean of 0.1 and a standard deviation of 2.1. Find the probability that the mean of a simple random sample of 900 members will be negative. (03)
- Q.3.** a) A population consist of letter "MUST". Draw all possible samples of size 2 with replacement, make sampling distribution of sample proportion for letter "U" and hence verify the following results
- $$\mu_{\hat{p}} = p \text{ and } \sigma_{\hat{p}} = \sqrt{\frac{pq}{n}} \quad (05)$$
- b) Two random samples of sizes $n_1 = 40$ and $n_2 = 45$ are drawn from a binomial population with $p = 0.70$. What is the probability that $-0.1 < \hat{p}_1 - \hat{p}_2 < 0.1$? (03)
- Q.4.** a) Discuss probability and non probability sampling. (04)
- b) Discuss sampling and non sampling errors. (04)
- Q.5.** a) A confidence interval is constructed, from a random sample of size $n = 50$, for a mean yield of a normal population which has $\sigma = 21$ tons. the limits for the interval are 866.11 and 875.89 tons. What confidence coefficient was used. (04)
- b) Find the 95% confidence interval for the mean of a normal distribution with $\sigma = 3$, given the sample as 2.3, -0.2, -0.4, and -0.9. (04)
- Q.6.** a) A random sample of size 40 is taken from a non normal population yielded the sample mean $\bar{x} = 71$ and $S^2 = 200$. test the null hypothesis $\mu = 72$ against the alternative hypothesis $\mu \neq 72$. Using a 0.01 significance level. (04)
- b) A sample of size 78 from a binomial population gave 35 successes. Test the null hypothesis that the true proportion of success is 0.55 against the alternative that it is less. (04)
- Q.7.** a) The weights of four persons before they stop smoking and 5 weeks after they stopped smoking are as follows: (04)

Person	1	2	3	4
Before	148	176	153	116
After	154	176	151	121

Use the t-test for paired observations to test the hypothesis at the 0.05 level of significance, that giving up smoking has no effect on a person's weight.

- b) Two random samples taken independently from normal populations with an identical variance yield the following results: (04)

	n	\bar{x}	s^2
Sample I	12	10	1200
Sample II	18	25	900

Test the hypothesis that the true difference between the population means is 10, that is, that $\mu_2 - \mu_1 = 10$ against the alternative that $\mu_2 - \mu_1 > 10$ at the 5 percent level of significance.

- Q.8.** a) A random sample of size $n = 8$ from a normal population gave the values 9, 14, 10, 12, 7, 13, 11, 12. Find 90% confidence interval for σ^2 . (04)
- b) Given two independent random samples of sizes $n_1 = 12$ and $n_2 = 10$ from two independent normal populations with $s_1 = 2.3$ and $s_2 = 1.5$. Test at 0.05 level of significance, the hypothesis $H_0: \sigma_1^2 = \sigma_2^2$ against the alternative $H_1: \sigma_1^2 > \sigma_2^2$. (04)

Note: Attempt five Questions in all. Section- A is compulsory. Select any four Questions from Section-B. Use of Calculator is allowed.

Section- A

Q.1. Attempt any eight parts.

- i. What are assumptions of ANOVA?
- ii. Partial Correlation Coefficient
- iii. Vital rates and Ratios
- iv. Coefficient of contingency
- v. Basic principles of experimental design
- vi. Non parametric method
- vii. Scatter Diagram
- viii. Regression coefficient

Section- B

Q.2. i) What are assumptions of ANOVA? (03)

ii) The tensile strength of Portland cement is being studied. Four different mixing techniques can be used economically. The following data have been collected

Mixing Technique	Tensile Strength (lb/in ²)			
1	3129	3000	2865	2890
2	3200	3300	2975	3150
3	2800	2900	2985	3050
4	2600	2700	2600	2765

- a) Test the hypothesis that mixing techniques affect the strength of the cement. Use $\alpha = 0.05$.
- b) Use the Fisher LSD method with $\alpha = 0.05$ to make comparisons between pairs of means. (05)

Q.3. Explain Mann Whitney U test for testing the identicalness of two populations. (08)

Q.4. i) State correlation coefficient with its properties (03)

ii) The Consumer Price Index (CPI) measures the average change over time in the prices paid by urban consumers for consumer goods and services. The CPI affects nearly all Americans because of the many ways it is used. One of its biggest uses is as a measure of inflation. By providing information about price changes in the Nation's economy to government, business, and labor, the CPI helps them to make economic decisions. The President, Congress, and the Federal Reserve Board use the CPI's trends to formulate monetary and fiscal policies. In the following table, x is the year and y is the CPI.

X	1915	1926	1935	1940	1947	1952	1964	1969	1975	1979	1980	1986
Y	10.1	17.7	13.7	14.7	24.1	26.5	31.0	36.7	49.3	72.6	82.4	109.6

- a) Calculate the least squares line. Write the equation in the form $\hat{y} = a + bx$.
- b) Find the correlation coefficient. Is it significant? (05)

Q.5. i) What is crude birth rate and how can it be determined? (03)

ii) Calculate the crude and standardized death rates of local population from the following data by using direct and indirect method (05)

Age group	Standard Population	No. of Deaths in standard Population	Local population	No. of Deaths in local Population
0-9	600	18	400	16
10-19	1000	5	1500	6
20-59	3000	24	2400	24
60 & over	400	20	700	21

Q.6. i) What is meant by experimental design state its principles? (03)

ii) The effect of five different ingredients (A, B, C, D, E) on reaction time of a chemical process is being studied. Each batch of new material is only large enough to permit five runs to be made. Furthermore, each runs requires approximately 1 1/2 hours, so only five runs can be made in one day. The experimenter decides to run the experiment as a Latin square so that day and batch effects can be systematically controlled. She obtains the data that follow. Analyze the data from this experiment (use $\alpha = 0.05$) and draw conclusions. Test whether the treatments means are equal. (05)

Batch	Day				
	1	2	3	4	5
1	A=8	B=7	D=1	C=7	E=3
2	C=11	E=2	A=7	D=3	B=8
3	B=4	A=9	C=10	E=1	D=5
4	D=6	C=8	E=6	B=6	A=10
5	E=4	D=2	B=3	A=8	C=8

Q.7. i) State goodness of fit test. (03)

ii) Five coins are tossed 1000 times and the number of heads were observed are given below

Number of heads	0	1	2	3	4	5
Frequencies	38	144	342	287	164	25

Test whether the Poisson fit gives a better fit (05)

Q.8. i) Explain randomized complete block design? (03)

ii) Three treatments A, B, C and D of a crop are tested in randomized block designed with three replications which is given below

Replications	B = 12.1	C = 51.2	A = 22.5	D = 40.1
	C = 43.2	D = 13.6	B = 16.1	A = 12.5
	A = 34.2	C = 23.5	D = 42.2	B = 14.2

Carry out necessary calculation for testing the treatments means. (05)

Attempt at most THREE questions from Section-A and TWO questions from Section-B

Section-A

- 1(i). Find equations of asymptotes of the curve $r = \frac{a}{\theta}$.
(ii). Determine the points of inflection of the curve $y^2 = x(x+1)^2$
2(i). Find area lying above the axis and between the circle $x^2 + y^2 - 2ax = 0$ and parabola $y^2 = ax$.
(ii). Determine the length of the loop of the curve $3y^2 = x(a-x)^2$
3(i). Show that the slope of tangent to the parabola $x^2 - 3y^2 - 4xy = 9$ at $(2, -1)$ is 4.
(ii). If $u = f\left(\frac{y}{x}\right)$, then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$.
4(i). Show the sphere $x^2 + y^2 + z^2 = 18$ and cone $x^2 + z^2 = (y-6)^2$ are tangent at their intersection.
(ii). Examine $f(x, y) = x^2 + xy^2 - 4x - 1$ for relative extrema.
5(i). Evaluate the integrals

$$\int_0^1 \int_{2x}^2 \exp(y^2) dy dx \quad \text{and} \quad \iiint_S 15x^2 z^2 dx dy dz,$$

S is bounded by $x^2 + y^2 = 1$ and $x^2 + z^2 = 1$.

- (ii). Find the volume of a tetrahedron bounded by the coordinate planes and the plane

$$\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1, \quad a, b, c > 0$$

Section-B

- 6(i). Find the distance between the parallel planes $2x + 2y - 4z + 3 = 0$ and $3x + 3y - 6z + 1 = 0$.
(ii). Determine the measure of angle between the lines

$$\frac{x-2}{1} = \frac{y-3}{1} = \frac{z+1}{2} \quad \text{and} \quad \frac{x-2}{2} = \frac{y-3}{-1} = \frac{z+1}{3}$$

- 7(i). Show that the joins of $(0, -1, 0)$ and $(2, 4, -1)$ intersects the joins of $(1, 1, 1)$ and $(3, 3, 9)$.
(ii). Find the cylindrical coordinates of the point $(2\sqrt{2}, 2, -2)$.
8(i). Transform $x^2 + y^2 - z^2 = 9$ into spherical coordinates.
(ii). Express $\rho \cos \phi = 2$ into rectangular coordinates.

Note: Attempt *TWO* questions from Section-A and *THREE* questions from Section-B

Section-A

- Q. 1. (a) Determine the series $\sum_{n=1}^{\infty} \left(\frac{1}{2^n} - \frac{1}{2^{n+1}} \right)$ converges or diverges. If converges, find its sum.
(b) Check whether the series $\sum_{n=1}^{\infty} (-1)^{n-1} \frac{n^2}{(n+1)!}$ converges absolutely or conditionally.
- Q. 2. (a) Find a power series for $\frac{\ln(1+x)}{1+x^2}$.
(b) Use the alternating series test and discuss the convergence of $\sum_{n=1}^{\infty} \frac{\cos n\pi}{\sqrt{n\pi}}$.
- Q. 3. (a) Use bisection method to find a root of $x^3 - x - 2 = 0$ in the interval $[1, 2]$
(b) Use secant method for $f(x) = \cos x - x$, $x_0 = 0.5$ and $x_1 = \pi$.

Section-B

- Q. 4. (a) Use graphical method to maximize $z = 10x_1 + 11x_2$ subjected to conditions
 $3x_1 + 4x_2 \leq 9$; $5x_1 + 2x_2 \leq 8$; $x_1 - 2x_2 \leq 1$ where $x_1, x_2 \geq 0$.
(b) Solve the differential equation $(e^x + 1)ydy = (y + 1)e^x dx$.
- Q. 5. (a) Use simplex method to find the maximum of $z = 2x_1 - x_2 + 2x_3$ subject to the constraint
- $$\begin{aligned} 2x_1 + x_2 &\leq 10 \\ x_1 + 2x_2 - 2x_3 &\leq 20 \\ x_2 + 2x_3 &\leq 5, \end{aligned}$$
- where $x_1 \geq 0$, $x_2 \geq 0$ and $x_3 \geq 0$.
- (b) Find the maximum value of $z = 3x + 2y$ subject to the following constraints: $x \geq 0$, $y \geq 0$
- $$\begin{aligned} x + 2y &\leq 4 \\ x - y &\leq 1. \end{aligned}$$
- Q. 6. (a) Solve the differential equation $\frac{x+y}{y-1} dx - \frac{1}{2} \left(\frac{x+1}{y-1} \right)^2 dy = 0$.
(b) Find the solution of the differential equation $\frac{dy}{dx} - y = e^{2x} - 1$.
- Q. 7. (a) Solve the initial value problem $2x \frac{dy}{dx} + y = \frac{2x^2}{y^3}$, $y(1)=2$.
(b) Find equation of orthogonal trajectory of the curve of the family $y = x - 1 + ce^{-x}$.
- Q. 8. (a) Find the general solution of $(D^4 + 8D^2 - 9)y = 9x^3 + 5 \cos 2x$.
(b) Solve the differential equation $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10x + \frac{10}{x}$.
-

Attempt FIVE Questions in all, Select TWO questions from Section-A and THREE from Section-B.

SECTION-A

Question 1

(a) State the Sandwich Theorem for Sequences. Use this theorem to find the limit of the sequence $\left\{ \frac{\cos^2 n}{3^n} \right\}_{n=1}^{\infty}$ as $n \rightarrow \infty$.

(b) Use the appropriate comparison test to investigate convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{2}{\sqrt{n}+1}$.

5+5 marks

Question 2

(a) Use the Cauchy's Integral Test to determine whether the series $\sum_{n=1}^{\infty} \frac{\tan^{-1} n}{n^2+1}$ converges or diverges.

(b) Define convergent and divergent infinite series in terms of sequence of partial sums. Hence show that the infinite series $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)} + \dots$ is a convergent series. What is the sum of this series?

5+5 marks

Question 3

(a) Define conditional convergence of an alternating infinite series. Show that the series $\sum_{n=1}^{\infty} \frac{\cos n\pi}{n+3}$ converges conditionally.

(b) Use power series expansions of $\ln(1+x)$ and $\frac{1}{1+x^2}$ and find a power series for $\frac{\ln(1+x)}{1+x^2}$. What will be the interval of convergence of this power series?

5+5 marks

SECTION-B

Question 4

(a) Define and explain the following concepts with the help of examples.

(i) Linear and nonlinear odes (ii) Order and degree of an ode

(b) Solve the following first order ode.

$$\frac{dy}{dx} = \frac{y \cos x + 2xe^x}{1 - \sin x - x^2e^y}$$

5+5 marks

Question 5

(a) What is an integrating factor (IF)? Find the general solution of the following first order ode by finding its IF.

$$\frac{dy}{dt} = \frac{1}{\sin y - \frac{t}{y}}.$$

(b) Define singular solutions of an ode. Solve $xp^2 - 2yp + 4x = 0$ and find its singular solutions.

5+5 marks

Question 6

(a) Use the UC method to find the general solution of the following second order non-homogeneous ode

$$y'' - y' - 2y = \cosh 2t + 6.$$

(b) Use the formula for the LT of integrals to find $\mathcal{L}^{-1}\left\{\frac{1}{s^2(s^2-a^2)}\right\}$.

5+5 marks

Question 7

(a) Find the general solution of the following second order ode

$$(x+2)\frac{d^2y}{dx^2} - (2x+5)\frac{dy}{dx} + 2y = (x+1)e^x,$$

given that $y_1(x) = e^{2x}$ is a solution of the associated homogeneous differential equation.

(b) Find the general solution of the second order differential equation

$$ty'' - (1+t)y' + y = t^2e^{2t}, \quad t > 0,$$

given that $y_1(t) = 1+t$ and $y_2(t) = e^t$ are the solutions of the associated homogeneous differential equation.

5+5 marks

Question 8

(a) Use Laplace transform to solve the i.v.p given by

$$\frac{d^2y}{dt^2} + y = 2u(t-2)\sin \pi t, \quad y(0) = 1, \quad \left.\frac{dy}{dt}\right|_{t=0} = 0.$$

(b) State and prove the t-shifting property of the Laplace Transform (LT).

5+5 marks

MUST/B.A/A18/PII/Math-A-III/C290

Attempt **FIVE** Questions in all, Select **THREE** questions from **Section-A** and **TWO** from **Section-B**.

SECTION-A

Question 1

(a) Given $x^y = e^{x-y}$. Find $\frac{dy}{dx}$.

(b) Find a such that the following function is continuous at $(0, 0)$.

$$f(x, y) = \begin{cases} \frac{3xy}{\sqrt{x^2+y^2}} & \text{if } (x, y) \neq (0, 0) \\ 0 & \text{if } (x, y) = (0, 0) \end{cases}$$

5+5 marks

Question 2

(a) Define Pedal Equation of a curve. Write down the procedure for finding the pedal equations.

(b) Show that the locus of the middle points of a system of parallel chords of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $y = -\frac{b^2}{ma^2}x$, where m is the slope of the chords.

5+5 marks

Question 3

(a) Identify and sketch the graph of the polar curve $r = \frac{10}{2+3\cos\theta}$.

(b) Show that the tangents to the cardioid $r = a(1 + \cos\theta)$ at the points $\theta = \frac{\pi}{3}$ and $\theta = \frac{2\pi}{3}$ are, respectively, parallel and perpendicular to the initial line.

5+5 marks

Question 4

(a) Define horizontal and vertical asymptotes of a plane curve. Find the equations of horizontal and vertical asymptotes of $y = \frac{(x-2)^2}{x^2}$.

(b) Show that the radius of curvature of the semi-circle with center at origin and radius r is r .

5+5 marks

Question 5

(a) Define a Linear Programming (LP) Problem. Solve the following LP problem by using graphical method.

Minimize $z = 2x_1 + x_2$ subject to the following constraints.

$$\begin{aligned} x_1 + x_2 &\geq 1, \\ x_1 - x_2 &\geq -1, \\ x_1 + 2x_2 &\leq 4, \\ x_1, x_2 &\geq 0. \end{aligned}$$

(b) Consider the following LP problem.

Minimize $w = 200y_1 + 255y_2$ subject to the following constraints.

$$5y_1 + 5y_2 \geq 2,$$

$$2y_1 + 3y_2 \geq 1,$$

$$y_1, y_2 \geq 0.$$

Convert this problem to a dual LP problem. Hence, solve the dual problem by using Simplex Method.

5+5 marks

SECTION-B

Question 6

(a) Derive the formula for the Washer Method to find volume of a solid of revolution obtained by revolving the area enclosed by the graphs of $x = a$, $x = b$, and the two continuous functions f and g where $f(x) \geq g(x)$ for all $x \in [a, b]$, about the x-axis. Sketch the area as well.

(b) Use Shell Method to find the volume of the solid of revolution obtained by revolving the area enclosed by the graphs of $y = x^2 - 1$ and $y = 0$ from $x = 2$ to $x = 3$, about the y-axis.

5+5 marks

Question 7

(a) State and prove the Second Theorem of Pappus.

(b) Evaluate the integral $\iint_D e^{y^2} dy dx$, where the region D in \mathbb{R}^2 is $0 \leq x \leq 1$, $y = 2x$, and $y = \frac{1}{2}$. Sketch D .

5+5 marks

Question 8

(a) Use double integrals to find the area inside the circle $r = 4 \sin \theta$ and outside the lemniscate $r^2 = 8 \cos 2\theta$.

(b) Evaluate $\iiint_S 15x^2z^2 dx dy dz$, where the region S in \mathbb{R}^3 is bounded by $x^2 + y^2 = 1$ and $x^2 + z^2 = 1$.

5+5 marks

MUST/B.A/A18/PII/Math-A-IV/C290

Note: Attempt FIVE questions in all, selecting TWO questions from Section-I and THREE from Section-II.

Section-I

- Q.1. a) Find the position vector of a point which divide the join of two given points whose position vectors are \mathbf{a} and \mathbf{b} in the given ratio $\lambda:\mu$.
b) Find the moment about the point $A(5, -1, 3)$ of the force $4\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ through the point $B(5, 2, 4)$.
- Q.2. a) Find the value of λ for which the vectors $\mathbf{i} + \mathbf{j} - \mathbf{k}$, $\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ and $\lambda\mathbf{i} + \mathbf{j} - \lambda\mathbf{k}$ are coplanar.
b) Find the unit vector perpendicular to the surface $\phi = x^2 + y^2 - z$ at $(1, 2, 3)$.
- Q.3. a) Show that $[\mathbf{a} \times \mathbf{b}, \mathbf{b} \times \mathbf{c}, \mathbf{c} \times \mathbf{a}] = [abc]^2$
b) If $\mathbf{v} = \mathbf{a} \times \mathbf{r}$ prove that $\mathbf{a} = \frac{1}{2} \text{curl} \mathbf{v}$, where \mathbf{a} is constant vector.

Section-II

- Q.4. a) Forces P, Q act at point O and their resultant is R . If any transversal cut the lines of action of the forces in the points A, B, C respectively, prove that $\frac{P}{OA} + \frac{Q}{OB} = \frac{R}{OC}$.
b) If forces $l\overline{AB}, m\overline{BC}, l\overline{CD}, m\overline{DA}$ acting along the sides of quadrilateral are equivalent to couple, show that either $l = m$ or $ABCD$ is parallelogram.
- Q.5. a) If the forces $p\overline{AB}, q\overline{BC}, r\overline{CD}, s\overline{AD}$ acting along the sides of plane quadrilateral are in equilibrium, show that $pr = qs$.
b) Forces P, Q, R act along the sides BC, CA, AB of triangle ABC , Find the condition that their resultant is parallel to BC and determine its magnitude.
- Q.6. a) Show that a system of coplanar forces may be represented in an infinite number of ways by two forces, one through each of fixed points in their plane.
b) A circular disc of weight W and radius a is suspended horizontally by two vertical strings each of length l attached to the ends of diameter. A horizontal couple applied to the disc turns it through angle θ . Find the moment of the couple.
- Q.7. a) Prove that the potential energy of a body is equal to that of a single particle with mass equal to the total mass of the body, situated at its centre of gravity
b) A heavy elastic string whose natural length is $2\pi a$ is placed around smooth cone whose axis is vertical and whose semi vertical angle has measured α . If W be the weight and λ the modulus of string, prove that it will be in equilibrium when in the form of circle of radius $a(1 + \frac{W}{2\pi\lambda} \cot\alpha)$.
- Q.8. a) The least force which will move a weight up an inclined plane is of magnitude P . Show that the least force acting parallel to the plane which will move the weight upwards is $P\sqrt{1 + \mu^2}$, where μ is the coefficient of friction.
b) A uniform ladder rest in limiting equilibrium with one end on rough horizontal plane, and other against smooth vertical wall. A man ascends the ladder, show that he cannot go more than half way up.

Note: Attempt FIVE questions in all, selecting TWO questions from Section-I and THREE from Section-II

Section-I

- Q.1. a) Use Newton Raphson method to find the positive real root of $e^x = 3x$ correct up to three decimal places.
b) Find the positive root of $\sin x - \frac{x}{2} = 0$ using false position method.
- Q.2. a) Solve the system of linear equations by Jacobi's method
$$x_1 + 6x_2 + 2x_3 = 15$$
$$x_1 + x_2 - 6x_3 = -3$$
$$6x_1 - x_2 + x_3 = 9.$$

b) Solve the cubic equation $x^3 - 7x^2 + 14x - 8 = 0$, if the roots are in G.P.
- Q.3. Evaluate the integral $\int_0^3 x^2 \cos x dx$ using 7 points Simpson's rule and compare your answer with the exact value and the value obtained by trapezoidal rule.

Section-II

- Q.4. a) Determine the radial and transverse components of velocity and acceleration.
b) Prove that the force field $F = (y^2 - 2xyz^3)i + (3 + 2xy - x^2z^3)j + (6z^3 - 3x^2yz^2)k$ is conservative, and determine its potential.
- Q.5. a) Discuss the motion of particle moving in a straight line if it starts from rest at a distance "a" from a point "O" and moves with acceleration equal to μ times its distance from "O".
b) A particle is projected vertically upwards with a velocity $\sqrt{2gh}$ and another is let fall from a height "h" at the same time. Find the height of point where they meet each other.
- Q.6. a) A shell bursts on contact with ground and pieces from it fly in all directions with all speeds upto 80 feet per second. Prove that a man 100 feet away is in danger for $\frac{5}{\sqrt{2}}$ seconds.
b) Determine the maximum possible range for projectile fired from a cannon having muzzle velocity v_0 and prove that the height reached in this case is $\frac{v_0^2}{4g}$.
- Q.7. a) A particle is moved by a force $F = 20i - 30j + 15k$ along straight line from point A to point B with position vectors $2i + 7j - 3k$ and $5i - 3j - 6k$ respectively, Find the work done.
b) Show that the law of force towards a pole of particle describing the curve $r^n = a^n \cos n\theta$ is given by $f = \frac{(n+1)h^2 a^{2n}}{r^{2n+1}}$.
- Q.8. a) A particle of mass "m" is moving under the action of force $F_1 = -mw^2x$, $F_2 = mF_0t$, and $F_3 = -2m\mu\dot{x}$. Assuming that the damping is small, setup and solve the equation of motion.
b) A particle is fired upward with the velocity "u" in a medium whose resistance is proportional to the square of velocity. Show that the particle return to the point of projection with the speed $\frac{uV}{\sqrt{u^2+V^2}}$, where V is the limiting velocity of the particle in the medium.