

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
AGRICULTURE
(OPTIONAL)
PAPER - I
[07]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION-A

Answer the following in about 150 words each.

1.
 - a) Explain adaptation and resilience as the means to mitigate climate change and weather extremes. (10)
 - b) How high yielding and short duration crop varieties result in a shift in cropping patterns? (10)
 - c) Discuss in brief the important Indian forest products and their scientific tapping. (10)
 - d) Explain in brief the precision nutrient management strategies for sustainable agriculture and soil health management. (10)
 - e) How chemical free agriculture can pave the way for agricultural sustainability? (10)
2.
 - a) Discuss the participatory integrated watershed management approach for rural prosperity and reclaiming degraded lands. (20)
 - b) Discuss the technologies and strategies for sustainable agricultural development of rainfed and water scarce areas. (20)
 - c) Explain phosphorus fixation and its management in different soil conditions. (10)
3.
 - a) How artificial intelligence, internet of things and information and communication technology can bring a paradigm shift in agriculture? (20)
 - b) Explain nitrogen transformation and its losses in soil. Discuss nitrogen management in aerobic and anaerobic conditions for a sustainable agroecosystem. (20)
 - c) Discuss drip irrigation and fertigation for efficient water and nutrient management. (10)
4.
 - a) Discuss the concept, objectives and economic principles of farm planning. (10)
 - b) Discuss market intelligence, test marketing and market management strategies for development of agricultural sector. (20)
 - c) How do co-operatives contribute to the economic development in India? (10)
 - d) Discuss the objectives, advantages and disadvantages of agricultural price policy in India? (10)

SECTION - B

Answer the following in about 150 words each.

5.
 - a) Explain soil microbial resources for improving nutrient use efficiency in an integrated plant nutrient management system. (10)
 - b) Explain weeds as the most important biotic constraint to agricultural production. Discuss non-conventional weed management strategies for modern agriculture. (10)
 - c) Discuss the problem of crop residue burning and its effect on the environment. Suggest viable alternatives to crop residue burning. (10)
 - d) Discuss soil carbon sequestration as an elusive climate change mitigation tool. (10)
 - e) Discuss the role of *krishi vigyan kendras* and other agricultural extension agencies in rural agriculture. (10)
6.
 - a) What are the problems caused by soil erosion? Describe the agronomical practices to check water erosion for sustainable use of land resources. (10)
 - b) Why soils are said to be reactive, not inert? Why soils are generally negatively charged? (10)
 - c) Discuss the applicability and limitations of irrigation scheduling methods and techniques. (10)
 - d) Explain the fate of fertilizers added to the soil. Discuss soil pollution mitigating strategies. (10)
 - e) What are specialty fertilizers particularly for secondary nutrients, micronutrients and beneficial elements? (10)
7.
 - a) Discuss the advantages and disadvantages of methods of rice establishment (transplanted, direct seeded and system of rice intensification). (20)
 - b) How resilience in agriculture through crop diversification can be an adaptive management strategy for environmental change? (10)
 - c) Discuss the status, problems and solutions for oil-seed production in India. (20)
8.
 - a) Discuss the role of non-governmental organisations, farmer-producer organisations and self-help groups for rural development. (20)
 - b) Explain the principle and components of integrated farming system? Describe its advantages in present Indian scenario. (10)
 - c) Explain the importance of rain water harvesting. Describe different techniques of rain water harvesting. How the stored water can be utilized efficiently? (20)

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
ANIMAL HUSBANDRY AND VETERINARY SCIENCE
(OPTIONAL)
PAPER - I
[09]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/ Part is indicated against it. Answers must be written in English in Question-Cum-Answer (QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

1. a) Describe the deficiency symptoms of trace elements in dairy animals in tabulated form. (10)
b) Why correlated characters are important in genetic studies? Write brief note on genetic, environmental and phenotypic correlations. (10)
c) Discuss the various factors affecting semen quality in bulls. (10)
d) Briefly explain the feeding regimes from new born calf to heifer stage. (10)
e) Describe National Livestock Mission and Rashtriya Gokul Mission. (10)
2. a) Define crossbreeding. Explain in brief different methods of crossbreeding. Write the advantages and disadvantages of crossbreeding. (15)
b) Explain the following: (3×5=15)
i) Nutrient losses in ensilage.
ii) Urea treatment of paddy straw.
iii) Feeding and management of piglets.
c) Discuss composition and functions of blood in mammals. (10)
d) Discuss the physiochemical properties of ejaculated semen in domestic animals. (10)
3. a) Discuss the factors affecting digestibility of feed in the domestic animals. (15)
b) Describe mechanism and importance of testicular thermoregulation in breeding bulls. (15)
c) What is inbreeding? Explain different types of inbreeding and its genetic and phenotypic effects. (10)
d) Discuss in detail the excretion and transport of gases in birds. (10)
4. a) Describe the factors effecting prenatal and post-natal growth. (10)
b) Explain the following: (2×10=20)
i) Counter current mechanism in kidney.
ii) Oxygen hemoglobin dissociation curve.
c) Explain feeding management of broiler birds. (10)
d) Describe different methods to spread awareness among the livestock farmers. (10)

SECTION - B

5. a) Explain the digestion of carbohydrates in dairy animals. Explain how non protein nitrogen compounds are utilized by ruminants. (15)
b) What is mutation? Explain in detail the different type of mutations and their genetic and phenotypic effects. (15)
c) Explain causative factors and therapeutic management of anestrus in buffaloes. (10)
d) Describe biosynthesis and ejection of milk in mammals. (10)

6. a) Explain the following: (2×10=20)
i) Significance of blood groups in animals.
ii) Different stages of clot formation.
b) How nutrition effects milk yield and milk composition in dairy animals. (10)
c) Describe the different stages of mitosis and their significance. (10)
d) Describe the followings: (2×5=10)
i) Fructolysis Index Test.
ii) Catalase Test.
7. a) How will you select good dairy animals to start the dairy business? (10)
b) Explain the following: (2×10=20)
i) Strategies to improve conception rate in dairy cows under field conditions.
ii) Feeding strategies of dairy animals during transition stage.
c) Discuss the effect of stress on production and reproduction in livestock. (20)
8. a) Explain the following: (3×5=15)
i) Importance of Blood- Testis Barrier.
ii) Conservation of fodder.
iii) Anti-diuretic hormone.
b) Write a note on inheritance of lethal genes in different species of livestock and poultry. (10)
c) Explain the role of evolution and domestication in the history of animal breeding. (10)
d) Define breed and describe the breed characteristics of Zebu cattle. Classify the breeds of cattle in India based on utility. Describe the characteristics of one dairy, draught and dual-purpose breed of India. (15)
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
ANTHROPOLOGY
PAPER - I
[11]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions No.1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part are indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

Write notes on the following in about 150 words each.

(5×10=50)

1.
 - a) Kula Ring
 - b) Sapir-Whorf Hypothesis.
 - c) Holism vs Atomism in Anthropology
 - d) Models in Anthropology
 - e) Ruth Benedict
2.
 - a) What was Mead's theory about the "cause" of adolescent crises? What is Mead's contribution to the Culture and personality school of thought? (20)
 - b) "Anthropology is the most scientific of the humanities, and the most humanistic of the sciences". Discuss. (15)
 - c) What are the challenges of holistic perspective in anthropology? How are they addressed? (15)
3.
 - a) Describe the impact of feminist movement on the universality of family and marriage as institutions. (20)
 - b) Differentiate between power and authority. Explain with examples different types of authorities in context rural India. (15)
 - c) Explain sacred and profane with examples. Compare and contrast Emile Durkheim and Clifford Geertz's approach to religion. (15)
4.
 - a) What is Matrilineal descent? Critically discuss matrilineal puzzle. (20)
 - b) Discuss the view that caste is not social stratification, but a system of hierarchy. (15)
 - c) What is narrative analysis? How is narrative analysis used in qualitative research? (15)

SECTION - B

Write notes on the following in about 150 words each.

(5×10=50)

5.
 - a) Trisomy 18
 - b) Grimaldi
 - c) Nobel Prize (Medicine or Physiology) 2022 in Human Evolution
 - d) Eugenics
 - e) Bioevents to Fertility

6. a) What is Hardy Weinberg Law? Discuss various evolutionary forces influencing Hardy Weinberg Law. (20)
- b) Neolithic is called revolution not evolution. Discuss it with suitable Indian examples. (15)
- c) What is Consanguineous Marriage? Discuss genetic effects of consanguineous and cousin Marriages. (15)
7. a) Discuss various types of chromosomal aberrations in man illustrating with suitable examples. (20)
- b) Discuss Polygenic Inheritance citing the example of human skin colour. (15)
- c) Megalithic cultures of South India mean Iron age. Discuss. (15)
8. a) Designing equipment, sports, and forensic anthropology have applied aspects of anthropology. Discuss with suitable examples. (20)
- b) What is physique? Describe Heath-Carter method of assessing the human physique. (15)
- c) Describe the physical characteristics of Australopithecus and the associated stone age cultures. (15)
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
BOTANY
(OPTIONAL)
PAPER - I

[13]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.*
- ii) Your answer should be precise and coherent.*
- iii) If you encounter any typographical error, please read it as it appears in the text book.*
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) No blank page should be left in between answers to various questions.*

SECTION - A

1. Write short notes on:
 - a) Why bryophytes are called amphibians of plant kingdom? (10)
 - b) Economic importance of algae. (10)
 - c) Applications of plant tissue culture. (10)
 - d) Chemotaxonomy. (10)
 - e) Endosperm - development and functions. (10)
2.
 - a) Outline the beneficial roles of microbes in agriculture, health care and industry. (20)
 - b) Comment on stelar evolution in vascular cryptogams. (15)
 - c) Write the botanical name, family, morphology of the economically important part, and uses, of ONE representative each from cereals, spices, beverages, timber, and drug yielding plants. (15)
3.
 - a) How are fossils studied? List the various kinds of fossils with examples. (20)
 - b) Compare and contrast pteridophytes and gymnosperms. (15)
 - c) List the distinguishing features of Brassicaceae, Euphorbiaceae, and Liliaceae. Draw the floral diagram and give floral formula of any representative member. (15)
4.
 - a) Describe the symptoms, causal organisms and remedial measures of plant diseases caused by ONE viral and ONE fungal pathogen. (20)
 - b) Comment on different kinds of stomata with the help of suitable drawings. (15)
 - c) Distinguish between any **THREE**: (15)
 - i) Ring porous and diffuse porous wood
 - ii) Leaf anatomy of C₃ and C₄ plants
 - iii) Glandular and non glandular hairs
 - iv) Monocot and dicot root
 - v) Chlorophyceae and Rhodophyceae

SECTION - B

5. Write briefly about:
 - a) Energy plantations. (10)
 - b) Microsporogenesis in angiosperms. (10)
 - c) Centres of origin of cultivated plants. (10)
 - d) Plant quarantine (10)
 - e) Cycadales. (10)
6.
 - a) Explain the evolutionary significance of heterospory and seed habit in pteridophytes. (20)
 - b) Distinguish between bacteria, viruses and mycoplasma and describe how they multiply. (15)
 - c) Briefly describe the techniques and applications of embryo rescue. (15)

7. a) Describe Palynology and its applications. What are the various methods of pollen storage? (20)
- b) Define the terms totipotency, somatic hybridization, and somaclonal variation and mention their applications. (15)
- c) Explain unusual (anomalous) secondary growth with suitable illustrations. (15)
8. a) Elaborate on how Apomixis and Polyembryony are useful in crop production. (20)
- b) Enumerate the merits and demerits of Bentham and Hooker's system of classification. (15)
- c) What is the significance of Ethnobotany in India? (15)
-

CC(M)
CHEMISTRY
(OPTIONAL)
PAPER - I
[15]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in All. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer (QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their Own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

1. (a) Show that the wavefunctions of a particle confined in a one - dimensional box of length a is orthogonal. Calculate the expectation value of position of this particle in the one-dimensional box of length l . (20)

- (b) Give schematic diagrams of radial probability distribution curves for 3s, 3p and 3d orbitals.

Comment upon the significance of number of nodes in the radial distribution curve for an orbital. (10)

- (c) Consider the following table.

Molecule	Dipole moment	Bond
		length
HCl	3.44×10^{-30} C.m	0.127 nm
HBr	2.65×10^{-30} C.m	0.140 nm
HI	1.00×10^{-30} C.m	0.161 nm

Calculate the fractional charge on the halogen atoms. Comment on the covalent character of the molecules. (10)

- (d) Discuss the effect of temperature on the viscosity of fluids (gases and liquids). (10)

2. (a) Briefly describe and compare the *powder and rotating crystal* method for obtaining X ray diffraction patterns for solids. (10)

- (b) Draw a well labelled phase diagram of Sulfur. On the basis of Gibbs phase rule, explain the non-existence of four phases at a point in the diagram. Comment upon the densities of rhombic, monoclinic and liquid sulfur, based on slopes drawn in the diagram. (15)

- (c) Derive the expressions for T_c , P_c and V_c in terms of van der Waals constants, a and b , for a real gas. (10)

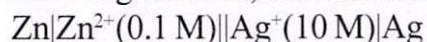
- (d) Show that the Joule-Thomson coefficient (μ_{JT}) for an ideal gas is zero. Explain why this coefficient is positive for a real gas. (15)

3. (a) Wetting angle for mercury in contact with glass is 140° . Comment on its adhesive nature. A liquid has half the density and half the surface tension than B liquid. What would be the height in the capillary to which B would rise, if A rises to 1 cm? (10)

- (b) Derive the expression for calculation of entropy change for an ideal gas when P and T are variable. (10)

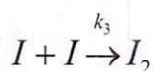
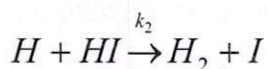
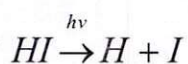
- (c) In the light of Maxwell-Boltzmann distribution of molecular velocities, discuss and explain with the help of a neat, well labelled diagram, the temperature effect on molecular speeds. Calculate root mean square and average velocity for hydrogen gas at 0°C . (15)

- (d) For the given cell, EMF is found to be 1.62 V at 25°C .



Write the half-cell reactions and overall cell reaction. Calculate equilibrium constant for the cell reaction. (15)

4. (a) i) Derive the expression for $t_{1/2}$ for a reaction of order 3/2. (3×5=15)
 ii) Half-life of a first order reaction ($A \rightarrow B$) is 10 minutes. Calculate the percentage of A remaining after 1 hour.
 iii) What is the effect of pressure on reaction rate? Explain.
 (b) Based on MO theory, arrange the following in decreasing order of bond length.
 O_2^- , O_2 , O_2^{2-} , O_2^+ . (10)
 (c) Decomposition of HI follows the following mechanism: (10)



Derive the corresponding differential rate law and the expression for quantum yield.

- (d) Write the expression for BET equation. How BET equation accounts for the qualitative explanation of five different types of observed adsorption isotherms? (15)

SECTION - B

5. (a) Would Jahn - Teller distortion be as significant for tetrahedral complexes as it is for octahedral complexes? Explain your answer. (15)
 (b) Show all the possible isomers for the following complexes:
 i) $[Co(NH_3)_5(NO_2)](NO_3)_2$
 ii) $[Co(H_2O)_2(ox)BrCl]^-$
 iii) $[Cr(NH_3)_4ClONO_2]Br$ (15)
 (c) For $[IrCl_6]^{3-}$ and $[NiCl_4]^{2-}$ coordination compounds, sketch crystal field splitting diagram by filling the appropriate d orbitals by electrons. Predict the magnetism of the complex. (10)
 (d) Write the IUPAC names of the following complexes:
 i) $K[Ag(CN)_2]$
 ii) $[Co(NH_3)_5ONO]^{2+}$
 iii) $[NH_3)_5Co-O_2-Co(NH_3)_3]^{4+}$
 iv) $[Cr(en)_3]Cl_3$
 v) $[Cr(H_2O)_6]Co(CN)_6$ (10)

6. (a) What is active transport across biological membrane? Discuss the mechanism of transport of Na^+/K^+ across the membrane. (15)
- (b) Write balanced equations for each of the following processes:
- Preparation of $\text{B}_3\text{N}_3\text{H}_6$.
 - Reaction of diborane with LiH
 - Preparation of $\text{Na}[\text{BH}_4]$
 - Combustion of diborane (at red heat)
 - Preparation of $(\text{C}_6\text{H}_5)_3\text{B}$. (10)
- (c) Discuss different modes of bonding of cyclopentadiene with metals by giving suitable examples. (10)
- (d) What are chelate complexes? On what factors does the stability of chelate complexes depend? Explain with suitable examples. (15)
7. (a) Describe at least 5 types of silicates depending on the linking of SiO_4 unit. (15)
- (b) Actinides are more prone to complex formation than the lanthanides. Explain and give two examples of actinide(V) complexes. (10)
- (c) Complete and balance the following reactions.
- $$\text{ClF} + \text{SO}_2 \rightarrow$$
- $$\text{Cl}_2 + \text{F}_2 \rightarrow$$
- $$\text{IF}_5 + \text{H}_2\text{O} \rightarrow$$
- $$\text{SiO}_2 + \text{IF}_7 \rightarrow$$
- $$\text{SiCl}_4 + \text{H}_2\text{O} \rightarrow$$
- (10)
- (d) Comment upon the possible bonding modes observed in nitrosyl compounds. Compare by discussing the hybridization and shapes of NO^+ and NO^- complexes with metals. (15)
8. (a) On the basis of crystal field theory explain why $[\text{Co}(\text{NH}_3)_6]^{2+}$ is easily oxidized to $[\text{Co}(\text{NH}_3)_6]^{3+}$. (10)
- (b) Draw the structures of the following compounds $\text{XeO}_4, \text{XeF}_6, \text{XeOF}_4, \text{XeO}_3, \text{XeO}_2\text{F}_2$. (10)
- (c) Write a note on cytochromes. (15)
- (d) What is Lanthanide contraction? Explain the cause and discuss the effects of lanthanide contraction. (15)

Total No. of Printed Pages-11]

Roll No. _____

CC(M)
CIVIL ENGINEERING
(OPTIONAL)
PAPER - I

Time Allowed - Three Hours

[17]

Maximum Marks-250

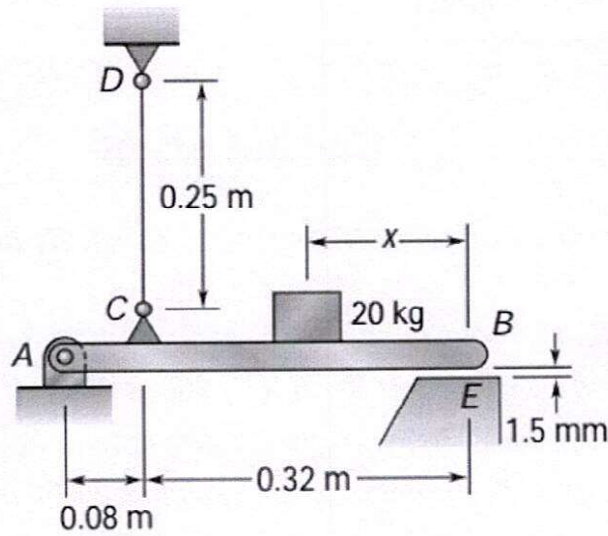
INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) For any typographical error, please read it as it appears in the question paper.
- iv) Diagrams/Figures, may be drawn wherever required in the space provided.
- v) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- vi) No continuation sheets shall be provided to any candidate under any circumstances.
- vii) No blank page should be left in between answers to various questions.
- viii) Non Programmable Calculators are allowed.

SECTION - A

1. a) A rigid beam AB , is hinged at end A . A small gap of 1.5 mm exists between end B and the platform at point E as indicated in the figure. A steel wire CD of length 0.25 m and 2 mm diameter is attached at point C of the beam. Determine the distance x from end of the beam at which a block of 20 kg should be placed so that the end B just comes in contact with point E . Assume elastic modulus of steel to be 200 GPa. (10)



1. b) i) State any Four limitations of the field Plate Load Test. (4+6=10)
- ii) A plate load test using a plate of size 30 x 30 cm is carried out on a cohesionless soil. The water table is at great depth. The plate settled by 20mm at the load intensity of 200 kPa. Determine the settlement of a square footing of size 3m x 3m at the same load intensity.
1. c) An RC column with an unsupported length of 3.0 m has been designed to have a cross-sectional dimension of 400 mm x 575 mm. The column has fixed supports at both ends. M25 concrete and Fe 415 steel are used for its construction. The clear cover to the reinforcement is 40 mm all around. The amount of longitudinal reinforcement provided is 5494 mm². Reinforcement and other geometric details are shown in the figure below. (2+2+6=10)

Answer the following questions.

- i) What would be its ultimate load-carrying capacity if the column has been designed to experience axial load allowing for the minimum eccentricity (as per IS 456) alone?
- ii) If it was possible to ensure a pure axial loading with no eccentricity, what could have been the value of the maximum axial load that the column could carry?
- iii) The reinforcement provided (5494 mm^2) is detailed in a manner shown in the following figure. Do you think the detailing is alright as per the provisions specified in IS456? If not, then identify the issues. You should point out the flaws both in longitudinal and transverse reinforcements if they exist.

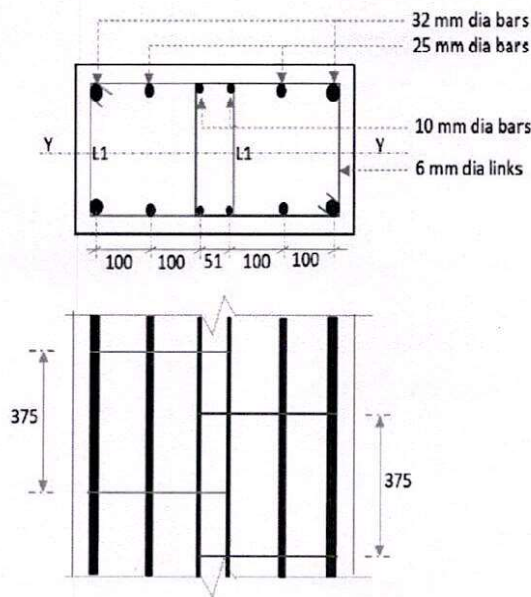


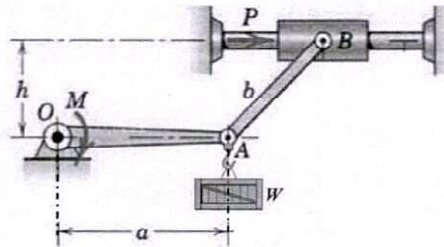
Figure (a): Cross-sectional view of an RC column. The longitudinal reinforcements are symmetrically placed. Bar diameters are given for both longitudinal and transverse reinforcements. Center to center distances between the bars along the longer edge are also mentioned.

Figure (b): Longitudinal section of RC column. Staggered arrangement of the links along with their pitch is shown.

1. d) Define the following: (10)
 - (i) Seepage Velocity
 - (ii) Non-Newtonian Fluid
 - (iii) Strain Energy
 - (iv) Turbulent flow
 - (v) Shrinkage Limit
1. e) A 30cm diameter Cylinder having length 50cm is placed inside a hollow shaft of diameter 30.1 cm. Inner cylinder is rotated at 350 rpm. The gap between cylinder is filled with viscous oil having viscosity 10 poise. Determine the power loss due to viscosity. (10)

2. a) Two rigid links, OA and AB , are connected through a pin at point A . The lengths of these members are respectively a and b . The end O of OA is a hinge support, and member AB is connected at end B with a sliding collar through a pin. Assume that the slider is frictionless. There is a hanging weight W at A , and a moment M is applied on the member OA near the hinge support. (20)

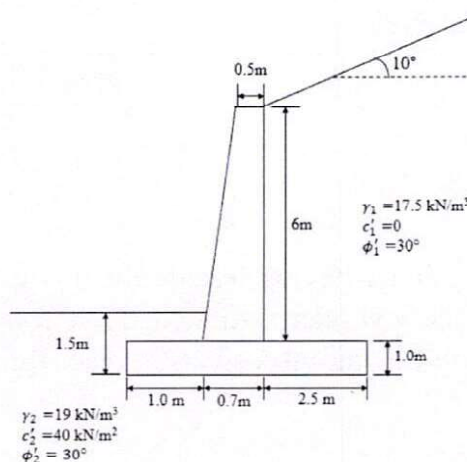
Determine the force P on the sliding collar, which will keep the link OA horizontal and prevent it from rotating under the action of W and M . Neglect the weight of the components.



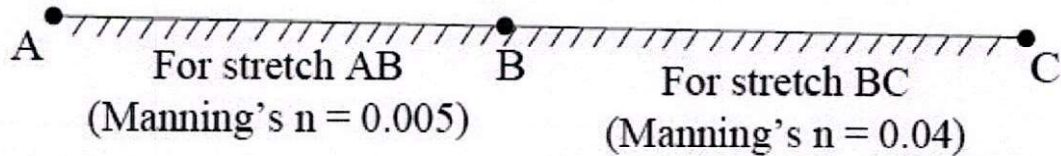
2. b) A stream function is given by $\psi = \frac{3}{2}(y^2 - x^2)$ Determine. (10)

- Discharge between (1,3) and (3,3)
- Resultant Velocity at those points
- Velocity Potential
- Type of fluid flow

2. c) For the cantilever retaining wall shown in Figure below, calculate the factor of safety with respect to overturning and sliding. Use $\gamma_{\text{concrete}} = 24 \text{ kN/m}^3$. Use $\delta = 2/3\phi'$ and neglect passive earth pressure P_p . (20)



3. a) A wide rectangular channel laid at a slope (S_o) of 0.001 carries a discharge of $4\text{m}^3/\text{Sec}/\text{m}$. As a consequence of lining of the upstream stretch AB, Manning's roughness coefficient of the channel varies from 0.005 (in stretch AB) to 0.04 (in stretch BC) as shown in the figure below. (20)

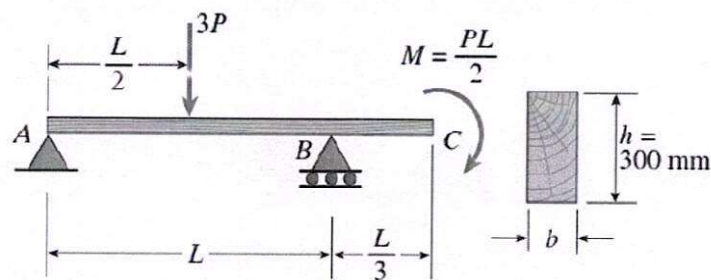


Assuming both the stretches (AB and BC) to be long enough, perform the following tasks

- Sketch the gradually varied profile that will be formed due to lining, clearly mentioning its nomenclature and mark the control section.
- Using Direct Step Method, compute the distance between the junction B and the hydraulic jump. Use one single step.
- Compute the head loss in the hydraulic jump

Assume that far away from the junction, the flow depths in both the stretches are equal to corresponding normal depths and consider the gravitational acceleration to be $10\text{m}/\text{s}^2$

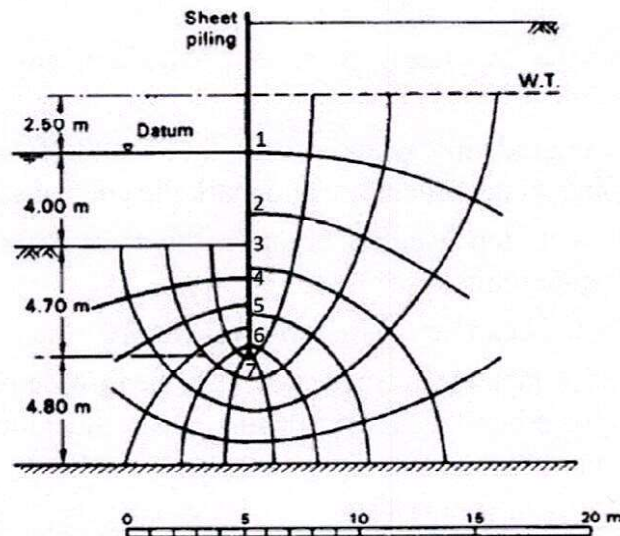
3. b) A timber beam ABC of rectangular cross section is supported at points A and B and has an overhang BC of length $L/3$. In addition to the self-weight of the beam, a concentrated load $3P$ and a concentrated moment $PL/2$ act on the beam as shown in the figure. If the allowable flexural stress and shear stress for timber are 12MPa and 0.8MPa respectively, determine the minimum required width b of the beam. Consider the following data: $L = 3.6\text{m}$, $P = 6\text{kN}$, depth of beam $h = 300\text{mm}$, unit weight of timber $= 5\text{kN}/\text{m}^3$. (20)



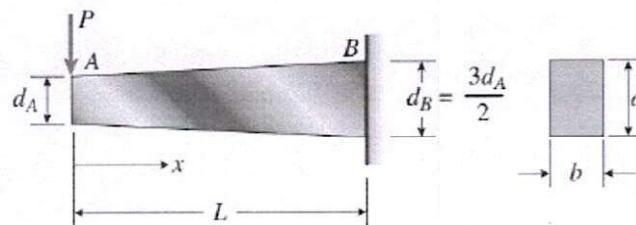
3. c) A normally consolidated clay was consolidated under a stress of 150kPa , then sheared undrained in axial compression. The principal stress difference at failure was 100kPa , and the induced pore pressure at failure was 88kPa . Determine (a) the Mohr-Coulomb strength parameters, in terms of both total and effective stresses analytically, (b) compute stress ratios $(\sigma_1 / \sigma_3)_f$ and $(\sigma'_1 / \sigma'_3)_f$ and (c) determine the theoretical angle of the failure plane in the specimen. (10)

4. a) The section through a sheet pile wall along a tidal estuary is given in Figure. At low tide, the depth of water in front of the wall is 4.00 m from the dredged level and the water table behind the wall lags 2.50m behind the tidal level. Calculate and plot the net distribution of water pressure on the piling. (20)

Level	1	2	3	4	5	6
Depth below Datum (m)	0	2.7	4	5.5	7.1	8.3



4. b) Figure shows a tapered rectangular cantilever AB , with depth d_A at the free end and depth $3d_A/2$ at the fixed end B . The width is constant ($= b$) along the entire length of the beam. A point load P acts at the free end of the cantilever. (5+15=20)
- Determine the moment of inertia I at a distance of x from the free end.
 - What is the slope and deflection at the free end A of the cantilever?



4. c) An aeroplane is to be modelled in a wind tunnel where a wind pressure is 10 times of atmospheric pressure. The velocity of aeroplane is 400 Km/hr. Determine (10)
- (i) Corresponding velocity of the wind in tunnel. Take scale ratio 1 by 15.
 - (ii) Force on prototype if the force on model is 500N.

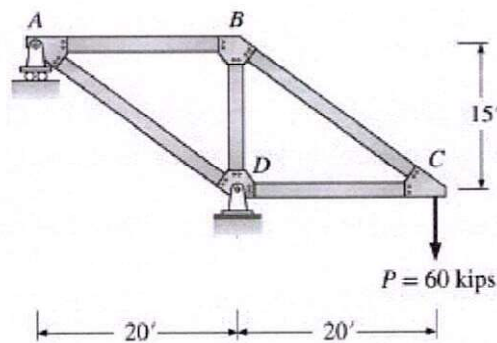
The Frequency of model if the frequency of prototype is 10.

SECTION-B

5. a) A flat plate is kept in vertical direction and a water jet having diameter 75mm and velocity 15m/s strikes the plate horizontally. Determine (10)
- (i) The force experienced by the plate, if the plate is at rest.
 - (ii) The work done by the jet, if the plate is at rest.
 - (iii) The force experienced by the plate, if the plate moves in the direction of jet at 5m/sec.
 - (iv) The work done per unit time (power) by the jet.
5. b) What are stress relaxation, stress corrosion and hydrogen embrittlement in high tensile strength steel used in prestressed concrete structures? What is loss of prestress? (2.5+2.5+2.5+2.5=10)
5. c) Explain four different types of cross-sections defined in IS 800. Elaborate the moment-rotation characteristics of cross-section classes by providing neat sketches. (10)
5. d) The properties of the sand are $\phi' = 30^\circ$, $\gamma = 17.5 \text{ kN/m}^3$, and $\gamma_{\text{sat}} = 18 \text{ kN/m}^3$. Determine the maximum slope angle of the sand in (a) the dry state, and (b) the saturated state if groundwater is present and seepage were to occur parallel to the slope. What is the safe slope in the dry state for a factor of safety of 1.5? (10)
5. e) A 3 m wide rectangular channel is narrowed to a width of 1.5 m to cause critical flow in the contracted section. If the depth of flow in the contracted section is 0.8 m, determine the discharge in the channel. Also compute depth of flow corresponding to sub critical flow at 3 m wide section. Neglect energy losses in the transition. consider the gravitational acceleration to be 10 m/s^2 . (10)

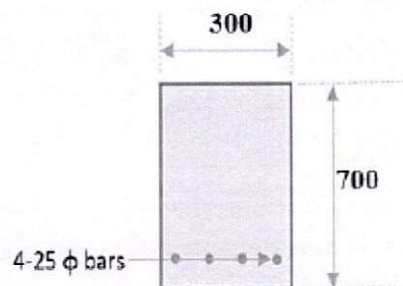
6. a) The following truss is designed with members having the same cross-sectional dimension given by $b \times b$ inch², where b is a whole number. The truss is subjected to vertical load 60 kips (kilo pound) at point C. The given value of Young's modulus is 30,000 kips/in². The lengths of the members may be obtained from the dimensions provided in the figure. Note that 1' = 12". (20)

Find the minimum value of b such that no member undergoes extension or contraction more than 1/3 inch, none of them experience axial stress more than 35 kips/in², and vertical deflection of point C remains less than 1.38 inch.



6. b) A designer has designed a rectangular RC beam having dimensions and reinforcement as shown in Figure. The beam has an effective span of 6 m and a clear cover of 30 mm has been provided. Considering M25 concrete and Fe 415 steel, determine the allowable unfactored load that the beam can carry including its self-weight. You may neglect the presence of stirrups for this particular problem. The design stress-strain values for steel as per IS code is as follows: (20)

Strain	0.0028	0.0030	0.0035	0.0038
Strees	0.840fy	0.845fy	0.860fy	0.870fy



6. c) A shallow foundation of 2.5m square cross-section is located at a depth of 1 m below the ground surface and is resting on a saturated compacted sand (10)

deposit of $\phi = 36^\circ$ and saturated unit weight of 18 kN/m^3 . The water table is located at a depth of 6m from the ground surface.

- Determine the ultimate bearing capacity of the footing.
- Compare the net ultimate bearing capacity of the footing for two cases of groundwater table locations, i.e. when it is located at the ground surface and at 1m below the base of the footing.
- If the footing is subjected to a vertical load of 600 kN and a moment of 150 kN-m, calculate the factor of safety of the footing. The effect of depth factor may be neglected.

SL SHAPE OF BASE NO.	SHAPE FACTOR		
	S_c	S_q	S_γ
i) Continuous strip	1.00	1.00	1.00
ii) Rectangle	$1+0.2 B/L$	$1+0.2 B/L$	$1-0.4 B/L$
iii) Square	1.3	1.2	0.8
iv) Circle	1.3	1.2	0.6

Use B as the diameter in the bearing capacity formula.

TABLE 1 BEARING CAPACITY FACTORS

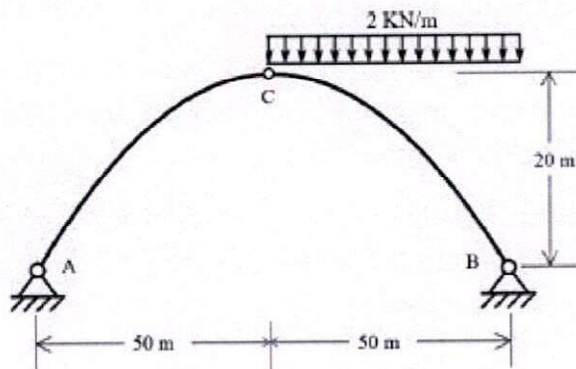
(Clause 5.1.1)

BEARING CAPACITY FACTORS			
ϕ (Degrees)	N_c	N_q	N_γ
0	5.14	1.00	0.00
5	6.49	1.57	0.45
10	8.35	2.47	1.22
15	10.98	3.94	2.65
20	14.83	6.40	5.39
25	20.72	10.66	10.88
30	30.14	18.40	22.40
35	46.12	33.30	48.03
40	75.31	64.20	109.41
45	138.88	134.88	271.76
50	266.89	319.07	762.89

NOTE - For obtaining values of N'_c , N'_q and N'_γ calculate $\phi' = \tan^{-1} (0.67 \tan \phi)$. Read $N_{\phi'}$, $N_{q'}$ and $N_{\gamma'}$ from the Table corresponding to the value of ϕ' instead of ϕ which are values of N'_c , N'_q and N'_γ respectively.

7. a) A pipeline having diameter 100mm is connected to a reservoir having head of liquid 4m and the Specific gravity of liquid is 0.8. At the end of the pipe, a nozzle having diameter 25mm is connected to discharge the liquid into atmosphere. The head loss in the pipe is 20 times of its Kinetic head. Determine (15)
- The rate of flow
 - The pressure at the inlet of the nozzle.

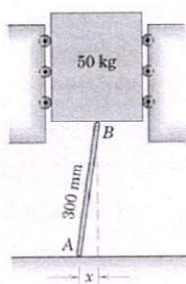
7. b) A three-hinged parabolic arch of span 100 m and rise 20 m is shown in the figure below. It is loaded with a uniformly distributed load of intensity 2 kN/m on its right half. Find out the normal thrust (axial force) and shear force at points where the maximum hogging and sagging moments develop. (20)



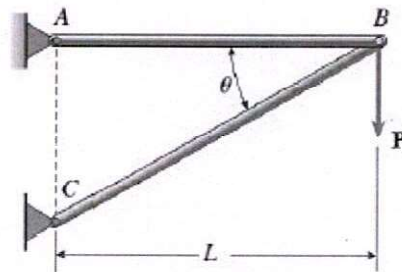
7. c) A layer of sand extends from ground level to a depth of 10m and overlies a layer of clay, of very low permeability, 10m thick. The water table is 6m below the surface of the sand. The saturated unit weight of the sand is 18.5 kN/m^3 and that of the clay is 19 kN/m^3 . The unit weight of the sand above the water table is 16 kN/m^3 . Over a short period of time the water table rises by 3m, and is expected to remain permanently at this new level. Determine the effective vertical stress at depths of 15m below ground level (a) immediately after the rise of the water table, and (b) several years after the rise of the water table. (15)

8. a) At a construction site, a cement container of 50 Kg weight is kept at an elevation from the ground by supporting it using a tilted stick of length 300 mm, as shown in the figure. The container has roller guides at its vertical edges. The coefficient of static friction at the upper end of the stick, where it is in contact with the container, is 0.3 and the same is 0.4 at the other end, where the stick touches the ground. (20)

Find the friction force in Newton at each end when the stick's inclination is given by $x = 75^\circ$. Also, find the maximum value of x for which the stick won't slip.



8. b) A reservoir having gross head 30m is used to supply water through a penstock of 60m diameter having length 500m. At the end of the pipe, a nozzle is connected to discharge water in atmosphere. Derive the expansion of the diameter of nozzle to develop maximum power. Also, find the maximum power developed. Take $f = 0.02$. (15)
8. c) A truss ABC consists of a horizontal member AB and an inclined member BC . Both the members have circular cross section of diameter d . While the length of AB remains constant ($= L$), the length of BC may vary depending on the angle of inclination θ . A point load P is applied at joint B . If the failure of the truss occurs by Euler buckling of member BC , determine the optimum angle of inclination θ such that the weight of member BC is minimised. Note: For minimum weight of the bar, the volume of the bar should be a minimum. You may assume the member to buckle in the plane of the figure only. (15)



Total No. of Printed Pages-3]

Roll No. _____

CC(M)
ECONOMICS
(OPTIONAL)
PAPER - I
[21]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Question No. 1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer (QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

Instructions : Wherever necessary your answer must include appropriate diagrams. **(5×10=50)**

Answer the following questions in about **150** words.

1.
 - a) In a situation of disequilibrium, how does the Walrasian adjustment differ from Marshallian adjustment?
 - b) Excess capacity is found at equilibrium of the monopolistic competitive market. Elaborate.
 - c) Discuss the Nash equilibrium of oligopoly. Explain why both firms charging price equal to the marginal cost is the only Nash equilibrium in the Bertrand model of oligopoly.
 - d) What is high powered money? Why is it termed as high powered? How is it related to money multiplier?
 - e) Can stagflation be explained through Keynesian analysis. Give reasons for your answer.

2.
 - a) Calculate the monopoly and duopoly equilibrium values for output, price, profit and consumer surplus when the demand function is $P = 50 - 2Q$ and the cost function is $C = 10 + 2q$, where Q is industry output and q is output of the firm.
What does increased competition do to a firm; equilibrium outcomes? **(20)**
 - b) Explain that the existence of the problem of free rider causes the market to fail in producing efficient equilibrium. What are solutions to this problem? **(15)**
 - c) Any desired Pareto efficient allocation can be attained by the competitive market mechanism if the initial endowments are adjusted appropriately. Elaborate. **(15)**

3.
 - a) In an economy with perfect capital mobility, fixed exchange rate and constant prices which of the two policies fiscal or monetary would be effective in increasing income? Explain your answer. **(20)**
 - b) Elaborate the concept of real exchange rate. Discuss the happening of real depreciation. **(15)**
 - c) Why was TRIPS included in WTO? Why was WTO TRIPS Agreement amended and what are these amendments? **(15)**

4.
 - a) Discuss the steady state condition in the Solow model with population growth and no technological progress. **(20)**
 - b) What do you understand by a firm's desired capital stock? How does the firm move from the actual capital stock to the desired level of capital stock in the long run? **(15)**
 - c) Explain partial and complete crowding out effect of expansionary fiscal policy. **(15)**

SECTION - B

Answer the following questions in about 150 words.

(5×10=50)

5. a) How can the policy dilemma of sacrifice ratio be addressed to?
b) Discuss the important indicators of sustainable development.
c) Distinguish between current versus capital account transactions. What are the components of these accounts?
d) Distinguish between public goods, merit goods and private goods.
e) Mention the classification of assets held by a commercial bank. Discuss the problems faced by commercial bank due to rise in NPAs.
6. a) Explain rational expectation. What are its shortcomings? Do you think that it is an improvement over the theory of adaptive expectation? (20)
b) If $C = 100 + .75 Y_d$, $t = 0.2$, $I = \text{Rs. 35 Crores}$, $G = \text{Rs. 25 Crores}$.
Calculate the following:
i. The equilibrium level of income and the value of government multiplier.
ii. When foreign sector in the above model is included with exports and imports being Rs. 22 Crores and Rs. 30 Crores respectively, find out new equilibrium value of national income? (8+7)
c) Differentiate between balance of trade (BOT) and balance of payment (BOP). What policies can be applied to correct the deficit in BOP? (15)
7. a) What are the instruments of monetary policy used by Reserve Bank of India? Discuss the multiple indicator approach used by RBI for monetary policy formulation. (20)
b) Explain the loanable fund theory of determination of rate of interest. (15)
c) Using the concept of consumer and producer surplus, discuss the gains and losses from export subsidies. (15)
8. a) What relationship you can envisage between economic development and environmental upgradation? How can the two be made complementary to each other? (20)
b) Discuss the concept of economic growth as propounded by Simon Kuznets. (15)
c) What does the factor price equalisation theorem postulate? What is its relationship to the international mobility of factors of production? (15)

CC(M)
ELECTRICAL ENGINEERING
(OPTIONAL)
PAPER - I
[23]

Time Allowed - Three Hours

Maximum Marks-250

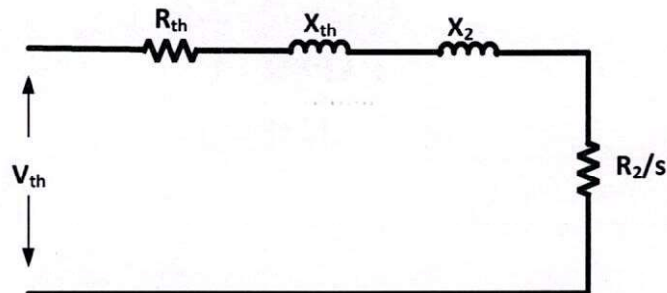
INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) *There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in **All**. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer (QCA) Booklet in the space provided.*
- ii) *Your answer should be precise and coherent.*
- iii) *For any typographical error, please read it as it appears in the question paper.*
- iv) *If you encounter any typographical error, please read it as it appears in the text book.*
- v) *Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- vi) *No continuation sheets shall be provided to any candidate under any circumstances.*
- vii) *No blank page should be left in between answers to various questions.*
- viii) *Non Programmable Calculators are allowed.*

SECTION - A

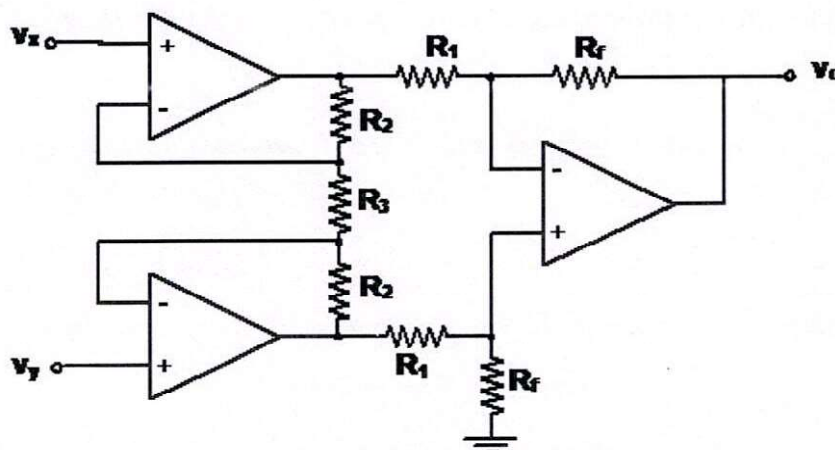
1. a) A 3-phase, Y-connected, 6-pole, 50 Hz induction motor has the following Thevenin equivalent circuit representation: $V_{th} = 250$ V, $R_{th} = R_2 = 1\Omega$, $X_{th} = X_2 = 2\Omega$. If the motor is in regenerative braking mode, calculate the speed for an active load of 120 Nm. (10)



- b) A three-phase fully controlled rectifier is used to feed an R-L load from the 400 V, 50 Hz mains input. Find the firing angle delay (in degrees) required, if the load takes 10 kW. The load inductance is large enough to give ripple free load current and the load resistance is 20Ω . (10)
- c) A voltage applied to a parallel plate capacitor is $V = 100\sin(2000t)$ V. The area of the plates is 10 cm^2 and separation distance is 5 mm. The relative permittivity (ϵ_r) of the dielectric material of the capacitor is 4. What is the peak magnitude of displacement current? ($\epsilon_0 = 8.854 \times 10^{-12}\text{ F/m}$). (10)
- d) Verify, for the differential amplifier shown in figure, (10)

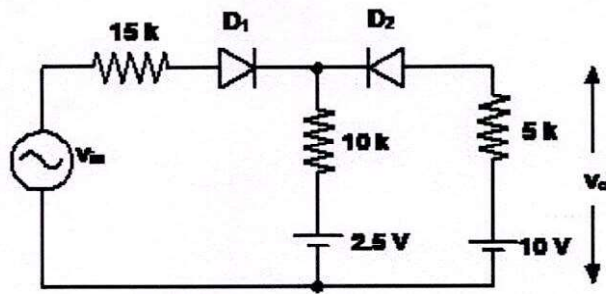
$$v_o = -\left(1 + \frac{2R_2}{R_3}\right) \frac{R_f}{R_1} (v_x - v_y)$$

Assume operational amplifier to be ideal.



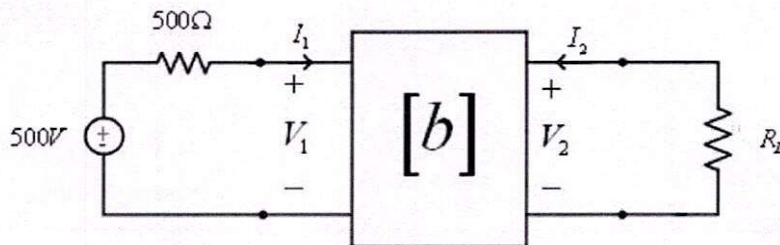
- e) Consider a discrete-time LTI system with impulse response $h[n] = \delta[n] + \delta[n+1]$. Determine the output $y[n]$ of the system for an input $x[n] = \delta[n] + 2\delta[n-1] + 3\delta[n-2]$. (10)

2. a) Draw the transfer characteristic of the circuit shown in the figure. Assume the diodes to be ideal. Also draw the output voltage waveform if $v_{in} = 20 \sin(2\pi ft)$ and $f = 1 \text{ kHz}$. (20)



- b) The inverse transmission parameters of a two-port network are given as $b_{11} = -20$, $b_{12} = -3000 \Omega$, $b_{21} = -2 \text{ mS}$, $b_{22} = -0.2$ (20)

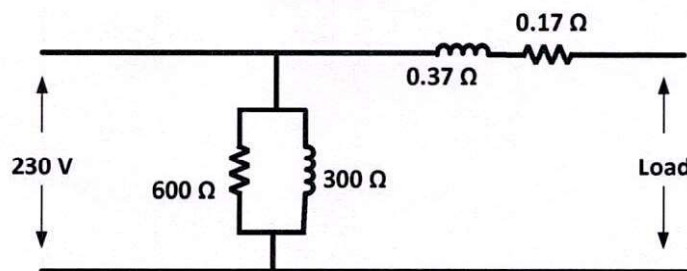
The network is terminated with a resistance $R_L = 5 \text{ k}\Omega$ as shown in the figure. Determine the voltage across R_L .



- c) Draw a Karnaugh map for the Boolean function $F = \sum_{WXYZ} (1,3,4,5,9,11,12,13,14,15)$ and realize the minimal function F which is obtained from Karnaugh map, using Programmable Logic Array (PLA). (10)

3. a) The equivalent circuit of a single phase 230/415 V, 50 Hz, 6 kVA transformer, connected to source from low voltage side, is illustrated in the figure below. The values shown in the equivalent circuit are referred to the low voltage side (230 V). A current of 10 A at 0.866 lagging pf is flowing through load. (20)

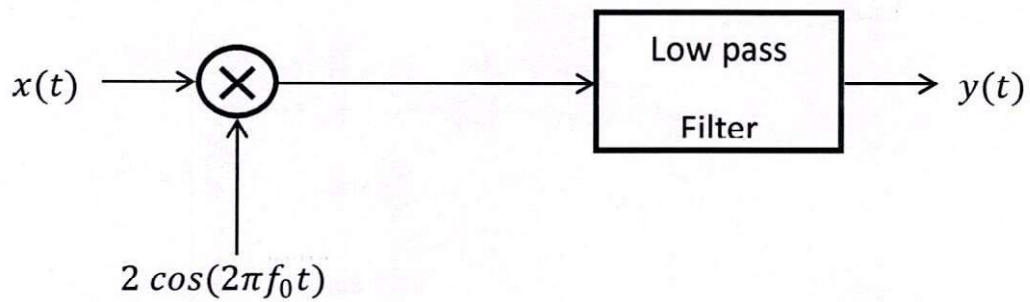
- i) Determine the input current
ii) Determine the efficiency of the transformer.



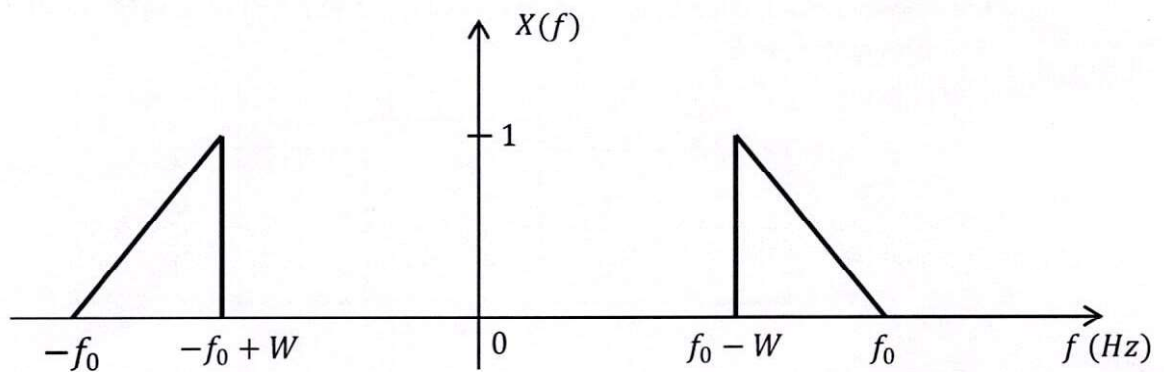
[Turn Over

b) Consider the system shown in figure:

(20)

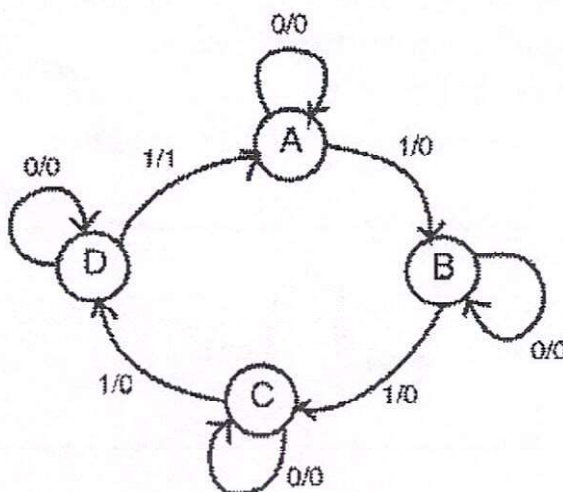


where the lowpass filter is an ideal filter with a cut-off frequency of W Hz. If the spectrum $X(f)$ of the input signal $x(t)$ is as shown in the figure below, determine and sketch the spectrum of the output signal $y(t)$.

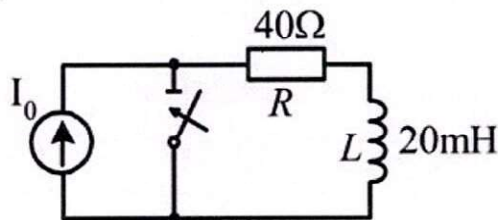


c) Consider a DSB-SC modulated signal with a carrier frequency of 1 MHz. If the bandwidth of the message signal is 5 kHz, what is the bandwidth of the modulated signal? (10)

4. a) Design a synchronous sequential circuit for the state machine shown in figure with D- flip-flops. Assume the states as: A = 00, B = 01, C = 10, and D = 11. (20)

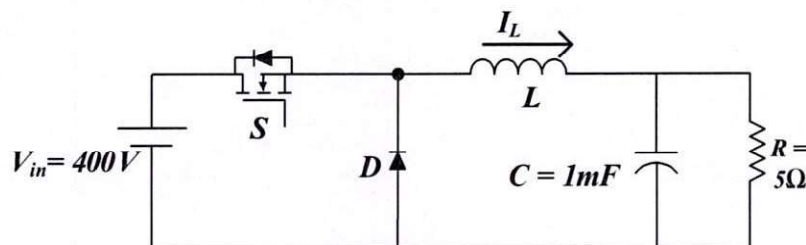


- b) A 220 V, 100 A, 1000 rpm separately excited dc motor has an armature resistance of 0.05Ω . It is driving a load having torque, $T_L = 350 - 0.2N \text{ Nm}$, where N is the speed in rpm. Operation below the rated speed are obtained by armature voltage control with full field and above the rated speed are obtained using the field control with rated armature voltage. Then (20)
- Calculate the value of flux as a percent of rated flux when the speed is 1200 rpm.
 - If the armature is fed from a single-phase fully controlled rectifier with a single-phase source of 250 V, 50 Hz, calculate the firing angle to obtain speed at 800 rpm. Assume continuous conduction mode.
- c) The RL circuit in figure is fed by a dc current source, $I_0 = 5 \text{ A}$. At instant $t = 0$, the switch is closed. Find the current through the resistance and the voltage across the inductance for $t > 0$. (10)

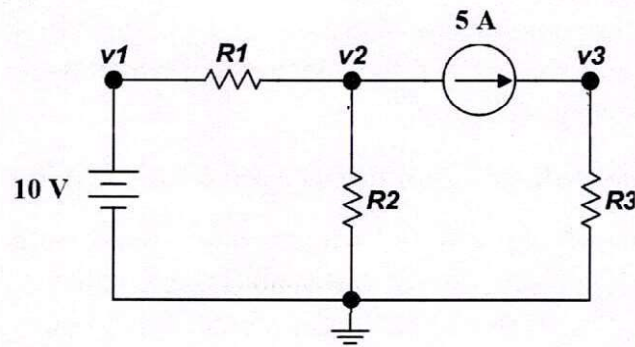


SECTION - B

5. a) A 230V, 500rpm, 100A separately excited dc motor has an armature resistance of 0.1Ω . This motor is coupled to an overhauling load with a torque of 800Nm. Determine the speed in rpm at which the motor can hold the load by regenerative braking. The source voltage is 230V. Neglect the motor's rotational losses. (10)
- b) A lossless dc-dc buck converter shown in the figure is supplying a resistive load from a 400V dc source. A 300 μH inductor is used to reduce the charging current ripple. For a duty ratio of 0.4, calculate the switching frequency to keep the peak to peak ripple current of the inductor at 1A. Assume, switch S and diode D are ideal. (10)

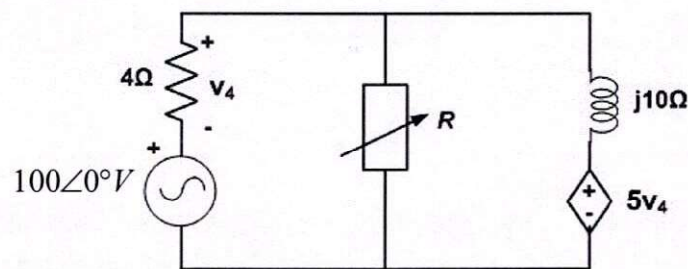


- c) Determine the node voltages v_1 , v_2 and v_3 using nodal analysis. $R_1=R_2=1\Omega$, $R_3=2\Omega$. (10)

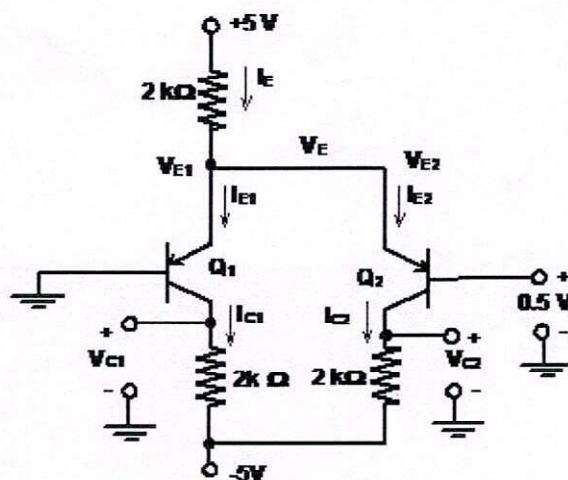


- d) Design a combinational circuit for 4-bit addition with ripple through carry. (10)
- e) Let X be a continuous random variable with mean zero and variance one. Find the mean and variance of the random variable $Y = 1 - 2X$. (10)

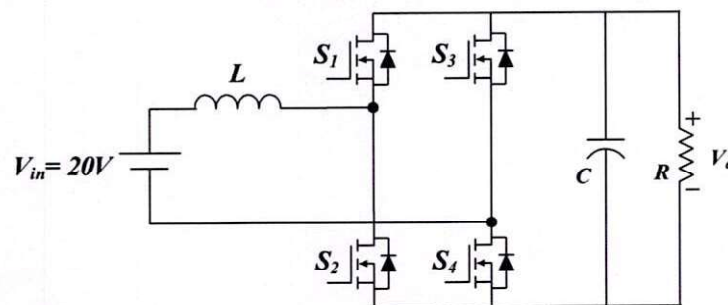
6. a) In the figure shown, determine the value of R for maximum power transfer. Also determine the maximum value of power. (20)



- b) A certain lossless transmission line of 40 m long operating at 2 MHz has $Z_0 = 40 \Omega$. The line is terminated with a load impedance $Z_L = 40 + j60 \Omega$. If the wave velocity is $u = 0.6c$, what is the input impedance of the line? ($c = 3 \times 10^8$ m/s). (20)
- c) Determine the currents I_E , I_{E1} and I_{E2} and voltages V_E , V_{c1} and V_{c2} w.r.t ground, of the circuit shown in the figure, if $V_{BE} = 0.7V$ and $\beta = 100$. Neglect base currents. (10)



7. a) Consider the signal $y(t) = u(t + 1) - 2u(t) + u(t - 2)$, where $u(t)$ is the unit step function. If $y(t) = x(1 - 2t)$, determine and sketch $x(t)$. (20)
- b) A Frequency Modulated (FM) signal with a frequency deviation of 20 kHz and a modulation frequency of 10 kHz is applied to two frequency multipliers connected in cascade. The first multiplier doubles the frequency and the second multiplier triples the frequency. Determine the modulation index of the FM signal obtained at the second multiplier output. (20)
- c) For the following power electronics converter shown in the figure, find the output voltage V_o . (10)



The switches S_1 and S_4 are turned-on at the same instant and are in conduction for $30 \mu s$, while S_2 and S_3 are turned-on at the same instant and are in conduction for $20 \mu s$. The switching frequency of the devices is kept at 20 kHz. Assume the switches are ideal and the converter is lossless. $C = 2 mF$, $R = 100 \Omega$, $L = 2 mH$.

8. a) A 208V, star-connected, 3-phase synchronous motor has a synchronous reactance of 4Ω per phase and negligible armature winding resistance. At a certain load, the motor takes 7.2 kW at 0.8 p.f lagging. If the power developed by the motor remains the same while the excitation voltage is increased by 50% by raising the field excitation, determine. (20)
- The armature current and
 - The difference of reactive power delivered.
- b) A three-phase, 440V, 50Hz, 970rpm, 6-pole, star connected squirrel cage induction motor is fed from a voltage source inverter (VSI) operating at the constant flux. The maximum to minimum speed ratio required is 5:1. The VSI is fed from the three-phase fully controlled converter having 440 V, 50 Hz mains input. If the VSI is operated in 180 deg conduction mode (six-step mode), then calculate the following: (20)
- Minimum and maximum dc input voltage to the inverter.
 - Firing angle of the fully controlled bridge converter while obtaining minimum and maximum dc voltage.

- c) A plane wave propagating through a lossless dielectric medium has (10)

$$\mathbf{H} = 2 \cos(\omega t - z) \mathbf{a}_y \text{ A/m.}$$

The medium has relative perm eability (μ_r) of 1 and intrinsic impedance (η) of 80π .
What is the frequency (ω) of $\mathbf{H}$?

$$(\epsilon_0 = 8.854 \times 10^{-12} \text{ F/m}, \mu_0 = 4\pi \times 10^{-7} \text{ H/m})$$

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
GEOLOGY
(OPTIONAL)
PAPER - I
[29]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions No. 1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer (QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

Answer the following in about 150 words each.

1.
 - a) Describe typical products of volcanic eruptions. (10)
 - b) What is a cirque and what are typical landforms associated with it? (10)
 - c) Describe plunging and non-plunging folds. (10)
 - d) Discuss paleomagnetic anomalies in relation to the sea-floor spreading. (10)
 - e) What are the rheologic characteristics of plastic deformation? (10)
2.
 - a) What do you understand by the term Soil Profile? Describe distinctions between soil profiles of different climate settings. (20)
 - b) Describe the seismic zonation map of India. Relate it to the major earthquakes in India in last 100 years. (15)
 - c) What is the difference between cleavage and joint in structural geology? How cleavage-bedding relationship is useful for deducing major structures? Illustrate your answer with sketches. (15)
3.
 - a) Describe stress ellipsoid in detail. What is the relation between stress and strain ellipsoid. (20)
 - b) What are the three major components of GPS and state their functions? With the help of a diagram show how they interact with each other. Describe the application of the GPS in diverse field of earth system science. (15)
 - c) Describe various types of stony meteorites including their significance in evolution of solar system. (15)
4.
 - a) Describe the longitudinal profile of a river considering the river to be originating from the Himalaya and descending to the sea-level. What will be the typical depositional landform associated with this river in upstream, middle and extreme downstream parts of this river? (20)
 - b) Describe spectral signatures and add a note on spectral reflectance pattern of different rocks, vegetation and water bodies. (15)
 - c) Explain the relationship between decay constant and half-life. Discuss one radiometric dating method suitable for the Archean rocks. (15)

SECTION - B

5. a) Describe the morphology of bivalves and their classification based on dentition. (10)
- b) Define the vadose zone and describe features associated with it. (10)
- c) List and define the common engineering properties of rocks which are determined in laboratory. (10)
- d) What are index fossils? Illustrate your answer with examples. (10)
- e) Were Dinosaurs ectothermic or endothermic? Discuss the evidence in support of your answer. (10)
6. a) Briefly describe three important microfossils groups. How useful are calcareous nanofossils in oil industry? (20)
- b) Describe major igneous activity including the processes of its formation towards end of Cretaceous leading to the creation of a Large Igneous Province (LIP) in India. (15)
- c) How is vertical hydraulic gradient calculated? Illustrate your answer by drawing two wells and labelling variables. (15)
7. a) What is a run-of-the river hydropower project? How it is different from a large reservoir associated project? Describe the geological investigations required for tunneling. (20)
- b) Describe the Lithostratigraphy of Jurassic succession of Kutch and also discuss their depositional environment. (15)
- c) Describe the visual system in Trilobite with special reference to adaptation. (15)
8. a) What are cratons? Describe briefly the three major Archaean cratons and three prominent Proterozoic mobile belts of Indian shield. (20)
- b) Define and describe Darcy's law. What is Reynold's number and its relevance in Darcy's law? Discuss utility and limitation of this law in hydrogeology. (15)
- c) Describe geological considerations for location of a concrete dam. What geological investigations are essential in this context? (15)

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
GEOGRAPHY
(OPTIONAL)
PAPER - I
[27]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) *There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. **Question No.1 and 5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a question/Part is indicated against it. Answers must be written in English in **Question-Cum-Answer(QCA)** Booklet in the space provided.*
- ii) *Your answer should be precise and coherent.*
- iii) *If you encounter any typographical error, please read it as it appears in the text book.*
- iv) *Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) *No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) *No blank page should be left in between answers to various questions.*

SECTION-A

1. Answer the following questions in about 150 words each: (5×10=50)
- a) Describe the role of plate tectonics in mountain building. (10)
 - b) Explain the impact of El Nino in bringing global weather changes. (10)
 - c) Discuss the role of physical and human factors in vulnerability of Joshimath to land subsidence. (10)
 - d) Contemporary problem of coral bleaching is consequence of global warming. Elaborate. (10)
 - e) Biodiversity is key to sustainability. Elaborate. (10)
2. a) Describe the interior structure of the earth and highlight the role of seismic waves in understanding earth's interior. (20)
- b) Discuss the advantages and limitations of social forestry. (15)
 - c) Explain how organisms of an ecosystem are linked together. (15)
3. a) Explain how climate change has enhanced flood vulnerability in south Asia. (20)
- b) Landscape is a function of structure, process, and stage. Elaborate. (15)
 - c) Discuss the potentials and limitations of marine resources and threats there to. (15)
4. a) Describe why urgent action to combat climate change and its impacts should be global priority and how it is impacting our farms and food. (20)
- b) Explain the basic elements of the Environmental Management System. (15)
 - c) Discuss the origin and characteristics of tropical cyclones. What is the energy potential of a tropical cyclone? (15)

SECTION B

5. a) Discuss the merits and demerits of quantitative revolution in human geography. (10)
- b) Why China is "The World's Factory"? (10)
 - c) Evaluate the role of growth poles and growth centres as a strategy for balanced regional development. (10)
 - d) Critically examine the role of satellite towns in urban planning. (10)
 - e) Discuss the strategy and role of SEZs in international trade. (10)
6. a) Critically evaluate Weber's industrial location theory. (20)
- b) Describe the geopolitics of heartland region in the context of Russia-Ukraine war. (15)
 - c) Explain global human development pattern on the basis of the human development index (HDI). (15)

7. a) Why is there such a thing as world hunger? What are the ways to solve this issue?(20)
- b) Discuss the challenges and ways for sustainable urbanisation. (15)
- c) Describe the different types of regions and methods of regionalisation. (15)
8. a) Highlight the factors contributing in mushrooming of slums in the third world cities. What is their social impact? (20)
- b) Explain why environmental issues have gained prominence in regional planning. (15)
- c) Describe the variations in demographic transition in more developed and less developed countries. (15)
-

Total No. of Printed Pages-4]

Roll No. _____

CC(M)
HISTORY
(OPTIONAL)
PAPER - I
[31]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) *There are Eight questions divided in Two Sections and printed in English. Candidate has to attempt Five questions in all. Question No.1 and 5 are compulsory and out of the remaining, any Three are to be attempted choosing at least One question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.*
- ii) *Your answer should be precise and coherent.*
- iii) *If you encounter any typographical error, please read it as it appears in the text book.*
- iv) *Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) *No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) *No blank page should be left in between answers to various questions.*

SECTION -A

1. Mark the following places on the map supplied to you with a short note not exceeding 30 words on the places plotted by you: (20×2½=50)

Besnagar

Hunsagi

Gufkral

Patliputra

Girnar (girnar)

Kannauj

Sopara

Manda

Tamralipati

Sanchi

Madurai

Kapilvastu

Ajanta

Rakhigarhi

Kanchi

Hazaribagh

Calicut

Plassey

Sravanbelgola

Vengi

2. a) To what extent does the urban planning and the culture of Indus Valley civilisation provide inputs to the present day urbanisation? Discuss. (20)
- b) To what extent archeological findings are useful in understanding the neolithic and chalcolithic culture in India. (15)
- (c) Bring out the changes that society went through between early vedic and later vedic period. (15)
3. a) Bring out the elements of change and continuity in the domestic and foreign policies of Ashoka. (20)
- b) The emergence and core philosophy of Buddhism and Jainism have a striking resemblance as well as certain differences. Compare and contrast the two religious philosophies. (15)
- c) Draw out the parallels between Ashoka's dhammas as found in his inscriptions and Vedic literature. (15)
4. a) Critically analyze the evolution of different schools of art in the Indian subcontinent between the 2nd century BCE to 3rd century CE in light of changing political landscape of subcontinent. (20)
- b) Examine the role of guilds and trade organisations on economic life of ancient India. (15)
- c) The Gupta age in ancient India has been called the 'Golden age of India', however this statement contrasts with changing position of women and increasing rigidity of caste system in Gupta period. Discuss. (15)

SECTION - B

5. Write short notes in not more than 150 words in each of the following. (5×10=50)
 - a) Evaluate Rajatarangini as a source of history.
 - b) How do you account for the decline of the major cities of the Indus Valley Civilization?
 - c) Discuss the attitude of Chishti saints towards the state. How were the Suhrawardi saints different in their attitude towards the government.
 - d) How was cartaz system used by the Portuguese to maintain their control over the oceanic trade?
 - e) Evaluate the contents of the Tabakat - i - Nasiri as a source of medieval history.
6. a) Examine the proficiency of the ancient Indians in field of science, mathematics, astronomy and metallurgy. (20)
- b) Bring out the parallel between Bhakti movement in medieval India and renaissance movement in 15th century Europe. (15)
- c) Trace the development of rock cut architecture in India. (15)

7. a) Mark out the differences between the administrative reforms of Khilji dynasty and Tughlaq dynasty. (20)
- b) "India had been for hundred of years the Lancashire of the eastern world." Do you agree with this statement. (15)
- c) Critically examine the works of foreign travellers as source of history of India. (15)
8. a) Discuss the evolution of maritime trade of India from 12th century to 17th century. (20)
- b) How did Shivaji organise his administration and finances to consolidate his power. (15)
- c) Critically evaluate the condition of labour in Delhi sultanate on the basis of historical sources. (15)
-

Total No. of Printed Pages-4]

Roll No. _____

CC(M)
LAW
(OPTIONAL)
PAPER - I
[33]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) *There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.*
- ii) *Your answer should be precise and coherent.*
- iii) *If you encounter any typographical error, please read it as it appears in the text book.*
- iv) *Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) *No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) *No blank page should be left in between answers to various questions.*

SECTION-A

1. Write Short Notes on: (5×10=50)
 - (a) Curative Petition
 - (b) Doctrine of Severability
 - (c) Fraud on the Constitution
 - (d) Excommunication and denominational rights
 - (e) Post-decisional hearing

2. (a) While examining the nature of the Indian federal structure, Professor P.K. Tripathi articulates thus, "the Constitution... does not satisfy the essential and indispensable requirements of federalism... and the use of the expression federal or federalism... is really speaking spurious. The conscious object or purpose of this spurious use is... to metamorphose a non-federal constitution into a federal one." (25+25=50)

Are you in agreement with his views? Analyse, with reference to appropriate references to the context.

(b) In their minority opinion while deciding the constitutional validity of the Tenth Schedule of the Constitution, Justices Sharma and Verma note, "The tenure of the Speaker, who is the authority in the Tenth schedule to decide this dispute, is dependent on the continuous support of the majority in the House and, therefore, he does not satisfy the requirement of such an independent adjudicatory authority; and his choice as the sole arbiter in the matter violates an essential attribute of the basic feature." How far are you in agreement with their views? Would you recommend policy alternatives? Elucidate.

3. (a) In the Sabarimala judgement, Justice D Y Chandrachud (as he then was), while commenting on the need for Fundamental Rights scrutiny of discriminatory tenets of personal laws, had opined: (25+25=50)

"Custom, usages and personal law have a significant impact on the civil status of individuals. Those activities that are inherently connected with the civil status of individuals cannot be granted constitutional immunity merely because they may have some associational features which have a religious nature. To immunize them from constitutional scrutiny, is to deny the primacy of the Constitution."

In light of these observations, critically evaluate contemporary incidents (and associated controversies) where personal laws have had a distinct point of tension with the operation of Fundamental Rights.

(b) Do you agree with H.M. Seervai that Directive Principles of State Policy are irrelevant in the constitutional scheme of things? Analyze, with relation to the trajectory of case law on the interrelationship between Fundamental Rights and Directive Principles. Do you notice any shift in course of such judicial decisions?

4. (a) A selection committee was constituted by the Central Government for promotions to higher posts from a list of senior officers. One of the members of selection committee was also promoted. An unsuccessful candidate challenged this selection. Will he succeed? Provide an elaborate answer with the help of administrative law principles and case laws. **(25 +25=50)**
- (b) The Tribunals Reforms Act 2021 started a much-needed but often overlooked debate on the functioning of tribunals in the country. It had been proposed that the 8 tribunals that operated as appellate bodies to hear disputes will be dissolved and their functions will be transferred to existing judicial forums such as civil court and High Court. The Central Government argues that the move was essential considering the inadequate functioning of tribunals. Do you think that The Tribunals Reforms Act should enhance the independence and separation of the principles of the constitution? In the light of Supreme Court decisions, critically analyse the stand of this afore-mentioned Act.

SECTION - B

5. Write Short Notes on: **(5×10=50)**
- (a) Freedom of the high seas
 - (b) United Nations Security Council
 - (c) Principle of distinction in International Humanitarian Law.
 - (d) International Court of Justice (ICJ)
 - (e) Judicial review over the delegated legislation.
- 6 (a) The purpose and principles of the United Nations Charter essentially represent the bedrock of international legal Jurisprudence. Explain. **(20+15+15=50)**
- (b) "The general rule with regard to the position of municipal law within the international sphere is that a state which has broken a stipulation of international law cannot justify itself by referring to its domestic legal situation." Elaborate with the help of relevant provisions.
- (c) The general rule of international law is "A State may when signing, ratifying, accepting, approving or acceding to a treaty can formulate reservations". What are the exceptions to the general rule of reservation to treaties?
7. (a) The practice of extradition enables one state to hand over to another state suspected or convicted criminals who have fled to the territory of the former. Enumerate the general 'principles' of extradition. **(15+20+15=50)**
- (b) Briefly explain the relevant international treaties to curb international terrorism. Do you reckon these treaties are effective?

- (c) "There are many different ways in which recognition can occur and it may apply in more than one kind of situation. It is not a single, constant idea but a category comprising a number of factors." In this regard, critically evaluate the theories of state recognition.
- 8 (a) Elaborate the role of Ombudsmen and other anti-corruption institutions in ensuring good Governance and accountability in the system of Governance in India.
(15+15+20=50)
- (b) Discuss the implication of the separation of power with respect to development of administrative law in India
- (c) Examine the scope of Judicial review over the administrative action. How does administrative review differ from legislative review
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
MANAGEMENT
(OPTIONAL)
PAPER - I
[35]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Question No.1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

Describe the following in about **150** words each.

(5×10=50)

1.
 - a) What is a span of control? **(10)**
 - b) Discuss any five essential managerial skills. **(10)**
 - c) List any five causes of low employee productivity. **(10)**
 - d) What is a learning organisation? **(10)**
 - e) Define recruitment. Explain the process of recruitment. **(10)**
2.
 - a) What is Scientific Management? Explain the principles of Scientific Management given by F.W. Taylor. **(20)**
 - b) In India Social responsibility is a myth. Support your answer with examples. **(15)**
 - c) What is organizing? Discuss the steps in organizing. **(15)**
3.
 - a) What is organisation conflict? What are the causes of conflict in an organisation? How it can be managed effectively? **(20)**
 - b) What is a virtual organisation? Discuss its benefits and challenges. **(15)**
 - c) Absolute decentralization is as theoretical as absolute centralization. Discuss and explain with examples. **(15)**
4.
 - a) Discuss principles of employee compensation management. **(20)**
 - b) Is 360 degree performance appraisal method effective in assessing the performance of government employees. What are the barriers it faces? **(15)**
 - c) Briefly explain any five on - the - job training methods. **(15)**

SECTION-B

5. Describe the following in about **150** words each.

(5×10=50)

- a) What is a Marketing Plan? Discuss key elements of a Marketing Plan. **(10)**
- b) What is Zero base budgeting? What are its advantages and disadvantages? **(10)**
- c) Explain symptoms of financial distress in any organisation. **(10)**
- d) What is the imprest system of accounting? **(10)**
- e) What is AIDAS theory of selling? **(10)**

6. a) Explain Money Measurement Concept, Going Concern Concept, Business Entity Concept, Accrual Concept and Matching Concept of accounting. (20)
- b) Distinguish between cash flow and fund flow statements of a firm. Why are these statements important. (15)
- c) What do you understand by marginal costing? Discuss its usefulness as a tool for managerial decisions. (15)
7. a) What is financial leverage? What are its advantages and disadvantages? (20)
- b) Explain Modigliani - Miller hypothesis of dividend irrelevance. What are the underlying assumptions of irrelevant hypothesis. (15)
- c) What is working capital? Why is it essential to maintain sufficient working capital?(15)
8. a) Discuss various methods of promotion. (20)
- b) Explain any five pricing strategies for fixing the price of a newly launched product.(15)
- c) What is meant by market positioning? Discuss market positions that brands typically take in the market. (15)
-

Total No. of Printed Pages-4]

Roll No. _____

CC(M)
MATHEMATICS
(OPTIONAL)
PAPER - I
[37]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) *There are Eight questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Question No.1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.*
- ii) *Your answer should be precise and coherent.*
- iii) *If you encounter any typographical error, please read it as it appears in the text book.*
- iv) *Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) *No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) *No blank page should be left in between answers to various questions.*

SECTION - A

1. a) Solve $\left(1 + x(1 - x^2)^{-\frac{1}{2}} - y\right)dx - (1 - x^2)^{\frac{3}{2}} dy = 0$ (10)
 - b) Find a basis and the dimension for the subspace of $\mathbb{R}^3$ given by $W = \{(x, y, z) \in \mathbb{R}^3 : 2x - 3y + 4z = 0\}$ (10)
 - c) Evaluate $\iiint_V \sqrt{x^2 + y^2} \, dx dy dz$, where V is the region bounded by $z = x^2 + y^2$ and $z = 8 - (x^2 + y^2)$ (10)
 - d) A function $f(x)$ is twice differentiable and satisfies the inequalities $|f(x)| < a^2$, $|f''(x)| < b^2$, $\forall x > a$ where a and b are constants. Prove that $|f'(x)| < 2ab$, $\forall x > a$ (10)
 - e) Find the equation of the right circular cone with vertex $(1, -2, -1)$, semi-vertical angle 60° and the line $\frac{x-1}{3} = \frac{y+2}{-4} = \frac{z+1}{5}$ as its axis. (10)
2. a) Find kernel, nullity, range and rank of the linear transformation $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ given by $T(x, y, z) = (x - y + 2z, 2x + y, -x - 2y + 2z)$. Also verify the rank-nullity theorem for T . (20)
 - b) If $f(0)=0$, $f'(x) = \frac{1}{1+x^2}$. Using Jacobian method prove that $f(x) + f(y) = f\left(\frac{x+y}{1-xy}\right)$ (15)
 - c) Solve $y'' + 2y' + 5y = 17 \cos 2x$, given that $y = 3$ and $y' = 0$ when $x = 0$. (15)
3. a) Find the volume generated by the revolution of the loop of the curve $r \cos \theta = a \cos 2\theta$ about the initial line. (20)
 - b) Find the dimension and a basis of the solution space W of the system
$$\begin{aligned} x + 2y + z - 3w &= 0 \\ 2x + 4y + 4z - w &= 0 \\ 3x + 6y + 7z + w &= 0 \end{aligned}$$
(15)
 - c) Find the equations of the line of the greatest slope on the plane $3x - 4y + 5z - 5 = 0$ drawn through the point $(3, -4, -4)$; given that the plane $4x - 5y + 6z - 6 = 0$ is horizontal. (15)

4. a) Find an orthogonal matrix which diagonalizes.

$$A = \begin{pmatrix} 6 & 4 & -2 \\ 4 & 12 & -4 \\ -2 & -4 & 13 \end{pmatrix} \quad (20)$$

- b) A line of constant length has its extremities lie on the $y = x \tan \alpha$, $z = c$; $y = -x \tan \alpha$, $z = -c$. Prove that the locus of its middle point is an ellipse. (15)

c) Evaluate $\int_0^a \int_0^{\sqrt{a^2-y^2}} \frac{dx dy}{(1+e^x)\sqrt{a^2-x^2-y^2}}$. (15)

SECTION - B

5. a) If u and v are two linearly independent integrals of $\frac{d^2 y}{dx^2} + P(x)\frac{dy}{dx} + Q(x)y = 0$ where P and Q are continuous functions of x . Prove that

$$u \frac{dv}{dx} - v \frac{du}{dx} = ce^{-\int P dx} \quad (c \text{ is a non-zero constant}) \quad (10)$$

- b) Show that if the differentiable scalar function $\phi(x, y, z)$ is any solution of Laplace's equation, then prove that $\text{grad } \phi$ is a vector that is both solenoidal and irrotational.

Also prove that $\text{div}(\phi \text{grad } \phi) = |\text{grad } \phi|^2$, and $\text{curl}(\phi \text{grad } \phi) = \vec{0}$ (10)

- c) Reduce the equation $axyp^2 + (x^2 - ay^2 - b)p - xy = 0$, where $p = dy/dx$ to Clairaut's form. Hence solve the equation and find its singular solution. (10)

- d) Show that the plane $x + 2y - z = 4$ cuts the sphere $x^2 + y^2 + z^2 - x + z = 2$ in a circle of radius unity and also find the equation of the sphere which has this circle as one of its great circles. (10)

- e) A particle is performing a simple harmonic motion of period T about a centre O and it passes through a point $P(OP = b)$ with velocity v in the direction OP . Prove that the time which elapses before it returns to P is $(T/\pi) \tan^{-1}(vT/2\pi b)$ (10)

6. a) Find the characteristic polynomial, eigenvalues and eigenvectors of the matrix A of the linear transformation $T: P_2(\mathbb{R}) \rightarrow P_2(\mathbb{R})$ defined by $T(f(x)) = f(x) + (x+1)f'(x)$ with respect to the standard ordered basis for $P_2(\mathbb{R})$, vector space of all polynomials having degree less than or equal to 2 with real coefficients. (20)

- b) Show that the equation to the plane containing the line $\frac{y}{b} + \frac{z}{c} = 1, x = 0$; and parallel to the line $\frac{x}{a} - \frac{z}{c} = 1, y = 0$ is $\frac{x}{a} - \frac{y}{b} - \frac{z}{c} + 1 = 0$, and if $2d$ is the shortest distance, Prove that $\frac{1}{d^2} = \frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2}$. (15)

- c) Use the Laplace transform to solve the initial-value problem.

$$y'' - 3y' + 2y = e^{-4t}, y(0) = 1, y'(0) = 5 \quad (15)$$

7. a) Prove that the enveloping cylinders of the ellipsoid

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

whose generators are parallel to the lines

$$x = 0, \frac{y}{\pm\sqrt{a^2 - b^2}} = \frac{z}{c} \text{ meet the plane } z=0 \text{ in circles.} \quad (20)$$

- b) Solve $x^2 \frac{d^2 y}{dx^2} - (2m-1)x \frac{dy}{dx} + (m^2 + n^2)y = n^2 x^m \log x, x > 0$ (15)

- c) A smooth parabolic wire (latus rectum = $4a$) is fixed with its axis vertical and vertex downwards and in it is placed a uniform rod of length $2l$ with its ends resting on the wire. Show that, for equilibrium, the rod is either horizontal, or makes with horizontal an angle $\cos^{-1} \sqrt{2a/l}$ (15)

8. a) A particle of unit mass moves under a central force $\mu r (r^4 - c^4)$, and is being projected from an apse at a distance c with velocity $c^3 \sqrt{2\mu/3}$. Show that its path is $x^4 + y^4 = c^4$ (20)

- b) Solve by the method of variation of parameters.

$$(1-x) \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 2(x-1)^2 e^{-x}, 0 < x < 1 \quad (15)$$

- c) Let ϕ and ψ be two scalar valued functions of position with continuous derivatives of second order at least. Prove that

$$\iiint_V (\phi \nabla^2 \psi - \psi \nabla^2 \phi) dV = \iint_S (\phi \nabla \psi - \psi \nabla \phi) \cdot \hat{n} dS \text{ where } V \text{ is the volume bounded by a closed surface } S \text{ and } \hat{n} \text{ is the positive normal to } S. \quad (15)$$

CC(M)
MECHANICAL ENGINEERING
(OPTIONAL)
PAPER - I
(39)

Time Allowed - Three Hours

Maximum Marks-250

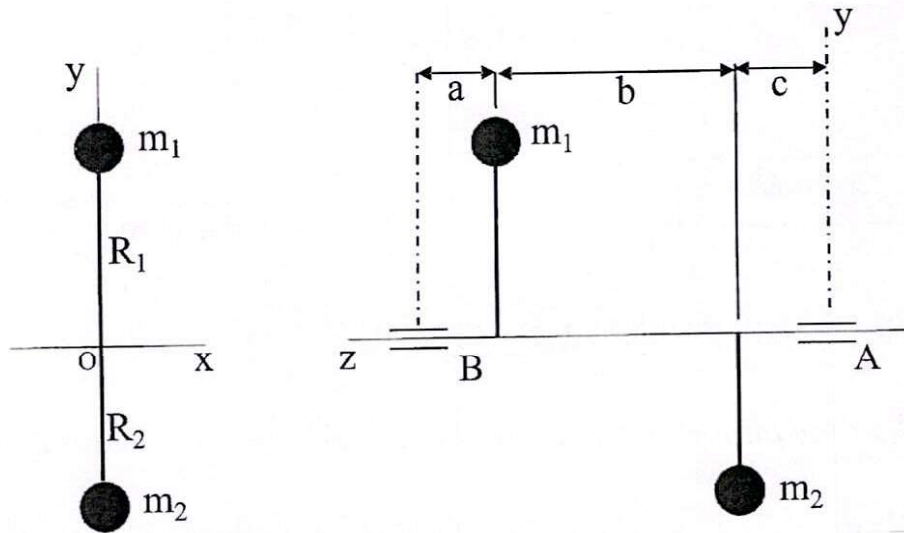
INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

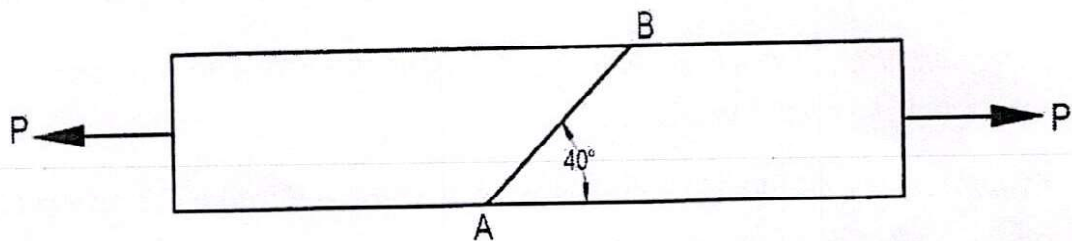
- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Diagrams/Figures, wherever required shall be drawn in the space provided for answering the question itself.
- v) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- vi) No continuation sheets shall be provided to any candidate under any circumstances.
- vii) No blank page should be left in between answers to various questions.
- viii) Non Programmable Calculators are allowed.

SECTION - A

1. a) Two rigid masses are attached to a shaft, rotating at 150 rev/mm as shown in the figures (Front and side view). The radial distance of the masses m_1 (1kg) and m_2 (3kg) from the shaft are specified as R_1 (60 mm) and R_2 (60 mm), respectively. Determine the bearing reactions at A and B ? In the figures $a=c=300$ mm, $b=600$ mm. (10)

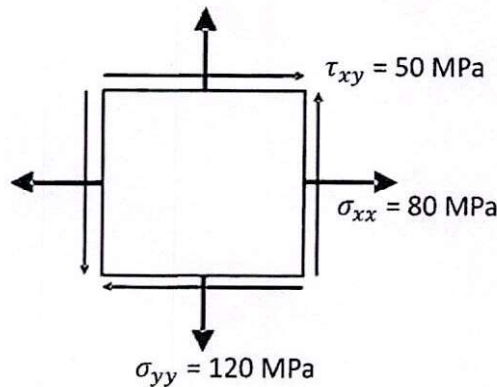


- b) Two wooden joists 50 mm x 100 mm are glued together along the joint AB as shown in figure below. Determine the values of normal stress and shearing stress in the glue if $P=200$ kN. (10)



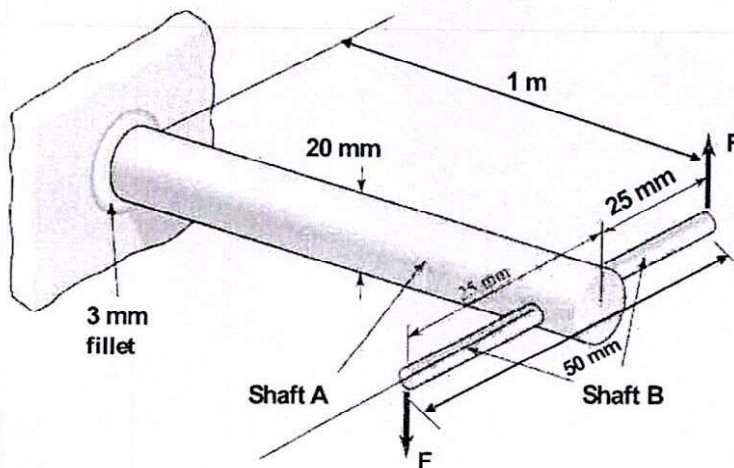
- c) The design loads of a member made of a brittle material produce the following non-zero stress components at the critical section in the member: The ultimate strength and poisons ratio of the material is 460 MPa and 0.2, respectively. Determine the factor of safety used in the design. (10)

- d) The non-zero stress components at a point in a steel plate are shown in the figure. Determine the value of principal strains. (Youngs modulus (E) and Poisson's ratio (of steel) are 200 GPa and 0.29, respectively) (10)

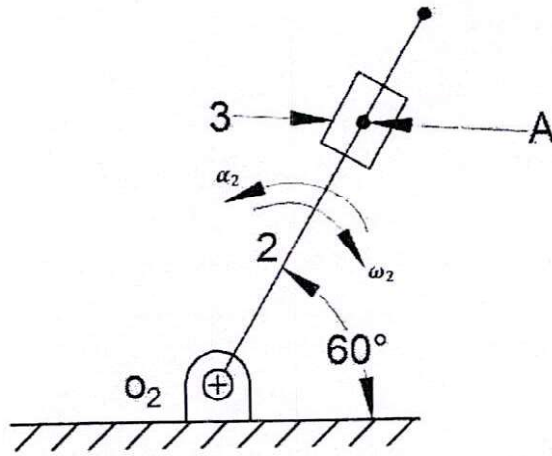


- e) A glass/epoxy specimen weighing 0.98 gm was burnt and the weight of the remaining fibers was found to be 0.49 gm. Densities of glass and epoxy are 2.4 gm/ml and 1.20 gm/ml, respectively. Determine the density of composite in the absence of voids. If the actual density of the composite was measured to be 1.50 gm/ml, what is the void fraction? (10)

2. a) In the figure, shaft A, made of AISI hot rolled steel (Ultimate tensile strength (S_{ut}) = 320 MPa and Yield strength (S_y) = 180 MPa), is welded to a fixed support and is subjected to loading by equal and opposite forces F via shaft B. A theoretical fatigue stress concentration K_{fs} of 1.6 is induced by the 3 mm fillet. The length of shaft A from the fixed support to the connection at shaft B is 1 m. The load ' F ' cycles from 0.5 to 2 kN. For shaft A, find the factor of safety for infinite life using the modified Goodman fatigue failure criterion. The effect of all endurance limit modifying factors can be accounted using a single multiplication factor of 0.5426. (20)

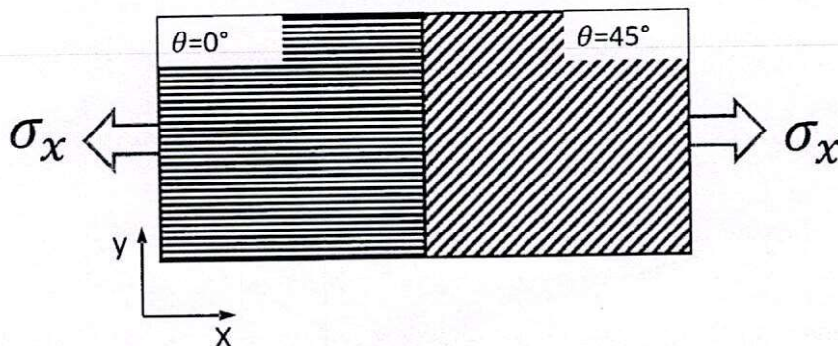


- b) The figure shows a point A on link 3 which is moving on link 2, at the same time link 2 is also rotating. Determine the acceleration of the point on link 3 which is coincident with a point on link 2. (Take, $v_{A/B}$, velocity of point with respect to is outwards (i.e. away from the centre of rotation), Acceleration of point with respect to is). (15)

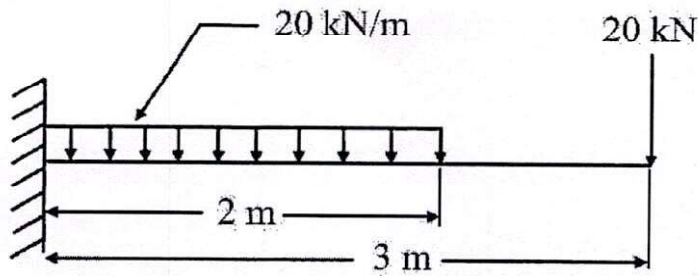


- c) Two laminae are joined as shown in the figure. Both are unidirectional lamina-fibres of one inclined at 0° and the other at 45° to the loading axis. Calculate the lateral deformation in both the laminae as a function of σ_x . Assuming that both the sections contain same fiber and fiber volume fraction with properties for unidirectional lamina is given in Table. (15)

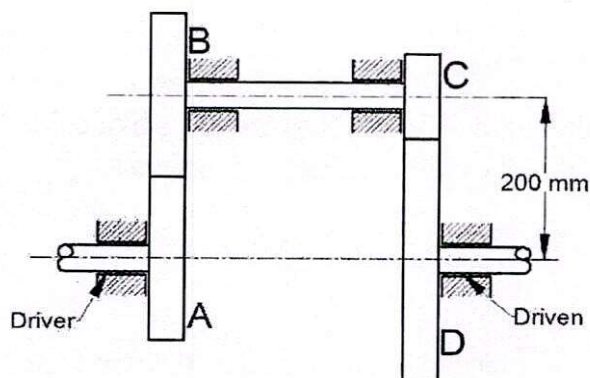
PROPERTY	VALUE
Longitudinal young's modulus (E_1)	145 GPa
Transverse young's modulus (E_2)	10.45 GPa
Shear modulus (G_{12})	6.9 GPa
Major poisons ratio V_{12}	0.28



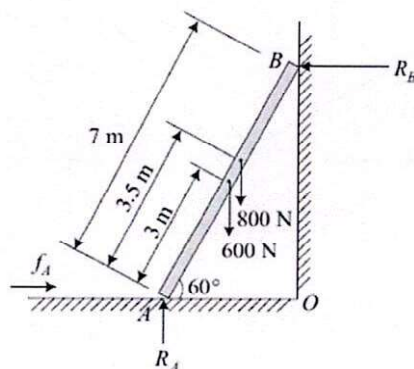
3. a) Determine the displacement of free end of cantilever beam as shown in Figure below. Take $E=2 \times 10^5 \text{ N/mm}^2$, $I=180 \times 10^6 \text{ mm}^4$. (20)



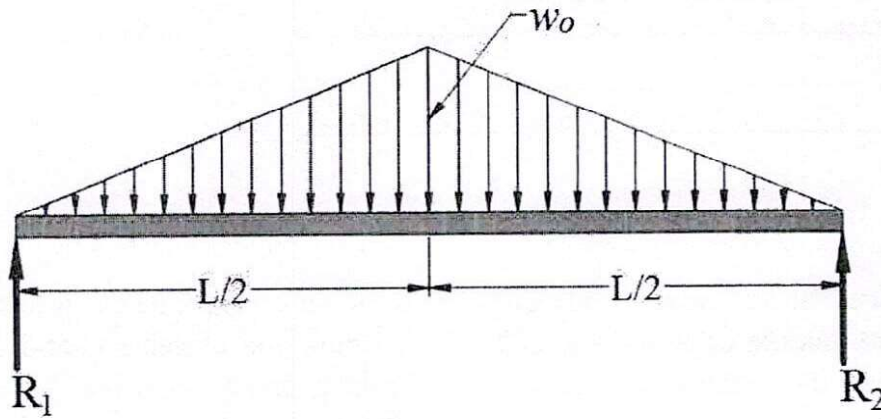
- b) The speed ratio of the reverted gear train, as shown in Figure below, is to be maintained 12. The module of gears A and B is 3.125 mm, and of gears C and D is 2.5 mm. Calculate the suitable numbers of teeth for the gears. No gear is to have less than 24 teeth. (15)



- c) A uniform ladder of weight 800 N and length 7m rests on horizontal ground and leans against a smooth vertical wall as shown in figure below. The angle made by the ladder with the horizontal is 60° . When a man of weight 600 N stands on the ladder 4m from the top of the ladder, the ladder is at the point of slipping. Determine the coefficient of friction between the ladder and the floor. (15)



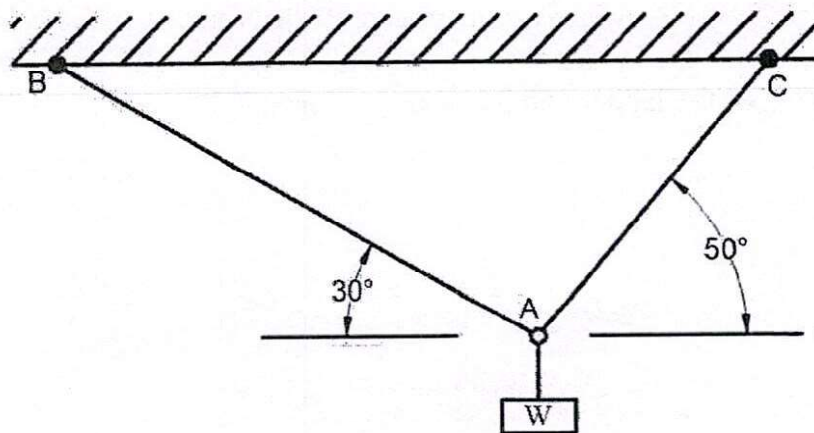
4. a) A beam carries a triangular loading as shown in figure below. Consider 'x' to be distance measured from the left end of the beam. Write the shear force and bending moment equations. Draw the shear force and bending moment diagrams, specifying the values at all change of loading position and point of zero shear. (20)



- b) For a long hoisting cable, the weight of the cable itself contributes to the elongation. The cable has a weight per unit length of 'w' over a total length of cable 'l'. A load P attached to the free end, show that the cable elongation is given as: (15)

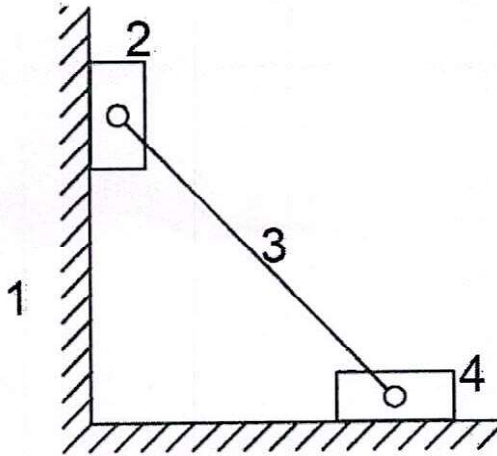
$$\delta = \frac{pl}{AE} + \frac{wl^2}{2AE}$$

- c) Determine the largest weight 'W' that can be supported by the two wires as shown in figure below. The stress in either wire is not to exceed 200 MPa. The cross-sectional area of wire AB and AC are 250 mm² and 350 mm², respectively. (15)



SECTION - B

5. a) For the mechanism shown below, locate all the Instant centres. Also determine the D.O.F. and specify the type of motion executed by sliders 2 and 4. (10)

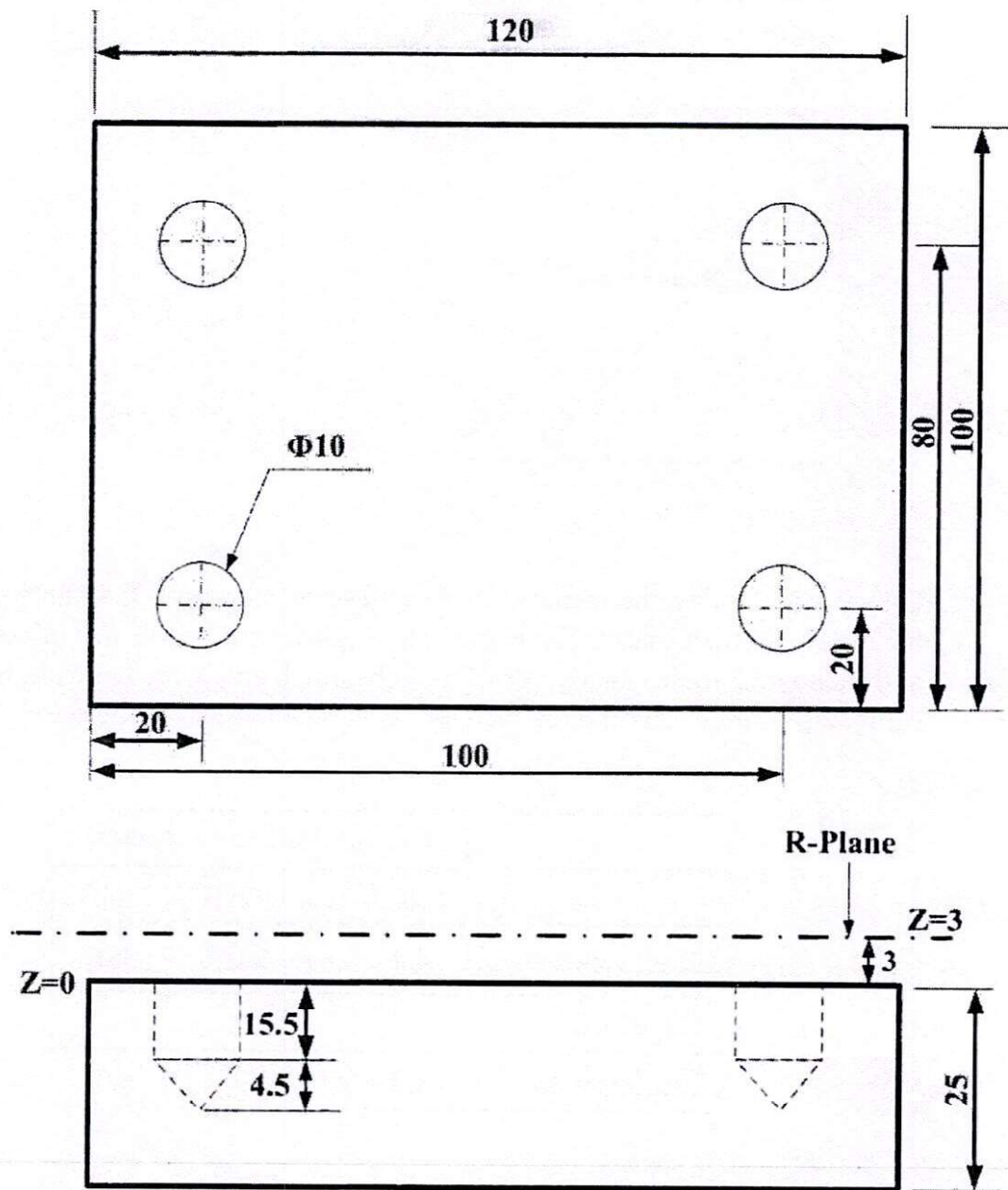


- b) On a particular day, the manager of a small print shop finds that three jobs must be handled on a “rush” basis. There are three employees available to work on these jobs, and each will handle exactly one of the jobs. Each employee has a slightly different estimated completion time for each job, as shown in the table below. (10)

	Completion time (hours)		
	Job A	Job B	Job C
Employee 1	4.2	4.1	5.4
Employee 2	4.4	4.0	5.2
Employee 3	4.3	4.2	5.0

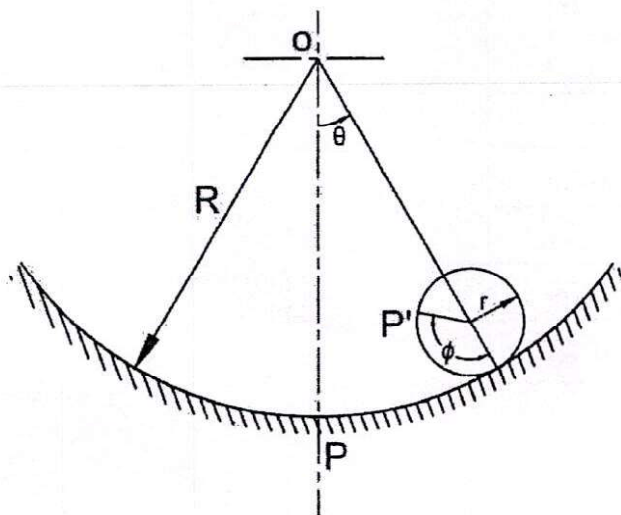
Formulate this as Linear Programming Problem (do not solve) to determine how to assign the employees to jobs so that the total completion time of all the three jobs is minimum.

- c) Write a part program for drilling the job using absolute mode as shown below with canned cycle G82. (10)



All dimensions in mm.

- d) A family wants to have a very well controlled vitamin C-rich mixed fruit-breakfast in the form of 5 fruit servings per day. They choose apples and bananas as their target fruits. Bananas cost 30 rupees per dozen (6 servings) and apples cost 80 rupees per kg (8 servings). Also, one banana contains 8.8 mg of Vitamin C and 100-125 g of apples i.e. one serving contains 5.2 mg of Vitamin C. Every person of the family would like to have at least 20 mg of Vitamin C daily, but would like to keep the intake under 60mg. Determine, how many fruit servings would the family have to consume on a daily basis per person to minimize their cost? (10)
- e) 'While measuring the effective diameter of an external screw thread gauge of 3.5mm pitch, a 30.500 mm diameter cylindrical standard and 2 mm wires is used. The micrometer reading over the standard and wires is 13.3768mm and micrometer reading over gauge and wire is 12.4228mm. Calculate the thread gauge effective diameter. Assume the value of constant P as per ISO system. (10)
6. a) A two-stroke engine running at 250 rpm delivers the torque, N.m, where is the angle turned by the crank from inner dead centre. The mass of the flywheel and radius of gyration is 350 kg and 450 mm respectively. What is the power developed by the engine and the total percentage fluctuation of speed of the flywheel. Determine the angular acceleration of the flywheel when the crank has turned through 60° from inner dead centre and the value of maximum angular acceleration and retardation of the flywheel. (20)
- b) The controlling force for a spring-controlled governor is a straight line. The values of controlling force is 1350 N when the radius of rotation of the balls is 185 mm and 750 N when it is 110 mm. The mass of each ball is 7 kg. Determine the speed of rotation when the radius of rotation is 140 mm. Find the increase in the initial tension so that the governor is isochronous. What will be the isochronous speed? (15)
- c) A cylinder of weight " W " and radius ' r ' rolls without slipping on a cylindrical surface of radius ' R ' as shown in the figure. Determine the natural frequency for small oscillations about the lowest point. (15)



7. a) During orthogonal cutting operation of mild steel the following observations were made by the machinist: Tangential cutting force = 650N; Thrust Force = 220N; Uncut chip thickness = 0.2mm; Chip thickness = 0.25mm; Width of cut = 4mm; cutting speed = 3m/s; Rake Angle = 10 degree. Determine the following: (20)

- (i) Shear stress along the shear plane
- (ii) Chip velocity
- (iii) Shear strain in the chip.

- b) A company's data, for its order quantity, for the past ten months are given in table below. Compute the monthly demand forecast for April through November using a 3-month moving average. Also, use exponential smoothing with smoothing parameter $\alpha = 0.5$ to compute the demand forecast for November, assuming the forecast quantity for January is 120. (15)

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Order Quantity (Actual Demand)	120	90	100	75	110	50	75	130	110	90

- c) A newspaper boy purchases newspaper early in the morning and cannot repurchase them (even if he wishes to) on the same day. He purchases the newspaper at Rs. 7 each and sells them at Rs. 11 each. If the newspaper remains unsold, he can return it for Rs. 1 each. The customer goodwill loss, if his/ her demand is not fulfilled, is expected at Rs. 1.5 each. What will be the optimum quantity to be purchased by newspaper boy? The probability of newspaper sale per day along with the respective demand is given below. (15)

Demand	Probability
10	0.04
15	0.08
20	0.13
25	0.26
30	0.31
35	0.09
40	0.09

8. a) A circular disc of MS (400 mm in diameter) of 200 mm thickness is compressed between two dies to final thickness of 100 mm. Assuming coefficient of friction to be 0.15 and yield strength in compression of MS to be 250 MPa. Determine the
- (i) maximum die pressure required for the above operation.
 - (ii) will there be any sticking of the material with the dies. (20)
- b) A building contractor subcontracts a job involving hanging wallpaper to a local merchant. To have an idea of the quality level of the merchant's work, the contractor randomly selects 300m² and counts the number of blemishes. The total number of blemishes for 30 samples is 80. Construct the center line and control limits for an appropriate control chart. Is it reasonable for the contractor to set a goal of an average of 0.5 blemish per 100m²? Is the process capable? (15)
- c) Information regarding a particular product of a company is given as below:
Total Sales = Rs. 3,00,000
Total Fixed cost = Rs. 45,000
Total variable cost = Rs. 2,25,000
Determine the Contribution, Profit, P/V Ratio, Break Even Point, Margin of Safety, and Net Profit for the sales of Rs. 6,00,000. (15)
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
PHILOSOPHY
(OPTIONAL)
PAPER - I
[43]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions No.1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION-A

1.
 - a) Critically comment on Spinoza's claim that "[T] *he more reality or being each thing has, the more attributes belong to it.*" (10)
 - b) Examine Quine's arguments against logical empiricism, as discussed by him in "Two Dogmas of Empiricism". (10)
 - c) Do you think Moore's defense of commonsense is a good response to skepticism? Explain how? (10)
 - d) Illustrate what Kant wants to convey when he says that "*Space is a necessary a priori representation that underlies all outer intuitions.*" (10)
 - e) Discuss how Plato's Forms (Ideas) possess the highest and most fundamental kind of reality. (10)
2.
 - a) Give a detailed account of Hegel's Dialectical Method as threefold moments (stages) of development. (20)
 - b) What does Heidegger mean by his assertion that "*Dasein's Being finds its meaning in temporality.*" Explain. (15)
 - c) Discuss Aristotle's account of substance in the light of his claim that "*Substance is primary in all senses, both in definition and in knowledge and in time. For none of the other categories can exist separately, but substance alone.*" (15)
3.
 - a) What is Cartesian Dualism? Explain how Descartes' philosophical endeavours led him to dualism? (20)
 - b) Philosophically reflect on "*God has been more generous with men than to give them a strong desire for knowledge that he has placed out of their reach.*" (15)
 - c) Critically evaluate the ontological status of essences in Husserl's phenomenological thoughts. (15)
4.
 - a) "*When we say that analytic propositions are devoid of factual content, and consequently that they say nothing, we are not suggesting that they are senseless in the way that metaphysical utterances are senseless.*" Examine the statement and explain why Ayer believes that analytic propositions are necessary but not senseless. (20)
 - b) Do you believe that Wittgenstein's later philosophy represents a complete repudiation of the notion of an ideal language? Answer with reasons. (15)
 - c) Discuss Kierkegaard's idea of authentic existence in reference to his assertion that "*The self is a relation that relates itself to itself...*" (15)

SECTION - B

5. a) Discuss Aurobindo's theory of Involution and its difference from Evolution. (10)
- b) What are the five sufferings (*kles'a*), given in Yoga philosophy? How can they be obliterated? (10)
- c) Elucidate the *Pañca skandhāḥ* (Five components) of Buddhism as defined in the *Dharma-saṃgraha*. (10)
- d) Expound the Jaina statement that "*Consciousness is the differentia (distinctive characteristic) of the soul*" (Upyogo Lakṣaṇam) (10)
- e) To what extent, Hume's philosophy has a resemblance with that of Buddhism? Examine the parallels. (10)
6. a) Discuss the debate between *anvitābhīdhānavāda* and *abhihitānvayavāda* and its philosophical significance in Indian epistemology. (20)
- b) "*We uphold plurality as the three entities - the individual selves, the world and the supreme Lord - are mutually distinct in their substantive nature and attributes and there is no mutual transposition of their characteristics.*" In the light of this statement, explain the relationship between Cit, Acit and Īś'vara. (15)
- c) Comment on Russell's assertion that "*Matter is a logical construction of sense - data.*" (15)
7. a) Give a philosophical account of Śaṅkara's idea of *adhyāsa* (superimposition) as explained by him in *Adhyāsa Bhāṣya*. What kinds of proof for *adhyāsa* does he offer? (20)
- b) Illustrate the process of evolution given in Sāṃkhya philosophy. Also, examine the reasons for why the world comes into existence in the very first place. (15)
- c) Do you agree with Sartre that *existence precedes essence*? Give reasons. (15)
8. a) Discuss the key features of Carvaka's metaphysics. (20)
- b) Give a detailed account of the Vaiśeṣika's atomic theory of creation. (15)
- c) Examine Kant's arguments against the three traditional attempts to prove god's existence: the ontological, cosmological and physico-theological (or teleological). (15)

Total No. of Printed Pages-7]

Roll No. _____

CC(M)
PHYSICS
(OPTIONAL)
PAPER - I
[45]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.
- vii) Non Programmable Calculators are allowed.

SECTION - A

Answer the following short questions. Each question carries 10 marks. (5×10=50)

1. (a) Consider the Young's interference experiment shown in the figure (see Fig. 1). Assume that the wavelength of the light is $6000 \text{ \AA}$, the slit widths are all the same, $S_0 = S_1 = S_2 = 0.2 \text{ mm}$, the slit separation $d = 2.0 \text{ mm}$ and $L_1 = 3.0 \text{ m}$. What is the distance between the central and first bright fringe on the screen.

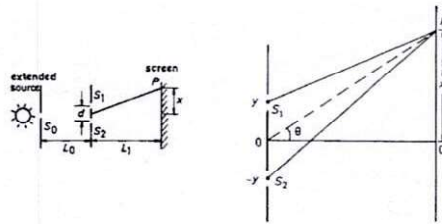


Figure 1:

- (b) A mass M , initially moving at speed v , collides and sticks to a mass m , initially at rest. Assume $M \gg m$. What are the final energies of the two masses, and how much energy is lost to heat, (i) in the lab frame and (ii) in the frame in which M is initially at rest? (Assume $M \gg m$).
- (c) A camera lens (of 50 cm focal length and aperture diameter D) sensitive to visible light is sharply focussed on the star. It is then used without refocussing for an object at a distance of 100m . Find the value of aperture D that will give the best resolution of this object.
- (d) State the Van der Waal's equation of state for a real gas and give the physical interpretation. Express the constants in terms of critical constants T_c , V_c and P_c .
- (e) Consider a two-dimensional ideal monatomic gas of N molecules of mass M at temperature T constrained to move only in the $x - y$ plane. Obtain an expression for $f(v)dv$, the total number of molecules with speeds between v and $v + dv$. Assume that the classical limit is applicable in considering the behaviour of these molecules. Derive a formula for the number of molecules striking unit length of the wall per unit time. Find the specific heats at constant area and at constant pressure.

2. (a) Three identical objects, each of mass m , are connected by springs of spring constant K , as shown in Figure. The motion is confined to one dimension.

At $t=0$, the masses are at rest at their equilibrium positions. Mass A is then subject to an external time-dependent driving force $F(t) = f \cos(\omega t)$, $t > 0$. Calculate the motion of mass C . (20)

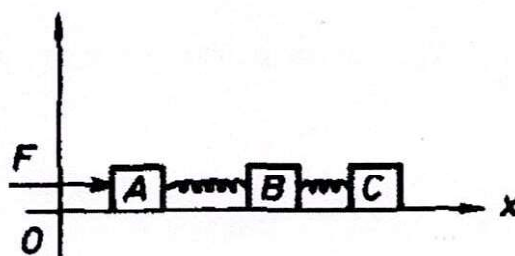
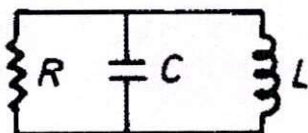


Figure 2:

- (b) A mass M performs a uniform circular motion with angular frequency ω in a plane. The centripetal force is provided by a spring with force constant, k . A small radial impulse is applied on the mass.
- i. Write down the equations of motion for the mass in polar coordinates and point out the conserved quantities (if any) from the equation of motion. (15)
 - ii. Obtain an expression for the frequency for the radial oscillation in terms of the mass M and the spring constant k and the angular frequency ω . (15)
3. (a) What is a Carnot's cycle? (5)
- (b) Illustrate the cycle on pV (Pressure-Volume) diagram (10)
- (c) Illustrate the cycle on ST (Entropy-Temperature) diagram (10)
- (d) Derive an expression for the efficiency of an engine using Carnot Cycle for its operation. (15)
- (e) The circuit shown is in thermal equilibrium with its surroundings at a temperature T . Find the classical expression for the root mean square current through the inductor. (10)



4. (a) A semi-infinite solenoid of radius R and n turns per unit length carries a current I . Find an expression of the radial component of the magnetic field $B_r(z_0)$ near the axis at the end of the solenoid where $r \ll R$ and $z = 0$. (12)
- (b) Write down the Lorentz transformation for the position four vector and obtain the transformation for the momentum four vector. (8)
- (c) Show that the Doppler effect on light frequency can be expressed as
- i) $\nu = \nu_0 \sqrt{\frac{1+\beta}{1-\beta}}$ When the source and observer are approaching. (10)
- ii) $\nu = \nu_0 \sqrt{\frac{1-\beta}{1+\beta}}$ When the source and observer are receding. (10)
- iii) $\nu = \nu_0 \frac{1}{\sqrt{1-\beta^2}}$ When the source and observer are in perpendicular directions passing each other. (10)

SECTION - B

Answer the following short questions. Each question carries 05 marks. (5×10=50)

5. (a) Distinguish between Fraunhofer and Fresnel diffraction in terms of the experimental arrangement used.
- (b) Show schematically an experimental arrangement which will allow Fraunhofer diffraction to be observed.
- (c) Draw the pattern observed on a screen of the Fraunhofer diffraction from a single slit (width a) and for a double slit (width a , separation d). Point out the distinguishing features of each pattern.
- (d) Calculate the interference pattern that would be obtained if three equally spaced slits were used instead of two in Young's experiments (screen far from the slits).
- (e) Consider a particle with a dispersion relation given by $E(k) = \hbar^2 k^2 / 2m$ where k is the momentum of the particle which can take values from $-\infty$ to $+\infty$. Show that the average energy per particle for a system of such collection of particles subject to Boltzmann statistics is given by $k_B T/2$ where k_B is the Boltzmann constant.

6. (a) A particle is constrained to be in a plane. It is attracted to a fixed point P in this plane; the force is always directed exactly at P and is inversely proportional to the square of the distance from P. Using polar coordinates, write the Lagrangian of this particle. Write Lagrangian equations for this particle and find at least one first integral. (25)
- (b) A rectangle coordinate system with axes x, y, z is rotating relative to an inertial frame with constant angular velocity ω about z -axis. A particle of mass m moves under a force whose potential is $V(x, y, z)$. Set up Lagrange equations of motion in the coordinate system x, y, z . (25)
7. (a) A one-dimensional quantum harmonic oscillator (whose ground state energy is $\hbar\omega/2$) is in thermal equilibrium with a heat bath at temperature T . What is the mean value of the oscillator's energy ($\langle E \rangle$), as a function of T ? What is the value of ΔE , the root mean square fluctuation in energy about $\langle E \rangle$. In the limiting case $kT \gg \hbar\omega$, and $kT \ll \hbar\omega$, how would $\langle E \rangle$ and ΔE behave? (10)
- (b) A circular aperture of radius a is uniformly illuminated by a plane wave of wavelength λ propagating along the z -axis. Assuming that the wave is incident from the left and the circular aperture is placed at $z = 0$ as shown in Figure, find the value of z (10)

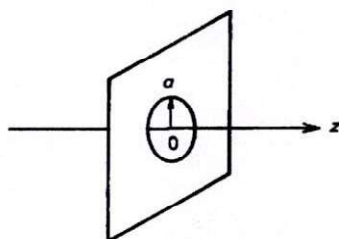


Figure 3:

to the right of the circular aperture for which illumination intensity on the axis is zero due Fresnel diffraction.

- (c) Derive Maxwell's relation (10)

$$\left(\frac{\partial S}{\partial V} \right)_T = \left(\frac{\partial p}{\partial T} \right)_V.$$

- (d) Using the relations, $p = \frac{1}{3} u(T) = U(T)/3V$, where p is pressure from isotropic radiation field, T is temperature, $u(T)$ is energy density and V is the volume of the cavity, show that u obeys the following equation. (10)

$$u = \frac{1}{3} T \frac{du}{dT} - \frac{1}{3} u.$$

- (e) Solve the above equation and obtain Stefan's law of radiation for a black body. (10)

8. (a) A particle of rest mass m and initial velocity u_0 along the x -axis is subject after $t=0$ to a constant force F acting in the y -direction. Find its velocity at any time t and show that $|u| \rightarrow c$ as $t \rightarrow \infty$. (15)
- (b) Consider a rigid lattice of distinguishable spin $1/2$ atoms in a magnetic field. The spins have two states, with energies $-\mu_0 H$ and $+\mu_0 H$ for spin up ($\uparrow$) and down ($\downarrow$), respectively, relative to $\mathbf{H}$. The system is at a temperature T . What will be the canonical partition function for this system. Determine the total magnetic moment $M = \mu_0 (N_+ - N_-)$ of the system. Also find the entropy of the system. (15)
- (c) Point out the differences in the fundamental assumptions underlying Maxwell-Boltzmann (MB) and Fermi-Dirac (FD) statistics. Sketch and depict the energy distribution function at two different temperatures for a system of free particles governed by MB statistics and one governed by FD statistics. Describe the behaviour in the high temperature limit. (10)
- (d) Derive the vapour pressure equation (Clausius-Clapeyron equation). (10)
-

Useful Data

Velocity of light in vacuum c	=	$3 \times 10^8 \text{ m/s}$
Mass of electron m_e	=	$9.11 \times 10^{-31} \text{ kg}$
Charge of electron e	=	$1.602 \times 10^{-19} \text{ C}$
Specific charge of electron e/m_e	=	$1.76 \times 10^{11} \text{ C/kg}$
$1 \text{ u} = 1 \text{ amu} = 1.660566 \times 10^{-27} \text{ kg}$	=	$931.5 \text{ MeV}/c^2$
Rest mass energy of electron $m_e c^2$	=	0.511 MeV
Permittivity in free space ϵ_0	=	$8.8542 \times 10^{-12} \text{ C}^2/\text{N/m}^2$
Permeability of free space μ_0	=	$4\pi \times 10^{-7} \text{ N/A}^2$
Gas constant R	=	8.314 J/mol/K
Boltzman constant k_B	=	$1.381 \times 10^{-23} \text{ J/K}$
Planck constant h	=	$6.626 \times 10^{-34} \text{ Js}$
$\hbar$	=	$1.0546 \times 10^{-34} \text{ Js}$
Bohr magneton μ_B	=	$9.274 \times 10^{-24} \text{ J/T}$
Nuclear magneton μ_N	=	$5.051 \times 10^{-27} \text{ J/T}$
Fine structure constant α	=	$1/137.03599$
Mass of proton M_p	=	$1.0072766 \text{ u} = 1.6726 \times 10^{-27} \text{ kg} = 938.3 \text{ MeV}$
Mass of neutron M_n	=	$1.0086652 \text{ u} = 1.6749 \times 10^{-27} \text{ kg} = 939.6 \text{ MeV}$
Mass of deuteron M_d	=	2.013553 u
Mass of α - particle M_α	=	4.001506 u
Mass of $^{12}_6\text{C}$	=	12.0000000 u
Stefan - Boltzmann constant σ	=	$5.7 \times 10^{-8} \text{ Watt/m}^2/\text{K}^4$
Mass of sun M_s	=	$1.99 \times 10^{30} \text{ kg}$
Radius of sun R_s	=	$6.96 \times 10^8 \text{ m}$
Gravitational constant G	=	$6.673 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

Total No. of Printed Pages-3]

Roll No. _____

CC(M)

POLITICAL SCIENCE AND INTERNATIONAL RELATIONS

(OPTIONAL)

PAPER - I

[47]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Question No.1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

Answer the following in about 150 words each:

(5×10=50)

1.
 - a) What are the basic premises of Sri Aurobindo's 'Cultural Nationalism'? (10)
 - b) Elucidate on the 'Concept of Equality' as propounded by Aristotle? (10)
 - c) Explain the Post-Behavioural approach? (10)
 - d) 'The central notion in Locke's political philosophy is his theory of natural law and natural rights' — Comment. (10)
 - e) What is the difference between Participatory Democracy and Deliberative Democracy? (10)
2.
 - a) Compare and contrast the views of Kautilya and Machiavelli on Statecraft? (20)
 - b) 'In John Rawls's egalitarian liberalism, citizens relate to each other as equals within a social order defined by reciprocity'. Discuss. (15)
 - c) Critically examine the basic assumptions and objections of Marxist's theory of State? (15)
3.
 - a) Examine the relationship between power, authority and legitimacy substantiating with examples. (20)
 - b) Define Human Rights and expound on three generations of Human Rights. (15)
 - c) Distinguish between liberal feminism and radical feminism. (15)
4.
 - a) Critically analyse Ambedkar's ideas on annihilation of caste. (20)
 - b) 'Different conceptions emerge in political theory on the basis of which both the past and the present theories can be judged and evaluated'. Discuss. (15)
 - c) Examine Hannah Arendt thoughts on totalitarianism, revolution and the nature of freedom. (15)

SECTION-B

Answer the following in about 150 words each:

(5×10=50)

5. a) Significance of 'Sepoy Mutiny' in Indian Freedom Movement (10)
b) 'Federalism is no longer the fault line of Centre-State relations but the definition of a new partnership of Team India'. Comment. (10)
c) Is Indian politics moving from ascriptive politics to developmental politics? Discuss. (10)
d) Examine the spirit behind Article 368 of the Indian Constitution. (10)
e) Why Chipko Movement is hailed as one of the strongest movements to conserve forests in India? (10)
6. a) 'Legitimising government action and protecting the Constitution against government overreach are two vital purposes of Judicial Review'. Discuss the efficacy of Judicial Review in India citing some instances. (20)
b) 'Constitution is not a mere lawyers' document, it is a vehicle of life, and its spirit is always the spirit of Age.' - Dr B.R. Ambedkar. Analyse the statement in relation to the Indian Constitution. (15)
c) Critically examine the Radical Humanist Perspective in Indian National Movement. (15)
7. a) Indian society is characterised by more ethnic and religious groups as compared to other countries of the world'. Discuss (20)
b) Critically assess the major Trends shaping India's Voting Landscape. (15)
c) Examine the role of the National Commission for Women in preserving, promoting and protecting the rights of Women in India? (15)
8. a) 'The role, powers, and discretion of the Governor's Office in States have been the subject of constitutional, political, and legal debate for decades. Discuss with relevant instances. (20)
b) Discuss the role of the Comptroller and Auditor - General of India in ensuring the accountability of the government. (15)
c) 'The goal of good governance could be achieved by strengthening the grass root level democracy'. In the light of the statement, examine the major constraints in Panchayat Raj Institutions and Urban Local Bodies in deepening of democracy in India. (15)

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
PSYCHOLOGY
(OPTIONAL)
PAPER - I
[49]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

Answer the following questions in about 150 words each.

(5×10=50)

1.
 - a) Discuss how attitudes are influenced by cognitive dissonance and reciprocal determinism.
 - b) What is objective introspection?
 - c) What is the role of neuroplasticity in learning and memory?
 - d) Discuss how heavy media coverage of the pandemic may have led to overestimating health risks due to the availability heuristic.
 - e) Discuss the 'critical period hypothesis' of language development with the help of a suitable case study.
2.
 - a) Do the assumptions of 'ego psychology' break free from 'Freudian Psychoanalysis'? Respond in light of the evolution in the psychodynamic perspectives. **(20)**
 - b) "Display of Violence in media has no influence on aggression." Discuss in the light of cross cultural research. **(15)**
 - c) Examine how H.M.'s case (who had surgery to relieve debilitating epileptic seizures in 1953) contributed to the understanding of the anatomical correlates of memory. **(15)**
3.
 - a) Critically analyse the Person Centred Therapy. **(20)**
 - b) What are the neurological underpinnings of circadian rhythms? **(15)**
 - c) "Advances in Neuroscience & neuropsychology are changing the face of Psychology." Discuss using relevant examples. **(15)**
4.
 - a) Discuss the key differences between Skinner's and Chomsky's views on language development. **(20)**
 - b) Elaborate on the basic steps of the scientific method in Psychology with the help of examples. **(20)**
 - c) Illustrate the use of quasi-experimental design in psychological research. **(10)**

SECTION - B

Answer the following questions in about 150 words each.

(5×10=50)

5. a) Discuss how understanding psychological principles can help in other areas of social sciences.
b) What functions do emotions serve?
c) Describe Broadbent's model of selective attention. Why is it called an early selection model?
d) Discuss the brain mechanisms underlying the thirst motive.
e) How are heuristics useful in problem-solving?
 6. a) Discuss the changes observed in the sympathetic and parasympathetic nervous systems in mindfulness meditation. **(20)**
b) Describe the 'phonological similarity effect' and the 'effect of articulatory suppression'. What do these effects indicate about the phonological loop? **(15)**
c) Examine the psychological impact of rapid physical development in adolescence. **(15)**
 7. a) With the help of examples, discuss how emotions influence decision-making. **(20)**
b) What are flashbulb memories? How are they encoded? **(15)**
c) Critically evaluate the utility of Gardner's theory of multiple intelligence in understanding the concept of intelligence. **(15)**
 8. a) What are the characteristics of effective communication? How can an individual communicate more effectively? **(20)**
b) Discuss Dr. Maxwell Maltz's theory of psycho-cybernetics. **(15)**
c) Compare and contrast the Rorschach and TAT tests. **(15)**
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
PUBLIC ADMINISTRATION
(OPTIONAL)
PAPER - I
[51]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are Eight questions divided in Two Sections and printed in English. Candidate has to attempt Five questions in all. Questions No.1 and 5 are compulsory and out of the remaining, any Three are to be attempted choosing at least One question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer (QCA) Booklet in the space provided.*
- ii) Your answer should be precise and coherent.*
- iii) If you encounter any typographical error, please read it as it appears in the text book.*
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) No blank page should be left in between answers to various questions.*

SECTION -A

Answer the following questions in roughly 150 words each:

(5×10=50)

1.
 - a) Examine the meaning and scope of public administration. Briefly discuss its significance in the present times. (10)
 - b) "New Public Management is a paradigm shift in public administration". Do you agree to this view. Give reasons for your answer. (10)
 - c) Critically examine the relevance of classical theories of organization. Do they explain the changing dynamics of organizations in contemporary times? (10)
 - d) What are the main trends of the Scientific Management Theory of Organization? To what extent are modern organizations a reflection of this theory? Discuss. (10)
 - e) Human Relations Theory of organization is an improvement over the classical theory of organization". Discuss. (10)
2.
 - a) "Decision-Making is the heart of public administration". In the light of the above statement discuss the contribution of decision-making theory. What are the steps to be taken to make decision making process efficient and transparent? Examine. (20)
 - b) How does Public Private Partnership [PPP] model contribute towards the process of development and governance? Examine the role of PPP model in promoting participatory governance. (15)
 - c) Define Interest Group and explain their role in ensuring accountability and control over administration with suitable illustrations. (15)
3.
 - a) Do you think Citizens' Charter is an effective instrument of administrative accountability? How does it contribute to good governance? Examine. (20)
 - b) "Development Administration is an action and goal oriented administrative system". Comment. (15)
 - c) "Delegated Legislation seeks to solve the problem of congestion at the 'Headquarters' level". In the light of the above statement, examine the methods of 'Delegation'. (15)
4.
 - a) How do you situate Women Self Help Groups in the administrative ecosystem? Examine how they impact the lives of women in terms of their empowerment and emancipation. (20)
 - b) Briefly discuss the various models of public policy and critically examine their relevance in the new age transformative governance. (15)
 - c) Examine the major debates of globalisation and analyse its impact on public administration. (15)

SECTION - B

Answer the following questions in roughly 150 words each:

(5×10=50)

5. a) Development of human resources is an integral part of the general economic planning. Do you agree? Give reasons for your answer. (10)
b) Critically examine F.W. Riggs Ecological Approach. Does it provide the best solutions to the needs of the developing countries? Examine. (10)
c) Leadership is instrumental in motivating the groups and improving organisational performance. In the light of the above statement, briefly examine the modern theories of leadership. (10)
d) 'Right to Information is an assertion of citizens' right to participate in democratic governance.' Comment and give your suggestions to make it more effective. (10)
e) Do you agree that good governance can become an effective instrument of inclusive development? Comment. (10)
6. a) What do you understand by e-governance? Give illustrations on how it has impacted the efficiency of administration. (20)
b) 'Recruitment is the cornerstone of the whole personnel structure.' With reference to the statement briefly outline the pre requisites of a good recruitment system. (15)
c) What are the differences between promotion and performance appraisal? Discuss the new methods of performance appraisal. (15)
7. a) Critically evaluate the recent innovations in Fiscal Management with special reference to Green Budget and Gender Budget. (20)
b) Discuss the relationship between accountability and ethical governance. (15)
c) What do you understand by Public Grievance? Briefly discuss its relevance and the institutional mechanisms for its redressal. (15)
8. a) Legislative control over the executive is one of the basic tenets of democratic government. Discuss some of the major forms of legislative control. (20)
b) What do you understand by civil society? Discuss the relationship between civil society and the state. (15)
c) Discuss the changing role of the State and Public Administration in an eco-system dominated by market economy. (15)

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
SOCIOLOGY
(OPTIONAL)
PAPER - I
[53]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) *There are Eight questions divided in Two Sections and printed in English. Candidate has to attempt Five questions in all. Questions No.1 and 5 are compulsory and out of the remaining, any Three are to be attempted choosing at least One question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.*
- ii) *Your answer should be precise and coherent.*
- iii) *If you encounter any typographical error, please read it as it appears in the text book.*
- iv) *Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) *No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) *No blank page should be left in between answers to various questions.*

SECTION - A

Answer the following questions in about 150 words each.

(5×10=50)

1. a) Why did Durkheim Study Totemism? (10)
b) What is "*Verstehen*"? (10)
c) What is case study method? (10)
d) Compare and contrast Sociology and Jurisprudence. (10)
e) Knowledge about society is obtained with scientific methods. Explain with suitable examples. (10)
2. a) Explain Durkheim's basic arguments on suicide. Can the high suicide rates in India be analysed in light of Durkheim's theory. (20)
b) Discuss the cause and consequences of labour movements in liberalized India. (15)
c) Compare and contrast between comparative and inverse deductive method. (15)
3. a) Auguste Comte's thinking reflected the tempestuous events of his period, Discuss. (20)
b) The changes in individual personality and thought process lead to changes in the social system. Discuss. (15)
c) Domestic violence by one member of the family against another impacts the mental wellbeing of children. Explain. (15)
4. a) How does technology change our work activities in industrial capitalist society? Discuss. (20)
b) How according to Marx, are human beings alienated from their human potential and what is the remedy he suggests? (15)
c) Critically discuss Max Weber's idea of bureaucracy. (15)

SECTION - B

Answer the following questions in about 150 words each.

(5×10=50)

5. a) What is Bio-Social system? (10)
b) Emile Durkheim was not merely a Sociologist, he was a Philosopher, too. Illustrate. (10)
c) Discuss Talcott Parsons idea of Cultural system. (10)
d) Discuss Auguste Comte's idea of Social Statics and Social Dynamics. (10)
e) Illustrate Robin Fox's four basic principles to study of kinship and marriage. (10)

6. a) For Mead, the self is far more than an "internalization of components of social structure and culture". Illustrate (20)
- b) What is occupational segregation? Discuss with contemporary issues of gender based segregation at work. (15)
- c) Discuss Emile Durkheim's critique of Animism and Naturalism with suitable examples. (15)
7. a) What is labelling and control theory of deviance ? Discuss with suitable examples.(20)
- b) Modern technology Acts as potential instrument of social transformation. Critically discuss. (15)
- c) What is Phenomenalism, Pragmatism and logical empiricism? (15)
8. a) Discuss the idea of stratification by education with suitable examples. (20)
- b) "The sacred thing is, par excellence, that which the profane must not and cannot touch with impunity" Illustrate with examples. (15)
- c) Discuss and differentiate Black feminism and post modern feminism. (15)
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
ZOOLOGY
(OPTIONAL)
PAPER - I
[57]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Question No.1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.*
- ii) Your answer should be precise and coherent.*
- iii) If you encounter any typographical error, please read it as it appears in the text book.*
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) No blank page should be left in between answers to various questions.*

SECTION - A

Answer the following in about 150 words each:

1.
 - a) What is retrogressive metamorphosis? Explain with *Herdmania* as an example. (10)
 - b) Describe PCR and its applications. (10)
 - c) Polychaetes exhibit different modes of life adapted to their habitats. Explain with examples. (10)
 - d) Differentiate between hormones and pheromones. Explain their role in animal behavior and communication. (10)
 - e) What are ecotones? Are mangrove forests examples of ecotones? Justify. (10)
2.
 - a) What are the various modes of flight in birds? Explain the various flight adaptations in birds. (20)
 - b) Describe the various density dependent and independent factors which affect the population growth? (15)
 - c) Differentiate between classical and operant conditioning. Add a note on acquisition, extinction and spontaneous recovery. (15)
3.
 - a) Explain, with suitable examples, various ways by which the parental care is shown in amphibians. (20)
 - b) Explain the adaptations that led to shift to terrestrial life in chordates. Comment on the interrelationship of reptilian groups. (15)
 - c) Explain different types of *in-situ* and *ex-situ* conservation of wildlife with suitable examples. Add a note on Project Tiger. (15)
4.
 - a) Give an account on general affinities of Prototheria. How does the limb structure in mammals provide an evidence of divergent evolution? (20)
 - b) Discuss Tuberculosis, its causative agent, diagnosis and treatment. (15)
 - c) Trace the evolution of heart in various group of vertebrates with the help of diagrams. (15)

SECTION - B

Answer the following in about **150** words each:

5.
 - a) Enumerate the various parasitic adaptations of helminthes. (10)
 - b) Explain canal system in sponges with suitable examples. (10)
 - c) Differentiate between correlation and regression. (10)
 - d) Explain, with examples, the concept and importance of gene therapy. (10)
 - e) Describe torsion and detorsion in Gastropods. Add a note on their significance. (10)
 6.
 - a) Give an account of fish locomotion, emphasizing on the role of muscles and fins. Explain how some fishes are able to fly. (20)
 - b) What are biological rhythms? Discuss their significance and mechanism of regulation. (15)
 - c) Give the systematic position and life cycle of an oil-seed insect pest. Add a note on the damage caused and its management. (15)
 7.
 - a) Name any *two* digenetic protozoan pathogens and their vectors. Describe the life cycle of any one of these. Add a brief note on its pathogenicity and prophylaxis. (20)
 - b) With the help of a diagram, describe Nitrogen cycle. Why is it key to Life? (15)
 - c) What is greenhouse effect? Discuss its causes and consequences. (15)
 8.
 - a) Enlist any five hard derivatives of vertebrate integumentary system. Explain various types of horns and antlers in mammals with examples and diagrams. (20)
 - b) Give an account of sexual reproduction in Protozoa. Discuss its importance. (15)
 - c) What is SDS-PAGE? Explain how protein fragments are separated and detected using this technique and its significance. (15)
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)

DOGRI

PAPER - I

[26]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instruction carefully before attempting questions.

- i) There are **EIGHT** questions divided in two Sections and printed in **Dogri**.
- ii) Candidate has to attempt **Six** questions in all.
- iii) Questions No. 1 and 5 are compulsory and out of the remaining, **FOUR** are to be attempted choosing at least **Two** question from each Section.
- iv) The number of marks carried by a question/part is indicated against it.
- v) Answers must be written in the medium authorized in the Admission Certificate which must be stated clearly on the cover of this Question-cum-Answer (QCA) Booklet in the space provided. No marks will be given for answers written in a medium other than the authorized one.
- vi) Word limit in questions, wherever specified, should be adhered to.
- vii) Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

SECTION - A

हिदायत - सुआल नं. 1 जरूरी ऐ। बाकी त्र'ऊं सुआलें (2,3 ते 4) चा कोई दो सुआल करो।

1. (अ) डोगरी भाशा खेतर दियें सीमा-रेखाएं बारै जानकारी दिंदे होई इसदियें कंढी, प्हाड़ी ते मदानी पट्टियें बारै मुख्तसर चर्चा करो। (30)

- (ब) डोगरी भाशा दियें व्यंजन ध्वनियें दा उच्चारण-स्थान दे अधार उप्पर वर्गीकरण ते विश्लेशन करो। (25)

(जां/OR)

- (अ) सिद्ध करो जे डोगरी भाशा दा उद्भव प्राचीन भाशा वैदिक संस्कृत थमां होए दा ऐ। (30)

- (ब) डोगरी भाशा च लिंग-परिवर्तन दे सिद्धांतें दा उदाहरणें समेत ब्यौरा देओ। (25)

2. डोगरी भाशा दी शब्द-रचना च प्रत्ययें दा केह योगदान ऐ? उपसर्गें दे योगदान कन्नै बने दे शब्दें बारै विस्तार च जानकारी देओ। (35)

3. डोगरी भाशा दी ध्वनि-संरचना च खंडेतर ध्वनियें दा केह योगदान ऐ ? मात्रा ते अनुनासिकता ध्वनिगुणें बारै उदाहरणें समेत ब्यौरा देओ। (35)

4. डोगरी भाशा दे संयुक्त जां मिश्रत वाक्यें दी रचना बारै विस्तार च ते उदाहरणें समेत जानकारी देओ। (35)

SECTION - B

हिदायत - सुआल नं. 5 जरूरी ऐ। बाकी त्र'ऊं सुआलें (6,7 ते 8) चा कोई दो सुआल करो।

5. आज्ञादी पैहले दे डोगरी साहित्य च कविता साहित्य गद्य साहित्य दी तुलना च किश मता लभदा ऐ। इस कथन दी पुष्टी युक्तियें ते रचनाएं दे हवाले कन्नै करो। (55)

(जां/OR)

हेठ दिह्ती दिह्ये पुस्तकेँ चा कु'नेँ पं'जेँ रचनाएं दे बारे च 40-40 शब्देँ च सारगर्भत जानकारी देओ।
(5×11=55)

(क) मंगू दी छबील

(ख) जागो डुंगर

(ग) दुद्ध, लहु जैहर

(घ) चेता

(ङ) निग्घे रंग

(च) सत रंग

(छ) अनन्त

(ज) सोचेँ दा सरलाऽ

(झ) जो तेरै मनचित लगी जा

(ञ) सप्तक

6. बावा जित्तो जां दाता रणपत दी कारक दे कथ्य दी जानकारी देइयै उं'दे चरित्र दे गुणें दा बखान करो। (35)
7. डोगरी कहानी दी विकास यात्रा दा संक्षिप्त परिचे देइयै भगवत प्रसाद साठे जां नरेंद्र खजूरिया दी कहानीकला बारै अपने विचार प्रकट करो। (35)
8. डोगरी नाटक दे विकास च प्रो. राम नाथ शास्त्री जां विश्वनाथ खजूरिया दे योगदान बारै विस्तृत ब्यौरा देओ।(35)
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
ENGLISH
ENGLISH LITERATURE
(OPTIONAL)
PAPER - I
[25]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) *There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in All. Question No.1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer (QCA) Booklet in the space provided.*
- ii) *Your answer should be precise and coherent.*
- iii) *If you encounter any typographical error, please read it as it appears in the text book.*
- iv) *Candidates are in their Own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) *No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) *No blank page should be left in between answers to various questions.*

SECTION - A

1. Write short notes on each of the following. Each question should be answered in about 150 words: (5×10=50)
 - a) Petrarchan Sonnet (10)
 - b) Metaphysical Conceit (10)
 - c) Jacobean Tragedy (10)
 - d) Romantic Ode (10)
 - e) Industrial Novel in the Nineteenth Century (10)

2.
 - a) Discuss Shakespeare's *Tempest* as a colonial text with postcolonial elements. (20)
 - b) How does John Donne combine religious feeling and the sonnet form in "Death be Not Proud"? Write a reasoned answer. (15)
 - c) Critically enumerate the thematic importance of any two epic similes in John Milton's *Paradise Lost*, one each from Book I and Book II. (15)

3.
 - a) Write a critical essay on the major elements of romantic poetry with reference to William Wordsworth's "Michael" and "The World is Too Much With Us." (20)
 - b) "But the Lear of Shakespeare cannot be acted...the greatness of Lear is not in his corporeal dimension, but in intellectual...." Critically discuss the Storm Scene in *King Lear* for theatre performance in light of this statement by Charles Lamb. (15)
 - c) How does Tennyson depict the moral, emotional, religious and intellectual meanderings of the poetic persona in his *In Memoriam*? (15)

4.
 - a) Discuss Alexander Pope's *The Rape of the Lock* as a burlesque. (20)
 - b) In what way does the sonnet form help Wordsworth to poetically capture the natural beauty of the city in the morning hour? Answer with reference to the images in the poem "Upon Westminster Bridge." (15)
 - c) Is it appropriate to characterize Ibsen's *A Doll's House* as a feminist play? Give a reasoned answer. (15)

SECTION - B

5. Study the following poem and answer the questions that follow. Each answer should be around 60-80 words. (5×10=50)

My "place of clear water,"
the first hill in the world
where springs washed into
the shiny grass

and darkened cobbles
in the bed of the lane.
Anahorish, soft gradient
of consonant, vowel-meadow,

after-image of lamps
 swung through the yards
 on winter evenings.
 With pails and barrows

those mound-dwellers
 go waist-deep in mist
 to break the light ice
 at wells and dunghills.

- a) Critically comment on the theme of the poem (10)
 - b) How does the poet delineate his "place of clean water?" (10)
 - c) Elaborate on the association of scene and sound that manifest in "Anahorish, soft gradient of consonant, vowel-meadow." (10)
 - d) Analyse the significance of compound words "mound-dwellers" and "waist-deep." (10)
 - e) Critically comment on the poet's choice of diction in the poem. (10)
6. a) Critically elaborate on the colonial and postcolonial undertones in the form and content of Jonathan Swift's *Gulliver's Travels*. (20)
 - b) How does the ironic statement that opens Jane Austen's *Pride and Prejudice* foreshadow the structure of the novel? (15)
 - c) How does the genre of picaresque novel enable Henry Fielding to depict the social realities of Eighteenth century England in *Tom Jones*? (15)
7. a) Write a critical essay on the structure of the novel *Hard Times* and its relation to Dicken's perspectives on the social, political and intellectual issues of nineteenth century England. (20)
 - b) Is it justifiable to interpret George Eliot's *Mill on the Floss* as representing a tragic failure of the individual spirit against the power structures of family and society? Discuss with reference to the novel. (15)
 - c) Critically discuss how Hardy's *Tess of d'Urbervilles*, by depicting the trials and sufferings of Tess Durbeyfield, represent sexual, political, economic and moral subjugation of rural and working-class women in nineteenth century England. (15)
8. a) Write a critical essay on the use of dialogues and their dramatic effects in Jane Austen's *Pride and Prejudice*. (20)
 - b) Write a critical note on Dicken's depiction of Coketown in *Hard Times*. (15)
 - c) Mark Twain's ideological position with regard to his representation of race relations and racism in *The Adventures of Huckleberry Finn* has been a matter of debate. Do you agree? Write a critical response with reference to the novel. (15)

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
HINDI
PAPER - I
[28]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instruction carefully before attempting questions.

- i) There are **EIGHT** questions divided in **Two** Sections and printed in **HINDI**.
- ii) Candidate has to attempt **FIVE** questions in all.
- iii) Questions No. 1 and 5 are compulsory and out of the remaining, **THREE** are to be attempted choosing at least **ONE** question from each Section.
- iv) The number of marks carried by a Question/Part is indicated against it.
- v) Answers must be written in the medium authorized in the Admission Certificate which must be stated clearly on the cover of this Question-cum-Answer (QCA) Booklet in the space provided. No marks will be given for answers written in a medium other than the authorized one.
- vi) Word limit in questions, wherever specified, should be adhered to.
- vii) Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

खंड - 1

1. किन्ही तीन विषय पर आलोचनात्मक टिप्पणी लिखिए. (20+15+15)
- (क) हिंदी सूफी काव्य का भाषिक महत्त्व
- (ख) देव नगरी लिपि की वैज्ञानिकता
- (ग) राष्ट्र भाषा के रूप में हिंदी की स्थिति
- (घ) दक्खिनी हिंदी की विशेषताएं
- (च) मानक हिंदी का स्वरूप
2. (क) काव्यभाषा के रूप में अवधी की विशेषताएं बताइए. (20)
- (ख) हिंदी की समृद्धि में उसकी बोलियों का योगदान बताइए. (15)
- (ग) विज्ञान और तकनीकी के क्षेत्र में हिंदी भाषा के प्रयोग की स्थिति का आकलन कीजिये. (15)
3. (क) राजा भाषा के रूप में हिंदी के प्रयोग की वर्तमान स्थिति पर प्रकाश डालिये. (20)
- (ख) आरम्भिक हिंदी के विकास में अपभ्रंश का योगदान बताइए. (15)
- (ग) स्वाधीनता आन्दोलन में हिंदी की भूमिका बताइए. (15)
4. (क) अमीर खुसरो के साहित्य में खड़ी बोली के आरंभिक स्वरूप पर प्रकाश डालिए. (20)
- (ख) ब्रज भाषा की उत्पत्ति और उसके विकास पर प्रकाश डालिए. (15)
- (ग) अवहट्ट की सामान्य विशेषताएं बताइए. (15)

खंड - 2

5. किन्ही तीन विषय पर आलोचनात्मक टिप्पणी लिखिए. (20+15+15)
- (क) रीतिकालीन कविता में प्रेम और सौन्दर्य
- (ख) विद्यापति की काव्य कला
- (ग) वर्तमान सन्दर्भों में भक्ति साहित्य की प्रासंगिकता
- (घ) सिद्ध-नाथ साहित्य का परवर्ती हिंदी साहित्य पर प्रभाव
- (च) बिहारी की बहुज्ञता

6. (क) रामविलास शर्मा की आलोचना दृष्टि पर प्रकाश डालिए. (20)
- (ख) हिंदी के ललित निबंधों के सांस्कृतिक पक्ष पर विचार कीजिए. (15)
- (ग) हिंदी रंग मंच की वर्तमान स्थिति पर प्रकाश डालिए. (15)
7. (क) नयी कहानी के वैशिष्ट्य की विवेचना करते हुए प्रेमचंद युग के कहानी साहित्य के साथ तुलनात्मक समीक्षा कीजिए. (20)
- (ख) हिंदी साहित्य के इतिहास लेखन की आधारभूत समस्याओं पर प्रकाश डालिए. (15)
- (ग) रेखाचित्र और संस्मरण के स्वरूप को रेखांकित करते हुए दोनों के अंतर को स्पष्ट कीजिए. (15)
8. (क) हिंदी नाटक के विकास में बाबू हरिश्चंद्र का अप्रतिम योगदान है'' इस कथन पर अपना मत प्रस्तुत कीजिए. (20)
- (ख) 'छायावादी काव्य में अभिव्यक्त सौन्दर्य चेतना' पर संक्षिप्त निबंध लिखिए. (15)
- (ग) प्रयोगवाद की विशेषताओं का उल्लेख कीजिए. (15)
-

Total No. of Printed Pages-4]

Roll No. _____

CC(M)
MEDICAL SCIENCE
(OPTIONAL)
PAPER - I
[41]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The number of marks carried by a question/Part are indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

1. a) Briefly describe the following: (3×5=15)
- i) Pharmacotherapy of chronic gout
 - ii) Pharmacotherapy of genital herpes simplex infection
 - iii) First line antitubercular drugs
- b) A 25-year-old female presented with a 1-week history of fever spikes at regular interval associated with chills, and rigors. Examination reveals a lethargic patient, with a temperature of 39.8°C (103.6°F) and splenomegaly and mild anaemia. She has no skin rash or lymphadenopathy. Initial laboratory studies are remarkable for haematocrit 29.8%, 45,000/mm³, creatinine 2.5 mg/dL (220 μmol/L), and mildly elevated bilirubin and transaminases. What could be the possible cause for the presentation? What are the tests to diagnose the condition? What treatment should be given to the patient? (20)
- c) Describe the steps of neuromuscular transmission in mammalian skeletal muscle with suitable diagrams. Give the mechanism of action of non-depolarizing neuromuscular blocker. (10+5=15)
2. a) Describe the scientific methodology to be followed to solve a case of exchange of baby in a hospital. (10)
- b) Describe the hip joint under the following headings: (1+4+6+4=15)
- i) Articulating surfaces
 - ii) Ligaments
 - iii) Movements possible, axes of movements, muscles causing these movements, nerves supplying these muscles
 - iv) Applied aspects
- c) Describe the speech areas of the brain and their blood supply. Add a note on aphasias. (7+3=10)
- d) Discuss the functional organisation of cerebellum. Describe with the help of diagram synaptic organization of the cerebellar microcircuit. Mention two clinical signs related to cerebellar disorder. (7+4+4=15)
3. a) Differentiate between the following: (5 +5+10+5=25)
- i) Parietal and Chief cells of stomach
 - ii) Lymph node and Thymus
 - iii) Lateral corticospinal and spinothalamic tracts
 - iv) Hyaline and elastic cartilage

- b) Describe the kidney under the following headings: (4+8+8+5=25)
- i) Parts
 - ii) Relations
 - iii) Microanatomy
 - iv) Applied aspects
4. a) Discuss the feedback regulation of thyroid hormone. Enumerate the physiological functions of thyroid hormone. Write a note on clinical features and management of hypothyroidism. (7+7+6=20)
- b) i) Discuss the various Renal function tests. Mention an early biochemical marker of renal damage in diabetes Mellitus. (2+2=4)
- ii) Explain the principle and applications of Restriction Fragment Length Polymorphism (RFLP) technique with the help of a specific example. (10)
- iii) Discuss the applications of radioisotopes in clinical diagnosis and treatment, with the help of suitable examples. (6)
- c) Discuss the principle and relevance of performing conventional PCR and Real time PCR. (10)

SECTION - B

5. a) Describe briefly the mechanism of action, use and adverse effects. (3×5=15)
- i) Methotrexate
 - ii) Amphotericin B
 - iii) Metformin
- b) Discuss dengue virus under the following headings: (8+7=15)
- i) Clinical spectrum
 - ii) Laboratory diagnosis
- c) Describe various classes of diuretic agents with example, their mechanism of action and adverse effects. (20)
6. a) Write short notes on: (3×10=30)
- i) Early infant diagnosis (EID) of HIV
 - ii) Amoebic liver abscess (ALA)
 - iii) Types of Malaria Parasites and clinical significance
- b) Many antibacterial drugs are effective because they selectively disrupt protein synthesis in the invading bacterial cell but do not affect protein synthesis in eukaryotic cells. Give specific examples of antibacterial drugs and the specific steps of bacterial protein synthesis that they block. Name one inhibitor that blocks protein synthesis and the step at which it acts, in both prokaryotes and eukaryotes. (10)
- c) Vitamin D is a hormone: Explain the biochemical basis of this statement. Discuss the role of Vitamin D as a hormone. (10)

7. a) i) What is granulomatous inflammation? Enlist diseases with granulomatous inflammation. Discuss pathogenesis of granulomatous inflammation in tuberculosis. (3+3+4=10)
- ii) Discuss the pathogenesis and factors involved in tumor metastasis. (10)
- b) i) Discuss the molecular classification of breast cancer and its implication in prognosis and therapy. (15)
- ii) Discuss the molecular diagnostics in leukemias. (15)
8. a) Differentiate Between: (4×5=20)
- i) Ligature of Hanging and Strangulation
- ii) Cadaveric Spasm and Rigor Mortis
- iii) Burns and Scalds
- iv) Strychnine Poisoning and Tetanus
- b) Discuss principle of consent in medical practice. (10)
- c) Describe in Brief: (5+10+5=20)
- i) Vitriolage
- ii) Sexual Perversions
- iii) Cell Mediated Immunity
-

Total No. of Printed Pages-3]

Roll No. _____

CC(M)
PUNJABI
PAPER - I
[34]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper

- i) *There are eight questions divided in two Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions No. 1 and 5 are compulsory and out of the remaining, any **Three** are to be attempted choosing at least One question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.*
- ii) *Your answer should be precise and coherent.*
- iii) *If you encounter any typographical error, please read it as it appears in the text book.*
- iv) *Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.*
- v) *No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) *No blank page should be left in between answers to various questions.*

SECTION - A

ਪ੍ਰਸ਼ਨ 1 :-

- (ੳ) ਪੰਜਾਬੀ ਦੀਆਂ ਅਖੰਡੀ ਧੁਨੀਆਂ ਸੰਬੰਧੀ ਚਰਚਾ ਕਰੋ। (10)
- (ਅ) ਪੰਜਾਬੀ ਵਿਅੰਜਨ ਧੁਨੀਆਂ ਦੇ ਵਰਗੀਕਰਨ 'ਤੇ ਸੰਖੇਪ ਨੋਟ ਲਿਖੋ। (10)
- (ੲ) ਭਾਸ਼ਾ ਅਤੇ ਉਪ ਭਾਸ਼ਾ ਵਿਚ ਕੀ ਅਸਮਾਨਤਾਵਾਂ ਹਨ। ਚਾਨਣਾ ਪਾਉ। (10)
- (ਸ) ਵਧੇਤਰ ਕੀ ਹੁੰਦੇ ਹਨ? ਇਸ ਦੀਆਂ ਕਿਸਮਾਂ ਬਾਰੇ ਚਰਚਾ ਕਰੋ। (10)
- (ਹ) ਨਾਥ ਜੋਗੀਆਂ ਦੇ ਸਾਹਿਤ ਸੰਬੰਧੀ ਸੰਖੇਪ ਨੋਟ ਲਿਖੋ। (10)

ਪ੍ਰਸ਼ਨ 2 :-

- (ੳ) ਮਲਵਈ ਉਪਭਾਸ਼ਾ ਦਾ ਖੇਤਰ ਦੱਸਦੇ ਹੋਏ ਇਸ ਦੀਆਂ ਪ੍ਰਮੁੱਖ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ 'ਤੇ ਚਾਨਣਾ ਪਾਉ। (15)
- (ਅ) ਮੁਕਤ ਅਤੇ ਬੰਧੇਜੀ ਰੂਪਗ੍ਰਾਮ ਕੀ ਹੁੰਦੇ ਹਨ? ਇਨ੍ਹਾਂ ਦੀ ਅੱਗੋਂ ਵੰਡ ਵੀ ਕਰੋ। (20)
- (ੲ) ਮੱਧਕਾਲ ਦੇ ਲੋਕਪ੍ਰਿਯ ਸਾਹਿਤ ਰੂਪ ਜਨਮਸਾਖੀ ਸੰਬੰਧੀ ਚਰਚਾ ਕਰੋ। (15)

ਪ੍ਰਸ਼ਨ 3 :-

- (ੳ) ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੇ ਜਨਮ ਬਾਰੇ ਕਿਹੜੇ ਕਿਹੜੇ ਵਿਚਾਰ ਪ੍ਰਚਲਿਤ ਹਨ ਅਤੇ ਤੁਸੀਂ ਕਿਸ ਵਿਚਾਰ ਨਾਲ ਸਹਿਮਤ ਹੋ। (20)
- (ਅ) ਪੰਜਾਬੀ ਵਾਰਾਂ ਦੇ ਆਰੰਭ 'ਤੇ ਚਾਨਣਾ ਪਾਉਂਦੇ ਹੋਏ ਇਸ ਦੇ ਵਿਕਾਸ ਦੀ ਚਰਚਾ ਕਰੋ। (15)
- (ੲ) ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ ਦੇ ਪ੍ਰਮੁੱਖ ਨਿਯਮ ਲਿਖੋ। (15)

ਪ੍ਰਸ਼ਨ 4 :-

- (ੳ) ਵਰਤਮਾਨ ਸਮੇਂ ਵਿਚ ਪੰਜਾਬੀ ਦੀ ਸਥਿਤੀ ਦੱਸੋ ਅਤੇ ਇਸ ਦੇ ਵਿਕਾਸ ਦੇ ਕੀ ਯਤਨ ਕੀਤੇ ਜਾ ਰਹੇ ਹਨ। ਚਰਚਾ ਕਰੋ। (20)
- (ਅ) ਗੁਰਮਤਿ ਕਾਵਿ ਦੀਆਂ ਪ੍ਰਮੁੱਖ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ 'ਤੇ ਚਾਨਣਾ ਪਾਉ। (15)
- (ੲ) ਵਚਨ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦਿੰਦੇ ਹੋਏ ਪੰਜਾਬੀ ਵਿਚ ਵਚਨ ਪਰਿਵਰਤਨ ਦੇ ਮੁੱਖ ਨਿਯਮਾਂ 'ਤੇ ਚਾਨਣਾ ਪਾਉ। (15)

SECTION - B

ਪ੍ਰਸ਼ਨ 5 :-

- (ੳ) ਪ੍ਰੇ. ਪੂਰਨ ਸਿੰਘ ਦੀ ਕਵਿਤਾ ਵਿੱਚ ਰਵਾਨੀ ਹੈ, ਆਪ ਮੁਹਾਰਾ ਵੇਗ ਹੈ, ਉਦਾਹਰਣਾਂ ਸਹਿਤ ਸਪੱਸ਼ਟ ਕਰੋ। (10)
- (ਅ) ਅਖਾਣ ਤੋਂ ਕੀ ਭਾਵ ਹੈ? ਇਸ ਦੀ ਬਣਤਰ ਕਿਹੋ ਜਿਹੀ ਹੁੰਦੀ ਹੈ? (10)
- (ੲ) ਸੁਖਬੀਰ ਦੀ ਨਾਵਲੀ ਵਿਲੱਖਣਤਾ 'ਤੇ ਸੰਖੇਪ ਚਾਨਣਾ ਪਾਉ। (10)
- (ਸ) ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼ ਦੀ ਕਹਾਣੀ ਦੀਆਂ ਕਥਾ ਜੁਗਤਾਂ 'ਤੇ ਸੰਖੇਪ ਨੋਟ ਲਿਖੋ। (10)
- (ਹ) ਪੰਜਾਬੀ ਆਲੋਚਨਾ ਵਿਚ ਪ੍ਰੇ. ਕਿਸ਼ਨ ਸਿੰਘ ਦਾ ਕੀ ਸਥਾਨ ਹੈ? ਚਰਚਾ ਕਰੋ। (10)

ਪ੍ਰਸ਼ਨ 6 :-

- (ੳ) ਲੋਕ ਗੀਤ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦਿੰਦੇ ਹੋਏ ਇਸ ਦੀਆਂ ਪ੍ਰਮੁੱਖ ਵੰਨਗੀਆਂ ਬਾਰੇ ਚਰਚਾ ਕਰੋ। (20)
- (ਅ) ਪ੍ਰਿੰ. ਤੇਜਾ ਸਿੰਘ ਦੀ ਨਿਬੰਧ ਕਲਾ 'ਤੇ ਨੋਟ ਲਿਖੋ। (15)
- (ੲ) ਹਰਿਭਜਨ ਸਿੰਘ ਸੁਹਜਵਾਦੀ ਕਾਵਿਧਾਰਾ ਦਾ ਪ੍ਰਮੁੱਖ ਕਵੀ ਹੈ। ਉਦਾਹਰਨਾਂ ਸਹਿਤ ਚਰਚਾਕਰੋ। 15

ਪ੍ਰਸ਼ਨ 7 :-

- (ੳ) ਸੁਰਜੀਤ ਪਾਤਰ ਦੇ ਕਾਵਿ ਸਫ਼ਰ ਦੇ ਵਿਭਿੰਨ ਪੜਾਵਾਂ 'ਤੇ ਚਾਨਣਾ ਪਾਉ। (20)
- (ਅ) ਚਰਨਦਾਸ ਸਿੱਧੂ ਦੇ ਨਾਟਕਾਂ ਦੇ ਸਮਾਜ ਸੱਭਿਆਚਾਰਕ ਸਰੋਕਾਰਾਂ 'ਤੇ ਨੋਟ ਲਿਖੋ। (15)
- (ੲ) ਭਾਈ ਵੀਰ ਸਿੰਘ ਦੇ ਲਿਖੇ ਮਹਾਂ ਕਾਵਿ 'ਰਾਣਾ ਸੂਰਤ ਸਿੰਘ' ਸੰਬੰਧੀ ਜਾਣਕਾਰੀ ਦਿਉ। (15)

ਪ੍ਰਸ਼ਨ 8 :-

- (ੳ) ਪੰਜਾਬੀ ਸਾਹਿਤ ਉੱਤੇ ਪਏ ਅੰਗਰੇਜ਼ੀ ਪ੍ਰਭਾਵਾਂ ਦੀ ਵਿਸਥਾਰ ਚਰਚਾ ਕਰੋ। (20)
- (ਅ) ਦਲੀਪ ਕੌਰ ਟਿਵਾਣਾ ਦੀ ਨਾਵਲ ਕਲਾ ਦੀਆਂ ਪ੍ਰਮੁੱਖ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ ਦੀ ਚਰਚਾ ਕਰੋ। (15)
- (ੲ) ਮੋਹਨ ਸਿੰਘ ਦੀ ਪੰਜਾਬੀ ਪ੍ਰਗੀਤ ਕਾਵਿ ਨੂੰ ਕੀ ਦੇਣ ਹੈ? ਚਰਚਾ ਕਰੋ। (15)

Roll No. _____

Total No. of Printed Pages-3

CC(M)
URDU
(OPTIONAL)
(LITERATURE)
PAPER - I

[55]

[Maximum Marks - 250]

[Time Allowed - 3 Hours]

سوالات سے متعلق خاص ہدایات

(سوالوں کے جواب تحریر کرنے سے پہلے درج ذیل ہدایات کو غور سے پڑھئے)

- ۱۔ اس پرچے میں آٹھ سوالات ہیں جو دو حصوں (سیکشن) پر مشتمل ہیں۔
- ۲۔ امیدوار کو کل پانچ سوالوں کے جواب دینے ہیں۔
- ۳۔ صرف پانچ سوالوں کے جواب لکھئے۔ سوال نمبر 1 اور 5 کے جواب لازمی ہیں۔ دونوں سیکشن کے باقی سوالات میں سے صرف تین سوالوں کے جواب دینے ہیں لیکن ہر سیکشن کے سوالات میں سے کم از کم ایک سوال کا انتخاب ضروری ہے۔
- ۴۔ ہر سوال یا سوال کے حصے کے نمبر اس کے سامنے درج کر دیئے گئے ہیں۔
- ۵۔ جوابات اردو میں ہی مطلوب ہیں۔
- ۶۔ سوالات کے جوابات کے لئے الفاظ کی جو تعداد مقرر کی گئی ہے اس کی پابندی لازمی ہے۔
- ۷۔ سوالات کے جوابات کو ترتیب وار اہمیت دی جائے گی۔ جب تک کوئی جواب یا اس کا حصہ کاٹ کر مسترد نہ کر دیا گیا ہو سوال کا جواب تصور کیا جائے گا اگرچہ جواب جزوی طور پر ہی حل کرنے کی کوشش کی گئی ہو۔ کوئی صفحہ یا صفحے کا کوئی حصہ اگر چھوڑا جائے تو اس کو کاٹنا ضروری ہے۔

[Turn Over

(1)

55-I/2023

SECTION - A

1. درج ذیل پر مختصر تنقیدی نوٹ (100 الفاظ میں) لکھئے۔
(5×10=50)
- (الف) قدیم ہند آریائی دور (10)
(ب) جدید ہند آریائی زبانیں اور اردو (10)
(ج) اردو تہذیب کے عناصر (10)
(د) اردو کی ابتداء اور ارتقاء کے سماجی عوامل (10)
(ه) اردو الفاظ کی لسانی بنیادیں (10)
2. درج ذیل پر تنقیدی نوٹ لکھئے۔
(20+15+15=50)
- (الف) اردو کی ابتداء سے متعلق مسعود حسین خاں کا نظریہ (200 الفاظ میں) (20)
(ب) مغربی ہندی اور کھڑی بولی کا رشتہ (150 الفاظ میں) (15)
(ج) اردو رسم خط اور الفاظ کی ساخت کی بنیادیں (150 الفاظ میں) (15)
3. درج ذیل پر تنقیدی مضمون لکھئے۔
(20+15+15=50)
- (الف) دکن میں اردو ادب کا آغاز و ارتقاء (200 الفاظ میں) (20)
(ب) دکنی اردو کے امتیازی پہلو (150 الفاظ میں) (15)
(ج) بیجاپور کی لسانی و ادبی خدمات (150 الفاظ میں) (15)
4. درج ذیل پر تنقیدی مضمون لکھئے۔
(20+15+15=50)
- (الف) دکن میں مثنوی کا آغاز و ارتقاء (200 الفاظ میں) (20)
(ب) اردو داستان نگاری میں ”سب رس“ کی اہمیت (150 الفاظ میں) (15)
(ج) قلی قطب شاہ کی شاعری کی خصوصیات (150 الفاظ میں) (15)

SECTION - B

5. درج ذیل پر مختصر تنقیدی نوٹ (100 الفاظ میں) لکھئے۔
(5×10=50)
- (الف) اُردو میں مرثیہ نگاری کی روایت (10)
- (ب) دبستان لکھنؤ کی ادبی خدمات (10)
- (ج) دکن میں مثنوی نگاری کی روایت (10)
- (د) شمالی ہند میں غزل کی روایت (10)
- (ه) اُردو میں جدید نظم کا آغاز و ارتقاء (10)
6. درج ذیل پر تنقیدی مضمون لکھئے۔
(20+15+15=50)
- (الف) اُردو میں ناول نگاری کی روایت و ارتقاء (200 الفاظ میں) (20)
- (ب) اُردو ڈرامے کے ارتقاء میں پاری تھیٹر کا کردار (150 الفاظ میں) (15)
- (ج) سرسید تحریک کی ادبی خدمات (150 الفاظ میں) (15)
7. درج ذیل پر تنقیدی مضمون لکھئے۔
(20+15+15=50)
- (الف) اُردو میں مکتوب نگاری کی روایت (200 الفاظ میں) (20)
- (ب) اُردو میں سوانح نگاری اور الطاف حسین حالی (150 الفاظ میں) (15)
- (ج) اُردو افسانہ نگاری اور منٹو (150 الفاظ میں) (15)
8. درج ذیل پر تنقیدی مضمون لکھئے۔
(20+15+15=50)
- (الف) اُردو تنقید نگاری میں کلیم الدین احمد کا مقام (200 الفاظ میں) (20)
- (ب) آل احمد سرور کی تنقید نگاری کے امتیازی پہلو (150 الفاظ میں) (15)
- (ج) ترقی پسند تنقید اور احتشام حسین (150 الفاظ میں) (15)

Total No. of Printed Pages-7]

Roll No. _____

CC(M)
COMMERCE AND ACCOUNTANCY
(OPTIONAL)
PAPER - I
[19]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

Please read each of the following Instructions carefully before attempting the paper.

- i) There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt Five questions in all. Question No.1 and 5 are compulsory and out of the remaining, any Three are to be attempted choosing at least **One** question from each Section. The number of marks carried by a Question/Part is indicated against it. Answers must be written in English in Question-Cum-Answer(QCA) Booklet in the space provided.
- ii) Your answer should be precise and coherent.
- iii) If you encounter any typographical error, please read it as it appears in the text book.
- iv) Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the Answer Script for strict adherence.
- v) No continuation sheets shall be provided to any candidate under any circumstances.
- vi) No blank page should be left in between answers to various questions.

SECTION - A

Write short notes on (in about **150** words).

(5×10=50)

1.
 - a) Purpose of Cost Control and Reduction. (10)
 - b) "The incidence of income-tax depends upon the residential status of an assessee". Critically evaluate the statement. (10)
 - c) Legal provisions for the redemption of shares. (10)
 - d) The duties of a statutory auditor as per the provisions of the Companies Act, 2013. (10)
 - e) Foreign exchange method. (10)

2.
 - a) The following figures have been extracted from the books of X Ltd. for the year ended 31st, March 2014. You are required to prepare a cash flow statement.
 - i) Net profit before taking into account income tax and income from law suits but after taking into account the following items was Rs.20,00,000:
 - a. Depreciation on Fixed Assets Rs.75,00,000.
 - b. Discount on Issue of Debentures written off Rs.30,000
 - c. Interest on Debentures paid Rs. 73,50,000
 - d. Book value of Investment Rs.3,00,000 (Sale of Investments for 3,20,000).
 - e. Interest received on Investments Rs. 60,000.
 - f. Compensation received Rs. 90,000 by the company in a suit filed.
 - ii) Income tax paid during the year Rs. 10,50,000.
 - iii) 15,000,10% Preference Shares of 100 each were redeemed on 31-03-2014 at a premium of 5%. Further, company issued 50,000 equity shares of 10 each at premium of 20% on 02-04-2013. Dividend Preference Shares were paid at the time of redemption.
 - iv) Dividends paid for the year 2012-13, 5 lakhs and interim dividend paid 23 lakhs for the year 2013-14.
 - v) Land was purchased on 02-04-2013 for 2,40,000 for which the company issued 20,000 equity shares of 10 each at a premium of 20% to the land owner as a consideration.
 - vi) Current assets and current liabilities in the beginning and at the end of the years were as detailed below:

Particulars	As on 31-03-2013	As on 31-03-2014
Stock	12,00,000	13,18,000
Sundry Debtors	2,08,000	2,13,100
Cash in Hand	1,96,300	35,300
Bills Receivable	50,000	40,000
Bills Payable	45,000	40,000
Sundry Creditors	1,66,000	1,71,300
Outstanding Expenses	75,000	81,800

(20)

2. b) Job No. 729 was commenced on 10th November 2021 and completed on 1st December 2021. Materials used were Rs. 700 and labour charged directly to the job was Rs. 300. Other information were as follows:

Machine No. 99 used for 20 hours; the machine hour rate is Rs.7 per hour.

Machine No. 98 used for 40 hours; the machine hour rate is Rs.3 per hour.

Five welders worked on the job for 6 days of 8 hours each; the direct labour hour rate for welders is 20 paise.

Other expenditures of the concern not apportioned for calculating the machine hour or the direct labour hour rates amounted to Rs. 20,000, total direct wages for the period being Rs. 30,000.

Ascertain the works cost of Job No. 729. (15)

2. c) Critically analyse the relevance of financial analysis. (15)

3. a) R, is employed with X Limited since 2011. He is entitled to the following from his employer:

Particulars	Rs.
Basic salary	9,000 p.m.
Dearness allowance (part of salary for retirement benefits)	2,000 p.m.
Children education allowance for three children	4,800 p.a.
Hostel expenditure allowance for three children	100 p.m. per child
House rent allowance up to 31.10.2021 (Rent paid for a house in Delhi Rs. 4,500 p.m.)	3,000 p.m.
Medical allowance upto 31.10.2021 (Entire amount was spent on his medical treatment)	500 p.m.
Commission 3% of turnover upto 31.10.2021 (Actual turnover Rs,10,00,000)	30,000

With effect from 1.11.2021, he was given rent free accommodation in Delhi which was owned by employer. Fair rent value of house is Rs.1,20,000 p.a. He was also provided 1500 cc motor car with driver w.e.f. 1.11.2021 to be used partly for official and partly for private purpose. The expenses of running and maintenance of car were met by R himself.

He was also given facility of watchman, sweeper and gardener right from 1.4.2021. The salary of each employee was Rs.300 p.m.

Compute his taxable income under the head Salaries for the assessment year 2022-23 assuming that R does not opt to be taxed under section 115BAC. (20)

3. b) What are the essential factors for installing a cost accounting system? Explain. Also explain 'Sunk Cost' and 'Opportunity Cost'. (15)

3. c) ABC & Co. purchased on 1st October 2014, machinery for 4,50,000 and spent 10,000 on freight and transit insurance. On 25th December 2014, it further spent 40,000 on its erection. The machinery was put to use on 1-1-2015. On 1st July 2015, it purchased the machinery for 1,00,000. During the year 2016, it spent 10,000 for repairs on 1-04-2016 on machinery purchased on 1st October 2014.

However, on 1-4-2017, a part of the machinery purchased on 1-10-2014 costing 2,00,000 was sold for 1,50,000. On 1-10-2017 it purchased another machinery for 3,00,000.

1st July, 2018, however, machinery purchased on 1st July, 2015 was sold for 65,000. Depreciation was charged by the firm @ 10% p.a. by written down value method. At the end of the year 2018, ABC & Co. decided to change the method of providing depreciation and adopted the straight-line method of charging depreciation @ 10% p.a.

Prepare Machinery Account as per the provisions of AS-10 (Revised) up to the year ending 31-12-2018. (15)

4. a) Jain Ltd. has authorized share capital of Rs.30,00,000 consisting of 3,00,000 equity shares of Rs. 10 each, the following is the trial balance of the company as at 31st March 2019.

Debit balances	Rs.	Credit balances	Rs.
Call in arrears	2,00,000	Sales	1,56,20,000
Purchases	87,70,000	Creditors	5,00,000
Advance tax paid	24,50,000	12% Debentures	10,00,000
Salaries	20,00,000	General Reserves	5,80,000
Selling expenses	22,00,000	Provision For Depreciation	
Rent	1,00,000	Plant	5,00,000
Prepaid Rent	20,000	Furniture	3,00,000
Interest on Debentures	1, 00,000	Securities Premium	4,50,000
Plant	25,00,000	Surplus A/c (01-04-2018)	1,20,000
Furniture	13,00,000	Provision for doubtful debts	30,000
Debtors	8,00,000	Commission	1,00,000
Discount on issue of debentures	10,000	Equity Share Capital	20,00,000
Stock (1-4-2018)	4,50,000	Provision for Tax(01-04-2018)	12,50,000
Bad debts	50,000		
Bank balance	4,50,000		
Buildings	10,50,000		
	2,24,50,000		2,24,50,000

Additional information:

- i) Rent Rs. 20,000 is outstanding
- ii) Plant includes Plant costing Rs. 2,50,000 purchased on 1st October, 2018
- iii) Provide depreciation on plant at 20% per annum and on furniture at 10% p.a. on written down value method.
- iv) Maintain a provision for doubtful debts at 5% on debtors.
- v) The company proposed a dividend at 10% on paid up share capital.
- vi) Make a provision of 30% for income tax (including surcharge and cess)
- vii) Corporate dividend tax is at 16.995% (including surcharge and cess)
- viii) Closing stock is 20,00,000
- ix) Debentures were issued on 1-4-2018.

You are required to prepare:

- a) Statement of profit and loss for the year ending 31st March 2019.
 - b) Balance sheet in the prescribed form as at 31st March 2019 as per schedule III of companies Act 2013. **(20)**
4. b) "Detection and prevention of errors and frauds is the secondary objective of independent financial audit." Do you agree? Explain in the light of some landmark judgment. **(15)**
4. c) A conference speaker discussing budgets and standard costs made the following statement: "Budgets and standards are not the same thing. They have different purposes and are set up and used in different ways; yet a specific relationship exists between them."
- i) Identify distinctions or differences between budgets and standards.
 - ii) Identify similarities between budgets and standards. **(15)**

SECTION- B

Write short note on:

5. a) Tax audit **(10)**
b) Forfeiture of shares. **(10)**
c) Perquisites u/s 17(2) of the IT Act 1961. **(10)**
d) Differential Costing **(10)**
e) Money Markets. **(10)**
6. a) Following information are made available to you with respect to capital structure of ABC Ltd. On 31st March 2018.

Particulars	Rs. In crores
Equity Share Capital (Shares of Rs.10 each)	600
Reserves:	
Securities Premium	
General Reserve	200
Profit and Loss Account	540
Export Profit Reserve (Statutory Reserve)	100
Loan Funds	160
	1600

The shareholders have a recommendation of board of directors, approved vide special resolution at their meeting on 10th April 2018, a proposal to buy-back maximum permissible equity shares considering the huge cash surplus following sale of one of its divisions.

The market price was hovering in the range of Rs.25 and in order to induce existing shareholders to offer their shares buy back, it was decided to offer a price of 20% above market.

Advise the company on maximum number of shares that can be bought back. If borrowed funds were Rs.2,400 Crores, and Rs.3,000 Crores respectively would your answer change?

(20)

6. b) Discuss the two commonly applied measures of divisional performance measurement.

(15)

6. c) Is there any difference between inter-source and inter-head adjustment under section 70 and 71 of the IT Act 1961. Discuss the provisions regulating set off and carry forward of losses.

(15)

7. a) Distinguish between 'short-term capital gain' and 'long-term capital gain'.
Miss Priyanka transfers the following capital assets:

	Debentures	Gold	House Property
Date of acquisition	August 12, 2004	August 15, 2019	May 20, 2003
Date of transfer	May 10, 2021	November 14, 2021	February 3, 2022
Sale consideration(in Rs.)	15,00,000	11,00,000	18,50,000
Stamp duty value(in Rs.)			21,00,000
Cost of acquisition(in Rs.)	10,50,000	8,40,000	87,000
Cost of improvement incurred in 2015-16(in Rs.)			1,10,000
Expenditure on transfer (in Rs.)	3,000	2,000	15,000

Note: CII of 2021-22: 317; 2003-04:109; 2015-16:254

Determine the amount of capital gain chargeable to tax in the assessment year 2022-2023

(5+15=20)

7. b) The following are the details of raw materials of Kanhaiya Ltd: 2016.

March 1	Opening Stock	200 units @45 per unit
March 5	Loss by Fire	100 units
March 10	Purchases	200 units @ 46.50 per unit
March 15	Normal Loss of stock	10 units
March 20	Issued for consumption	40 units
March 25	Purchases	150 units @48 per unit
March 30	Issued for consumption	100 units

Find out the value of stock as on 31-3-2016 if company follows perpetual inventory method by weighted average method.

(15)

7. c) Discuss the purposes and differences between Financial Accounting and Cost Accounting. (15)
8. a) The product of a company passes through 3 distinct processes. The following information is obtained from the accounts for the month ending January 31, 2008.

Particulars	Process P (Rs.)	Process Q (Rs.)	Process R (Rs.)
Direct materials	7,800	5,940	8,886
Direct Wages	6,000	9,000	12,000
Production Overheads	6,000	9,000	12,000

3000 units @ Rs. 3 each were introduced to process - I. There was no stock of materials or work in progress. The output of each process passes directly to the next process and finally to finished stock A/c.

The following additional data is obtained:

Process	Output	Percentage of Normal Loss to input	Value of Scrap per unit (Rs.)
Process P	2000	5%	2
Process Q	2520	10%	4
Process R	2250	15%	5

Prepare the necessary process account. (20)

8. b) Discuss the determinants and components of working capital in detail. (15)
8. c) Discuss the monetary and credit policy of RBI. (15)

