

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]

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. 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) Explain in detail the layout of a dairy farm for 100 dairy cows with different partitions and requirements. (20)
 - b) Explain the use of non-protein nitrogenous compounds in ruminant ration. Comment why the same cannot be used in the ration of non-ruminants. (10)
 - c) Discuss gaseous exchange in birds. How does it affect flight and thermoregulation?(10)
 - d) Inbreeding depression and heterosis are tools in hands of a breeder. Justify. (10)
2.
 - a) Describe the most used diluents along with their properties and composition for cryopreservation of cattle bull semen. (20)
 - b) Explain different steps to be followed for organizing a rural programme on prevention of Foot and Mouth Disease among livestock. (10)
 - c) Highlight the importance of iodine in regulating normal physiology in ruminants. How does its deficiency and toxicity affect ruminants? (10)
 - d) Explain principles, assumptions and applications of Hardy Weinberg Law. (10)
3.
 - a) Discuss anti-nutritional factors, their potential risks of toxicity and measures to alleviate them from the diet. (20)
 - b) Explain the structure and role of ATP in biological systems. (10)
 - c) What are lethal genes? Describe their effect on population and strategy for their elimination. (10)
 - d) What is precision livestock farming. Discuss advantages of precision livestock farming. (10)
4.
 - a) Who is a key communicator? Describe various techniques to select a key communicator. (20)
 - b) Explain epistasis and dominance in detail with suitable examples. (10)
 - c) Describe the transport of proteins and steroid hormones. Explain the hormone cell interaction. (10)
 - d) Explain different methods to increase the bypass protein in feed of dairy animals.(10)

SECTION - B

5. a) Enlist clotting factors. Discuss intrinsic and extrinsic pathway of blood circulation. Comment why new borns are susceptible to bleeding disorders? (20)
- b) Explain the procedure of forced moulting in layers. (10)
- c) Explain the role of animals in contemporary society? (10)
- d) What is genetic code? Explain its properties. (10)
6. a) Describe the renal clearance in detail. What are the essential components of the bicarbonate - phosphate buffer system for maintaining acid-base balance? (20)
- b) Explain the following (2×5=10)
- i) Least cost feed formulation
- ii) Pelletting of feed.
- c) Explain the measures to enhance post-thaw sperm motility in buffalo semen. (10)
- d) What are recurring costs. Explain the same in broiler production. (10)
7. a) Describe the role and functions of milk replacer and calf starter. (20)
- b) Describe oxygen transport. What is Oxygen-Hemoglobin Dissociation Curve? (10)
- c) Explain the following (2×5=10)
- i) Livestock Insurance Scheme
- ii) Animal Husbandry Infrastructure Development Fund.
- d) Define the leguminous and non-leguminous fodders with suitable examples. Which type of fodder is used for silage making and why? (10)
8. a) Explain in detail the impact of climate change on livestock production and its mitigation strategies. (20)
- b) Explain the following (2×5=10)
- i) Ideal Protein
- ii) Biuret
- c) Why record keeping is important in livestock farms? Briefly explain the various records to be kept in a commercial dairy farm. (10)
- d) Explain the factors affecting farmer's group cohesiveness. (10)

Total No. of Printed Pages-3]

CC(M)
ANTHROPOLOGY
(OPTIONAL)
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. 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 notes on the following in about 150 words each.

(5×10=50)

1. a) Cultural Materialism (10)
b) Edmund Leach (10)
c) Neo Animism (10)
d) Recent advancement in linguistic anthropology (10)
e) Ruth Benedict (10)
2. a) What are the distinctive features of an anthropological imagination? Why is anthropology seen as a bridge between sciences and humanities? (20)
b) Describe the method of structural analysis of myths. (15)
c) Explain the logic of sharing and co-operation in Band type of social organisation with suitable examples. (15)
3. a) Discuss the impact of feminist movements in concept of family and marriage as an institution. (20)
b) What is cognatic descent? What are the different types of cognatic descent groups and their significance as survival strategy? (15)
c) Explain the significance of evolutionary biology in understanding human behaviour. (15)
4. a) Define the term 'sustainable livelihood framework'. How is the concept important to understand tribal economic organisation in India? (20)
b) Discuss the relevance of the concept 'development cycle of domestic group.' What are the different variables that influence it? (15)
c) Give a brief review of benefits and limitations of various rapid ethnographic methods. (15)

SECTION-B

Write notes on the following in about 150 words each.

(5×10=50)

5. a) Demographic Transition (10)
b) Neanderthals (10)
c) Contribution of Jane Goodall in studying Primate behaviour. (10)
d) Nutritional anthropology. (10)
e) Gene mapping and Human diseases. (10)
6. a) Compare and contrast the anatomical features of Human and Apes. (20)
b) Differentiate between Human Growth and Development. Discuss various methods of studying human growth. (15)
c) Discuss the salient features of upper palaeolithic culture in India. (15)

7. a) Discuss the Bio-cultural adaptation to high altitude among human population. (20)
b) Describe various autosomal abnormalities of chromosomes in humans. (15)
c) Describe the biological basis of racial classification. (15)
8. a) Discuss the causes for early menarche and late onset of menopause in women. (20)
b) Are the non-communicable diseases increasing in Indian populations. Discuss your answer with suitable examples. (15)
c) Give an account of practical applications of anthropometry. (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 it's 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)
-

Total No. of Printed Pages-4]

**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. **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) Explain Maxwell's law for the distribution of speeds among molecules of a gas with the help of a well labelled plot. How will you derive the expression for most probable speed using this law? Is this speed distribution impacted by temperature? **(15)**
 - b) For the cell:

$$\text{Cd (Hg, 5\% by wt.)} \mid \text{CdSO}_4(0.05 \text{ m}) \parallel \text{CdSO}_4(0.02 \text{ m}) \mid \text{Cd (Hg, 10 \% by wt.)}$$
 - i) Write the half-cell reactions and the net reaction.
 - ii) Determine the EMF of the cell if the mean activity coefficient of CdSO_4 in 0.05 m and 0.02 m solutions is 0.20 and 0.30 respectively. **(15)**
 [Mol. wt. of Cd = 112.4, $\log(3.5185) = 0.5464$]
 - c) What do you understand by the terms symmetry elements and symmetry operations? Explain the following with respect to the above terms:
 - i) Mirror plane
 - ii) Proper rotation axis **(10)**
 - d) What is quantum efficiency? A quantum efficiency of 1×10^6 is obtained for a photochemical reaction between $\text{H}_2(\text{g})$ and $\text{Cl}_2(\text{g})$ using a wavelength of 480nm. Determine the amount of $\text{HCl}(\text{g})$ produced under the given conditions per calories of radiant energy absorbed. **(10)**
2. a) Discuss the origin of surface tension in liquids. Discuss one experimental method for the determination of surface tension of a liquid. **(15)**
 - b) What is thermodynamic aspect of the term "entropy"? Determine the change in entropy when 1 mol of ice is heated from 250K to 300K and the heat capacities (C_p, m) of water and ice are taken as 75.3 and $37.7 \text{ JK}^{-1} \text{ mol}^{-1}$ respectively. Given that the latent heat of fusion of ice is 6.02 KJ mol^{-1} .
 $[\log_e(1.0926) = 0.0886, \log_e(1.0983) = 0.0938]$ **(15)**
 - c) What do you mean by "component" of a system? How is it different from "constituent" of a system? Determine the number of components in the following systems:
 - i) Ammonium chloride undergoes thermal decomposition.
 - ii) Aqueous acetic acid.
 - iii) Calcium carbonate in equilibrium with its decomposition products. **(10)**
 - d) What are stoichiometric defects that occur in the solid state and give an example of each? Discuss the possibility of electrical conduction and its mechanism due to these defects in solids. **(10)**
3. a) An electron is placed in a 1-D box having a length of 0.10 nm. Determine:
 - i) The energy difference between $n = 2$ and $n = 1$ states of the electron.
 - ii) The probability of finding the electron in between $x = 0$ and $x = L/2$ in the $n = 1$ state. **(15)**
 - (b) A certain element having molar mass 181g/mol and density $16.4 \times 10^3 \text{ kgm}^{-3}$ crystallizes in a BCC lattice arrangement. Determine:
 - i) The edge length of the unit cell.
 - ii) The distance between the (112), (210) and (222) planes.
 - iii) The nearest neighbour distance between its atoms. **(15)**

c) What is half-life of a reaction? What is its significance? A certain compound decomposes at 300°C with a rate constant, $k = 2.4 \times 10^{-4} \text{sec}^{-1}$. Determine the temperature at which the half-life of the reaction would be 139.6 seconds if the activation energy for the reaction is 42kcal mol^{-1} . $[\log(20.67) = 1.3153]$ (10)

d) Outline a Born - Haber cycle for the formation of NaCl. Calculate the electron affinity of Cl with the help of the following thermochemical data in KJ/mol:

$$\Delta H_{\text{formation}} = -381.2, \Delta H_{\text{sublimation}} = 108.4, \text{ Ionization enthalpy} = 495.4, \\ \Delta H_{\text{dissociation}} = 241.8, \text{ Lattice energy} = -757.3. \quad (10)$$

4. a) What are the assumptions on which Langmuir adsorption isotherm is based? Derive the expression for this type of isotherm and explain the terms involved in it. (15)

b) Show that:

i) $\mu_{JT} = \frac{T(\partial V / \partial T)_p - V}{C_p} = \frac{V(\alpha T - 1)}{C_p}$ and is zero for an ideal gas.

ii) $[\partial H / \partial p]_T$ is zero for an ideal gas. (15)

c) What are ion selective electrodes? Give an example of one such electrode and explain its working mechanism. (10)

d) Explain the following:

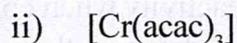
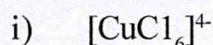
i) Electrophoretic effect.

ii) Critical solution temperature. (10)

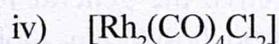
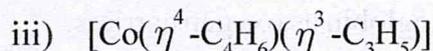
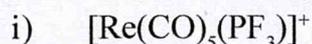
SECTION - B

5. a) What is $\text{Na}^+ - \text{K}^+$ pump? How does it function? Comment on the selectivity of this pump in transporting the Na^+ and K^+ ions. (15)

b) Explain the concept of Jahn-Teller distortion. Which of the following complexes are expected to show this distortion?



c) Give the electron count of the following organometallic compounds:



- d) i) What are boranes? Give one example of a Nido-borane and Arachno - borane each. (5)
- ii) Complete the following reactions: (5)
- A. $B_2H_6 + 2(Me)_3N \rightarrow ?$
- B. $3BCl_3 + 3NH_4Cl \xrightarrow{140^\circ C} ? \xrightarrow{NaBH_4} ?$
- C. $2Na[BH_4] + I_2 \xrightarrow{DMG} ?$
- D. $B_2H_6 + 2LiH \rightarrow ?$
6. a) How does IR spectroscopic technique help in understanding the structural aspect of carbonyl compounds? Explain the order of IR frequency in the following carbonyl complexes. (15)
- | Complex | $\nu(CO) \text{ cm}^{-1}$ |
|-------------------|---------------------------|
| $[Ti(CO)_6]^{2-}$ | 1748 |
| $[V(CO)_6]^-$ | 1859 |
| $[Cr(CO)_6]$ | 2000 |
| $[Mn(CO)_6]^+$ | 2204 |
- b) A solution containing 0.319g of a hydrate isomer (Molecular formula: $CrCl_3 \cdot 6H_2O$, molecular weight: 266.35) was passed through a cation exchange resin in acidic form. The acid so liberated used 19ml of 0.125 N NaOH for neutralization. Identify the isomer. (15)
- c) Give the IUPAC name of the following coordination complexes: (10)
- i) $[Pt(NH_3)BrCl(CH_3NH_2)]$
- ii) $[Co(NH_3)_3(ONO)_3]$
- iii) $[Pt(NH_3)_4] [PtCl_4]$
- iv) $[Rh(NCS)_3(NH_3)_3]$
- v) $K_2[Co(N_3)_4]$
- (d) Why are absorption bands of lanthanide ions weak but very sharp? Explain. (10)
7. a) What are fluxional molecules? How does fluxionality differ from isomerism and tautomerism? (15)
- b) What are cytochromes? What is the basis of their classification? Briefly describe the active site in cytochrome c? (15)
- c) What are interhalogen compounds? Comment on their reactivity when compared to halogens. Draw the structures of the following species showing the position of lone pair of electrons if any: I_2Cl_6 , IF_5 , $[ICl_2]^-$ (10)
- d) What is chelate effect? How does it impact the stability of coordination compounds? (10)
8. a) How is Zeise's salt prepared? Discuss its bonding and structural aspects. (15)
- b) What are silicones? Discuss their characteristic properties and applications. (15)
- c) Compare and contrast hemoglobin and myoglobin as oxygen carriers. (10)
- d) What are phosphazenes? How are they prepared? Give the general formula of cyclophosphazenes and draw the structures of any one cyclophosphazene molecule. (10)

Total No. of Printed Pages-8]

CC(M)

CIVIL ENGINEERING

(OPTIONAL)

PAPER - I

[17]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

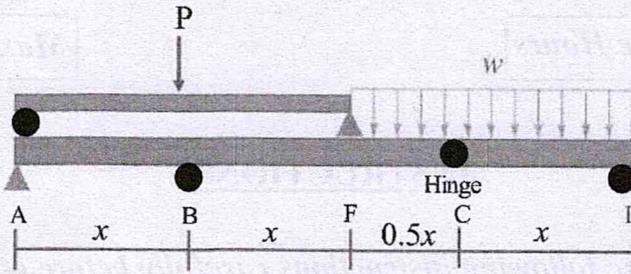
Please read each of the following instructions carefully before attempting the paper.

- 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) 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) Draw the Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) for only the bottom beam ABFCD. At C there is a moment releasing hinge. (i) Determine the Value of minimum shear (ii) Location of minimum shear (iii) Value of minimum bending moment (iv) Location of minimum bending moment (v) Slope of BD just to the left of F (vi) Slope of BMD just to the right of F (vii) Value of maximum bending moment (viii) Distance of point of maximum bending moment from support A.

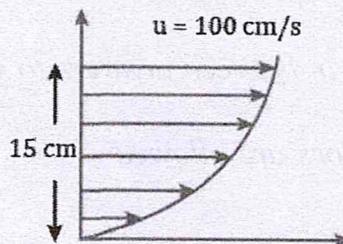
(1+1+3+2+3+3+3+4 = 20)



- (b) Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the two ends of a pipe 500 m apart is 4 m of water. Take the value of $f=0.009$.
- (c) Answer the following short answer questions:
- (i) Why are the end returns provided in fillet welds?
 - (ii) Why are plastic or compact sections preferred for compression members?
 - (iii) Under what circumstances will block shear failure dominate in bolted connection of steel tension members?
 - (iv) Define Kinematic Viscosity and explain its relationship with dynamic viscosity.
 - (v) What is critical flow? Why it is important in design of hydraulic structures.

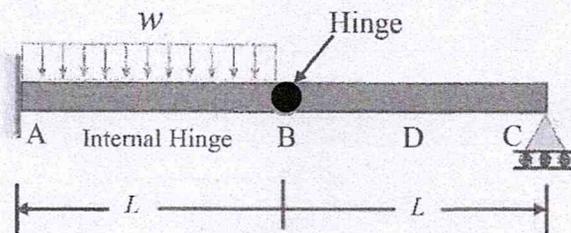
(4+4+4+4+4 = 20)

2. (a) A fluid flows over a flat plate, exhibiting a laminar flow pattern. The velocity distribution across the fluid layer follows a parabolic profile. The maximum velocity of 100 cm/s is reached at a distance of 15 cm from the plate. The dynamic viscosity of the fluid is 10 poise (equivalent to 1 Pa's). Calculate the shear stress within the fluid layer at a distance of 0 cm, 10 cm, and 15 cm from the plate.

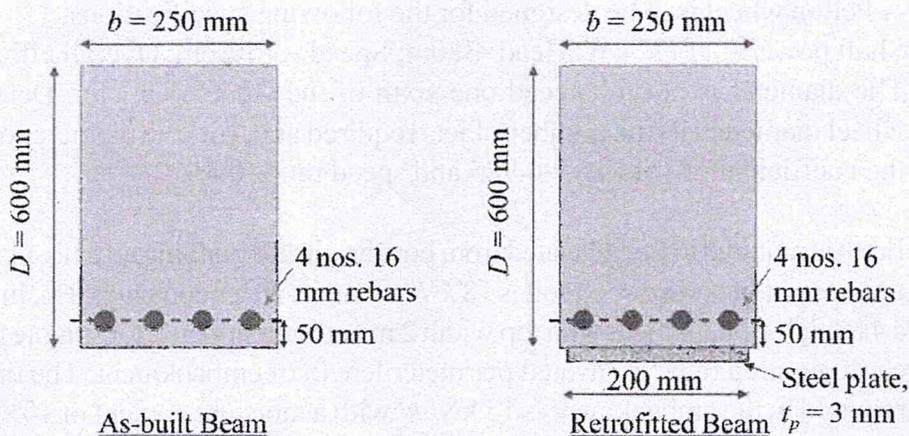


(2)

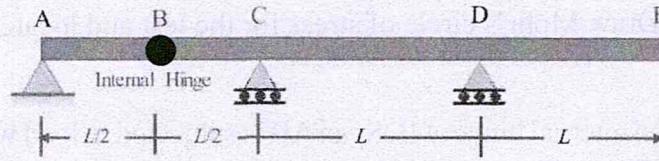
- (b) For the construction of an earthen dam, an unconfined compression test was performed on a clay sample under saturation conditions. The maximum (peak) load the clay sustained was 127 N, and the vertical displacement was 0.8 mm. The diameter and length of the sample were 38 mm and 76 mm. (i) Determine the undrained shear strength. (ii) Draw Mohr's circle of stress for the test and locate S_u . (10+5 = 15)
- (c) A beam with an internal hinge at B. Span AB is subjected to load w N/m. The modulus of elasticity of both spans is E N/m² and the second moment of area is I m⁴. Point D is at the center of BC. Given: $w = 4$ N/m, $L = 4$ m. (i) Determine deflection at point D (ii) Determine slope at point D. (7.5+7.5 = 15)



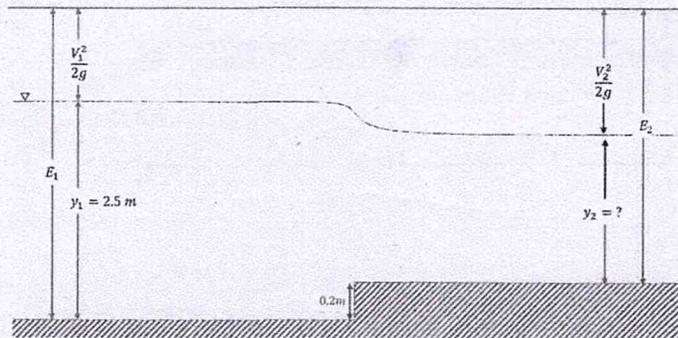
3. (a) An RC beam has cross-section as shown in the left figure below. Check whether the beam is safe to resist an ultimate moment of 125 kN-m. Take $f_{ck} = 20$ MPa and $f_y = 250$ MPa. The structural engineer decided to retrofit the beam with a steel plate of thickness, $t_p = 3$ mm (yield strength, $f_{yp} = 250$ MPa). The steel plate is glued at the bottom of the beam as shown in the right figure below. Find the ultimate moment capacity of the retrofitted rectangular beam and check whether the beam is now safe to resist an ultimate moment of 125 kN-m. (5+10=15)



- (b) Draw the influence line diagram for reaction at C using Müller-Breslau principle. Using ILD, calculate maximum reaction at C, if a uniformly distributed load of 10 kN/m of length $2L$ moves on the top of the beam. Take $L = 10\text{ m}$. (5+5 = 10)



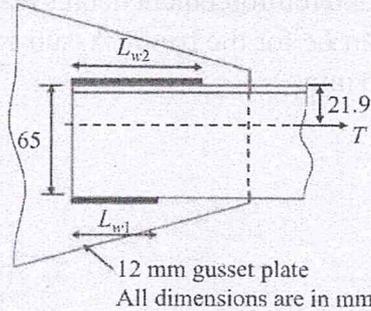
- (c) A 4-m wide rectangular channel is carrying $10\text{ m}^3/\text{s}$ at a depth of 2.5 m . There is a step rise of 0.2 m in the channel bottom. Assuming there are no losses at the transition, determine the flow depth downstream of the bottom step. Does the water surface rise or fall at the step? (10+5 = 15)



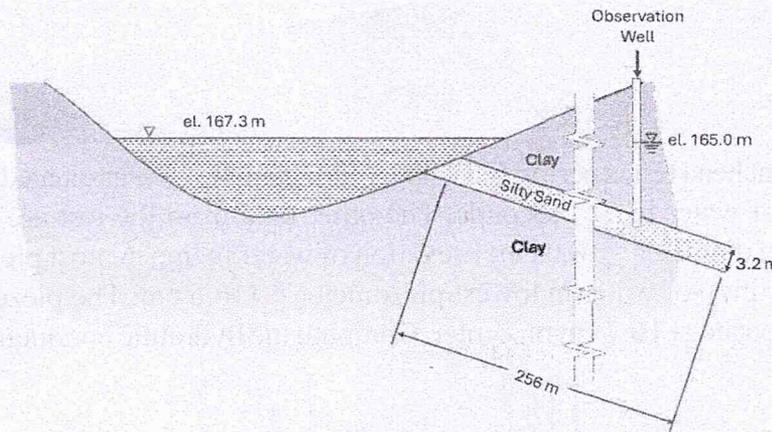
- (d) A 10-m wide, rectangular, concrete-lined channel ($n = 0.013$) has a bottom slope of 0.01 and a constant-level reservoir at the upstream end. The reservoir water level is 6.0 m above the channel bottom at the entrance. Assuming the entrance losses and the approach velocity in the reservoir to be negligible, determine the channel discharge and critical slope for the estimated discharge. (5+5=10)
4. (a) A Pelton wheel is to be designed for the following specifications.
 Shaft power = 11772 kW ; Head = 380 m ; Speed = 750 rpm ; Overall efficiency = 86%
 The diameter is not to exceed one-sixth of the wheel diameter. Determine (i) the wheel diameter (ii) the number of jets required and, (iii) the diameter of the jet. Take the coefficient of velocity = 0.985 and speed ratio = 0.46 . (20)
- (b) Earth is required to be excavated from borrow pits for building an embankment. The wet unit weight of undisturbed soil is 18 kN/m^3 and its water content is 8% . In order to build a 4 m high embankment with top width 2 m and side slopes $1:1$, estimate the quantity of earth required to be excavated per meter length of embankment. The dry unit weight required in the embankment is 15 kN/m^3 with a moisture content of 10% . (15)
- (c) What is an elastic collision, and how does it differ from an inelastic collision? Provide an example of each. (15)

SECTION -B

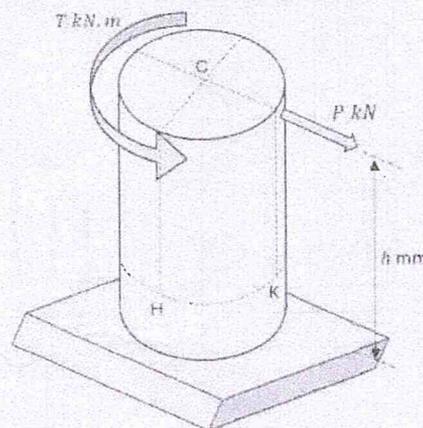
5. (a) Design a fillet weld to connect ISA $65 \times 45 \times 8$ mm with 12 mm thick gusset plate. The member carries a tensile service load $T=100$ kN. Assume weld size as 5 mm, steel grade E250 (Fe 410), partial safety factor for weld as 1.25. (10)



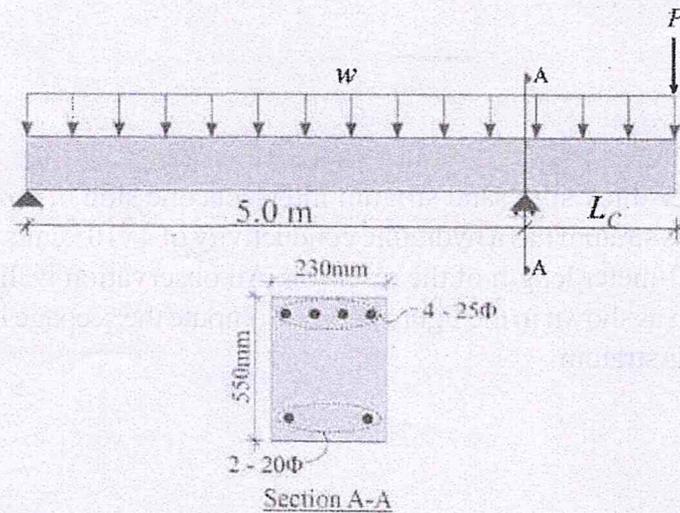
- (b) A 3.2-meter-thick silty sand stratum intersects one side of a reservoir, as shown in Figure. This stratum has a hydraulic conductivity of 4×10^{-2} cm/s and extends along the entire 1000-meter length of the reservoir. An observation well has been installed in this stratum as shown in the figure below. Compute the seepage loss from the reservoir through this stratum. (10)



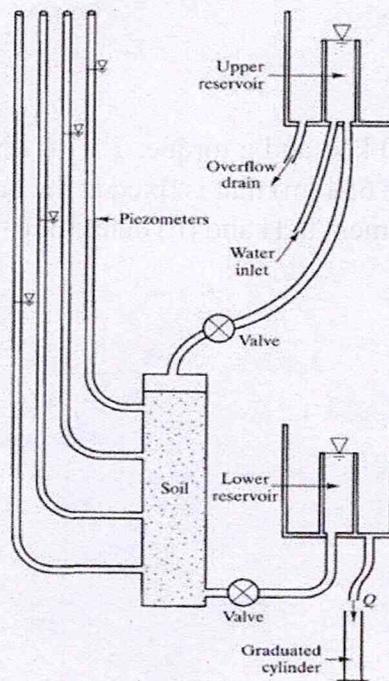
- (c) A lateral load, $P = 10$ kN, and a torque, $T = 1.4$ kN-m applied on top of a circular column (diameter, $d = 65$ mm) that is fixed at the base. Given $h = 240$ mm. (i) Draw the stresses on the element at H and (ii) determine the maximum principal stress. (5+5=10)



- (d) Explain any five dimensional-numbers and list their use cases. (4+4+4+4+4=20)
6. (a) A factored point load, $P=75$ kN is acting at the tip of the beam. The beam is also subjected to a factored uniformly distributed load (including self-weight), $w = 20$ kN/m. The beam cross-section and reinforcement details are shown at section A-A. Find the maximum cantilever span L_c for the beam. Assume M30 concrete and Fe415 Steel and effective cover as 50 mm. (20)

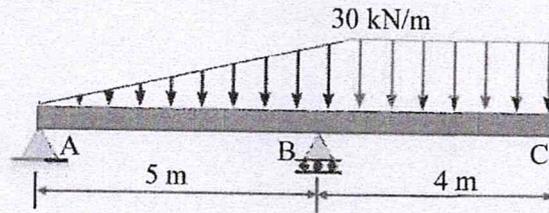


- (b) A constant head test is performed using a permeameter. The graduated cylinder collects 892 ml of water in 112 seconds. The other data from the test are as follows: Soil specimen diameter = 18.0 cm; Elevation of water in upper-most piezometer = 181.0 cm; Elevation of water in lowest piezometer = 116.6 cm; The piezometer inlets are evenly spaced at 16.7 cm on center. Compute the hydraulic conductivity, k . (10)

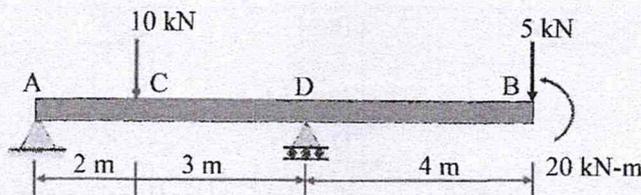


(6)

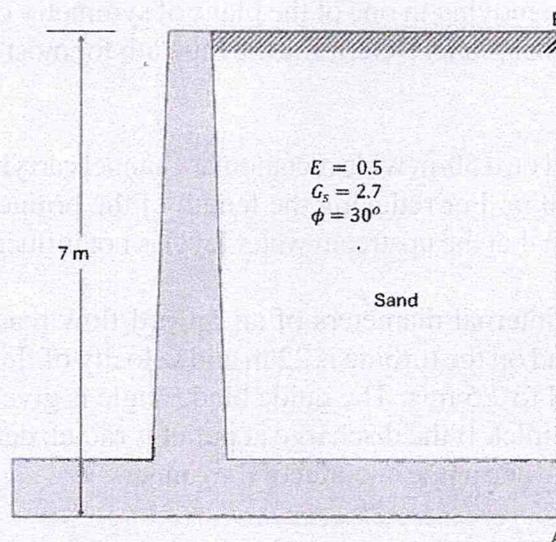
- (c) Using the moment distribution method, determine the moment at B, and draw the moment diagram for the beam. Assume the support at A is hinged, B is roller and C is fixed. EI is constant. (10)



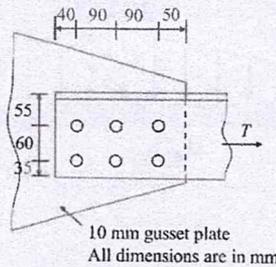
- (d) Using the unit load method, determine the slope and deflection at free end B. Flexural rigidity, $EI = \text{constant}$. (10)



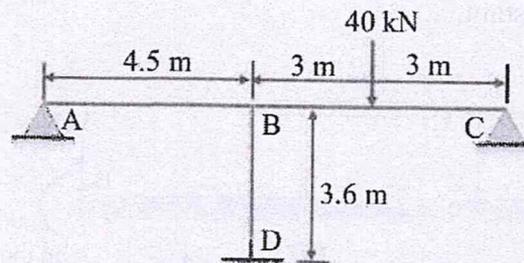
7. (a) A cantilever retaining wall of 7 meters height retains sand. The properties of the sand are: $e = 0.5$, $\phi = 30^\circ$, and $G_s = 2.7$. Using Rankine's theory, determine the active earth pressure at the base when the backfill is (i) Dry (ii) Saturated (iii) Submerged. Also, calculate the resultant active force in each case. Additionally, determine the total water pressure under the submerged condition. (6+7+7=20)



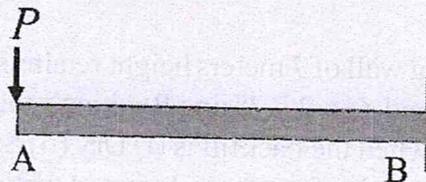
- (b) A single angle ISA $150 \times 100 \times 10$ mm connected to 10 mm thick gusset plate with 20 mm high-strength bolts of grade 8.8S. What is the maximum service load that can be supported, based on shear and bearing strengths of bolts, if the bolt threads do not fall in the plane of shear? Assume steel grade E250 (Fe 410), and bolt hole to be drilled one, partial safety factor for material of bolt as 1.25. (15)



- (c) Using slope deflection method, determine the moments at B and D, and draw the bending moment diagram of the frame. Assume the support at A and C are hinged, D is fixed, EI is constant. (15)



8. (a) For the cantilever beam, determine the vertical deflection at point A using stiffness method. Also, determine the fixed end moment at B and draw BMD. (15)



- (b) A column of length L and rectangular cross-section ($a \times b$) has a fixed end B and support a centric load at A as shown in figure below. Two smooth and rounded fixed plates restrain end A from moving in one of the plane of symmetry of the column and allow it to move in the other plane. Determine the ratio a/b for most efficient design against buckling. (10)
- (c) A bridge is planned on a 50-m wide rectangular channel carrying a flow of $200 \text{ m}^3/\text{s}$ at a flow depth of 4.0 m. For reducing the length of the bridge, what is the minimum channel width such that the upstream water level is not influenced for this discharge? (15)
- (d) The external and internal diameters of an inward flow reaction turbine are 1.2 m and 0.6 m. The head on the turbine is 22 m and velocity of flow through the runner is constant and equal to 2.5 m/s. The guide blade angle is given as 10° and the runner vanes are radial at inlet. If the discharge at outlet is radial, determine, a) the speed of the turbine. b) The vane angle at outlet of the runner. (5+5=10)

Total No. of Printed Pages-8]

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

Answer the following questions (in not more than 200 words each): (5×10=50)

1.
 - a) What is the importance of Financial Analysis? (10)
 - b) Explain Employees Stock Option and its benefits for Employees and Employer Company. (10)
 - c) Explain the Meaning and the Types of Responsibility Centers. (10)
 - d) What is the meaning of Activity Based Costing? State the process to implement Activity Based Costing and explain its main advantages. (10)
 - e) Explain the definition and meaning of Salary as per Income Tax Act, 1961. (10)

2. a) The following is the Trial Balance of M/s.Vibhuti Steels Ltd as on 31st March 2023:

Particulars	Amount in Rupees	
	Debit	Credit
Equity Share Capital(Share of Rs.10 each)		14,00,000
12% Bank Loan		2,80,000
Surplus in the Statement of Profit and Loss Account		5,18,000
Trade Creditors		2,24,000
Sales		81,76,000
Sales and Purchase Returns	33,600	42,000
Provision for Doubtful Debts		56,000
Building (at cost)	7,00,000	
Machinery(at cost)	21,00,000	
Stock	1,68,000	
Trade Receivables	7,00,000	
Bad Debts	29,400	
Cash and Bank	68,600	
Interim Dividend Paid	84,000	
Purchase	57,40,000	
Salaries	10,48,600	
Manufacturing Expenses	3,22,000	
Auditor's Fees	84,000	
Provision for Depreciation on Building		1,12,000
Provision for Depreciation on Machinery		4,06,000
Bills Receivables	49,000	
Directors' Fees	70,000	
Preliminary Expenses	16,800	
Total	1,12,14,000	1,12,14,000

Further you are provided with the following information:

- i) Stock on 31st March 2023 was valued at Rs.2,80,000.
- ii) Provide depreciation on Building @5% of cost and on Machinery @10% of cost.
- iii) Maintain provision for doubtful debts at 2% of Trade Receivables.
- iv) Make a provision of 40% for Corporate Taxes.

- v) Transfer Rs.37,800 to General Reserve
- vi) Write off Preliminary Expenses.
- vii) Bank Loan was raised on 1-Oct-2022.
- viii) The company has disputed a claim of Rs.14,000 for workmen's compensation.
- ix) Bills receivables represent short term loans and advances and not bills accepted by trade debtors.

From the above balances and information, **Prepare year end Statement of Profit and Loss Account and Balance Sheet as on 31st March 2023 as per Schedule III of Companies Act, 2013.** (30)

- b) The product of a manufacturing concern passes through two processes: A and B, so as to become the finished product. It is ascertained that in each process 5% of the weight of input is lost and 10% is the scrap, which from process A realizes Rs.200 per tonne and from process B Rs.500 per tonne. The following data is available relating to both the processes for a particular month:

Particulars	Process - A	Process - B
Materials in tonne	1,000	70
Cost of materials per tonne in rupees	313	500
Wages in Rupees	70,000	25,000
Manufacturing Expenses in rupees	20,000	13,125
Output in tonnes	830	780

Prepare process Accounts showing cost per tonne of each process. There was no stock or work in progress in each process. (20)

3. a) The ledger balances of Ramneek Ltd. as on 31st March 2023 are as follows:

Freehold Property at cost	1,08,000
Plant and Machinery	3,96,000
Lease hold Property at cost	2,52,000
Stock in trade	54,000
Trade Debtors	1,08,000
Investments at cost	72,000
Equity Share Capital (Share of Rs.10 each fully paid)	2,70,000
8% Cumulative Preference shares of Rs.10 each fully paid	3,60,000
9% Debentures (Secured on Freehold property)	1,08,000
Interest accrued on debentures	4,860
Securities Premium	9,000
Trade Creditors	1,53,000
Bank Overdraft	1,72,800
Accumulated Depreciation on Leasehold Property	32,400
Accumulated Depreciation on Plant and Machinery	1,08,000
Goodwill	99,000

Preference Dividends are in arrears for the past 4 years. After approval by the Tribunal of a scheme for the reduction of capital the following steps were taken:

- i) The Preference shares were reduced to Rs.7.50 per share and the equity shares to Rs.2 per share. After reduction the shares were consolidated into shares of Rs.10 each. The authorized capital was restored to Rs.3,60,000 8% Cumulative Preference shares and RS.2,70,000 Equity shares, both of Rs.10 each.

- ii) One new Equity Share of Rs.10 each was issued for every Rs.40 of gross Preference Dividend in Arrears.
- iii) The balance in securities premium account was utilised.
- iv) The debenture holders took over the freehold property at an agreed value of Rs.1,35,000 and paid the balance to the company after deducting the amount due to them.
- v) Plant and Machinery was written down to Rs.2,52,000.
- vi) Investments were sold for Rs.57,600.
- vii) Goodwill, accumulated losses, trade debts of Rs.15,480 and obsolete stock of Rs.18,000 were written off.
- viii) Contingent liability for which no provision was made was settled at Rs.12,600 and an amount of Rs.11,340 was recovered from insurers for a long pending claim.
- ix) The available cash is deposited into the bank overdraft account.

You are required to :

- (A) Determine the accumulated losses;
- (B) Show the necessary journal entries to record above transaction in the books of company;
- (C) Show the Capital Reduction Account and Cash Account. (30)

b) As an investment manager, you are supplied the following information:

Investment in Equity	Initial Price	Dividends	Year-end Market	Beta risk factor
Kafka Ltd.	Rs.50	Rs.4	Rs.100	0.8
Sama Ltd.	70	4	120	0.7
Jackob Ltd.	90	4	270	0.5
8% Govt. Bonds	1000	140	1010	1.0

You are required to calculate expected rate of return (cost of equity) on each security using Capital Assets Pricing Model (CAPM). (20)

4. a) Mr.Satish is a Sales Manager in a company in Jaipur. He has furnished the following details regarding his salary income for the previous year 2022-23:
 - i) Basic Salary Rs.85,000 p.m.
 - ii) Dearness Allowance Rs.30,000 p.m.
 - iii) Bonus Rs.50,000 p.a.
 - iv) Travelling Allowance Rs.45,000 out of which he spends Rs.30,000 for official purposes.
 - v) Reimbursement of medical bills Rs.25,000 (the treatment was done in a govt.hospital in India).
 - vi) He lived in a bungalow belonging to the company .Its fair rent is Rs.15,000 p.m. The company has provided on this bungalow the facility of a watchman and a cook each of whom is paid a salary of Rs.12,500 p.m. The company paid in respect of bungalow Rs.5,000 p.a towards electricity bills and Rs.3,000 p.a. for water bills.
 - vii) He has been provided with 1.5 lts. Engine capacity car for official and personal use. The maintenance and running expenses of the car (including driver) are borne by the company.

- viii) The following amounts were deposited into his provident fund account
- I. Own contribution Rs.90,000.
 - II. Employer Contribution Rs.1,25,000.
 - III. Interest @ 12% p.a Rs.66,600.
- ix) Rent of house recovered from Mr.Satish Rs.21,600.

Compute his taxable income under the head salary for the assessment year 2023-24.

Assuming that the population of Jaipur is 26 Lakhs as per 2001 census and Mr.Satish:

- A) Does not opt to be taxed under Section 115BAC.
- B) Opts to be taxed under section 115BAC. (30)

- b) The following are the Balance Sheets of M/s.Ananya Garments Ltd. As at 31- March-2022 and 31-March-2023.

Balance Sheet of M/s Ananya Garments Ltd. as on 31-March-2022- and 31-March-2023.

Particulars	Note No	Amounts in Rupees	
		2022-23	2021-22
I Equity and Liabilities			
(1) Shareholders Funds			
(a) Share Capital	1	5,35,000	4,10,000
(b) Reserves and Surplus	2	4,97,500	3,35,000
(2) Non-Current Liabilities			
Long term Borrowings	3	3,75,000	5,00,000
(3) Current Liabilities			
Trade Creditors		85,000	1,17,500
Total		14,92,500	13,62,500
II. ASSETS			
(1) Non-Current Assets			
Property, Plant, and equipment			
Tangible Assets	4	6,72,500	6,45,000
(2) Current Assets			
a) Inventories		4,50,000	4,72,500
b) Trade Receivables		2,12,500	1,90,000
c) Cash and cash equivalent		1,57,500	55,000
Total		14,92,500	13,62,500

Note to Accounts

Particulars	Amounts in Rupees	
	2022-23	2021-22
1. Share Capital		
Issued Subscribed and paid up “53,500 equity shares of ‘10 each’	<u>5,35,000</u>	<u>4,10,000</u>
2. Reserves and Surplus		
Balance in Statement of Profit and Loss	<u>4,97,500</u>	<u>3,35,000</u>
3. Long term Borrowings		
10% Debentures	<u>3,75,000</u>	<u>5,00,000</u>
4. Tangible Assets		
a) Land	1,87,500	2,50,000
b) Equipments	6,50,000	5,00,000
Less: Accumulated Depreciation	(1,65,000)	(1,05,000)
	6,72,500	6,45,000

Additional Information:

- Interim dividend of Rs.1,50,000 were declared and paid during the year (ignore corporate dividend tax)
- Equipment costing Rs.1,25,000 with accumulated depreciation of Rs.75,000 was sold for Rs.40,000.
- Interest on 10% debentures paid during the year amounted to Rs.50,000.

Prepare a statement of cash flow for the year ended 31-Mar-2023 as per AS-3(Revised)(20)

SECTION - B

Write short notes on the following :

(5×10=50)

- Features and Characteristics of Mutual Fund. **(10)**
 - Difference between Primary Market and Secondary Markets. **(10)**
 - Tax Audit. **(10)**
 - Banking Sector Reforms in India. **(10)**
 - Factors Affecting Dividend Policy. **(10)**
- SG Ltd has just installed Machine X at a cost of Rs.4,80,000 having a useful life of 6 years with no residual value. The annual production is estimated at Rs.1,80,000 units which can be sold at Rs.13 per unit. Annual operating costs are estimated at Rs.4,40,000 (excluding depreciation) at this level. Fixed costs are estimated at Rs.8 per unit (excluding depreciation) for the same level of output. The company has just come across another machine Y having the same useful life and capable of giving same output. The annual operating cost is expected at Rs.3,40,000(excluding depreciation). There will be no change in fixed cost. The capital cost of the machine is Rs.5,40,000 with nil residual value. The company can sell the machine X at Rs.1,40,000 but the cost of dismantling and removal will amount to Rs.40,000. The operations with Machine X have not yet started and the company wants to sell Machine X and purchase Machine Y. SG Ltd.provides depreciation under the straight-line method. Assume corporate tax at 35%. The cost of capital may be assumed at 12%.
(A) Advise whether the company should opt for replacement.
(B) Will there be any change in your view if Machine X has not been installed but the company must select any one of the two machines.
(Present Value of Interest Factor of Annuity: PVIFA12%, 6=4.111) **(30)**

- b) A Company produces a single product which is sold in the domestic market at Rs.75 per unit. The present production and sale are 50,000 units per month, representing 50% of the available capacity. The cost of the product is composed of variable cost of Rs.50 per unit and fixed cost of Rs.10 Lakhs per month.

To improve the profitability, the management has three proposals as under:

- i) To accept an export supply order for 30,000 units per month at reduced price of Rs.60 per unit, incurring additional variable cost of Rs.6 per unit towards export packing and duties.
- ii) To increase the domestic market sales by selling to the domestic chain stores 30,000 units at Rs.55 per unit, retain the existing sales at the existing price.
- iii) To reduce the selling price for the domestic market sales as advised by the sales department as under :

Reduce Selling Price by (Rs)	Increase in Sales Expected in Units
6	20,000
9	40,000
10	45,000

Prepare a comparative statement of profitability to show the results of above proposal and give your comments and advise on these proposals. (20)

7. a) The operating details of M/s.GKs Ltd during the year ended 31-Mar-2016 are as given below:

Particulars	Cost per Unit (Rs.)
Raw materials	30
Direct Labour	5
Overheads	15
Depreciation	5
Total cost	55
Profit	5
Selling price	60

Past trends indicate that the raw materials are held in stock, on an average for 2 months, work in progress (50% complete as to conversion costs) will approximate to half month's production. Finished goods remain in warehouse for one month. Suppliers of materials extend one month's credit. Normally two month's credit is allowed to debtors. A minimum cash balance of Rs.75,000 is expected to be maintained. The production pattern is assumed to be even during the year. Cash sales are expected to be 75% less than credit sales. Labour and overhead expenses remain in arrears for one month. The safety margin is 15%. Assuming the operating level to be 3,00,000 units, **Prepare a statement of working capital determination. (30)**

- b) The Gamma Ltd. is considering the feasibility to buy from a nearby jobber a component in the necessary quantities at a unit price of Rs.7.50. Transportation and storage costs for the component would be negligible and therefore can be ignored. Gamma Ltd. produces the component from a single raw material. The firm at present orders materials in Economic Order Quantity of 1000 units at a unit price of Rs.2; Average annual usage is 20,000 units of

the component. The yearly storage cost (including rent, taxes, return on inventory investment, etc.) at present is computed at Rs.2.50 per unit. The minimum inventory is set at 200 units. Direct labour cost for the component is Rs.5 per unit. Fixed manufacturing overhead is absorbed at Rs.2 per unit based on a normal capacity of 20,000 units. In addition to the above costs, the machine on which the components are produced is leased at Rs.100 per month.

Should Gamma Ltd. Make or buy the component? Would you like to qualify your answer in any way? (20)

8. a) AB Ltd. provides you with the following figures:

Profit before interest and taxes	Rs.3,00,000
Less: Interest on Debentures @12%	Rs. 60,000
Earnings Before Tax	Rs.2,40,000
Corporate Tax @50%	Rs.1,20,000
Earnings After Tax	Rs.1,20,000
Number of equity shares(Rs.10 each)	Rs. 40,000
Earnings Per Share (EPS)	Rs. 3
Current Market Price	Rs. 30
PE ratio (P/E)	Rs. 10

The company has undistributed reserves of Rs.6,00,000. The company needs Rs.2,00,000 for expansion. This amount will earn at the same rate as funds already employed. You are informed that a debt ratio higher than 35% will push the P/E ratio down to 8 and raise interest rate on additional borrowings to 14%. You are required to ascertain the probable price of the share under the following situations:

- i. Additional funds are raised as debt; and
- ii. The amount is raised by issuing equity shares
- iii. 50% of the additional funds are raised as debt and 50% as equity. **(30)**

b) The standard cost of Material and Labour for the making of a unit of a certain product are estimated as under:

Material: 800 kg at Rs.41.50 per kg

Labour : 180 hours at Rs.31.25 per hours

On completion of the production of a unit, it was found that 750 kg of material costing Rs.43.75 per kg. has been consumed and that the time taken was 160 hours, the wage rate being Rs.32.50 per hour. **(10)**

c) Z Ltd. has 10 lakh equity shares outstanding at the beginning of the year 2006. The current market price of the share is Rs.150 each. The company recommended Rs.8 per share as dividend. The capitalization rate is 12%.

- i) Based on MM approach, calculate the market price of the share of the company when the recommended dividend is (A) declared, and (B) not declared.
- ii) How many new shares are to be issued by the company at the end of the accounting year on the assumption that the net income for the year is Rs.2 crores and the investment budget is Rs.4 crores when dividends are distributed? What will be the market value of shares at the end of accounting year? **(10)**

Total No. of Printed Pages-3]

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

Answer the following questions in about 150 words.

(5×10=50)

1.
 - a) Using IS-LM analysis, explain how equilibrium rate of interest and income are determined with the interaction of both product and money markets.
 - b) At the equilibrium level, Walrasian adjustment differ from Marshallian adjustment. Discuss.
 - c) What is crowding out phenomenon? Does government borrowing always crowd out the private investment? Illustrate.
 - d) Evaluate Kuznet's inverted U shaped curve hypothesis of income distribution.
 - e) The perfect price discrimination under Monopoly market causes redistribution of consumer surplus and producer surplus. Explain using suitable diagrams.

2.
 - a) Discuss the social choice theory in Economics. Distinguish between the views of Amartya Sen and Kenneth Arrow in making choices for social welfare. (20)
 - b) Explain one of the non- collusive models of oligopoly. Why does an oligopolist avoid price competition among rivals? (15)
 - c) What are the characteristics of monopolistic competition? Does a monopolistically competitive market lead to excess capacity? (15)

3.
 - a) Explain the effectiveness of fiscal and monetary policies using Mundell-Flemming Model. (20)
 - b) What are the causes of fluctuations in real exchange rate? Explain the economic impact when the real exchange rate is greater than one. (15)
 - c) Do you agree with the view that the infatuation with free trade under WTO is at an end. What are the contentions between developed and developing nations in this regard? Give reasons for your answer. (15)

4.
 - a) Explain Harrod -Domar growth model. How has Solow improved upon Harrod- Domar's growth model? (20)
 - b) What are the tools used by a central bank to control money supply in an economy? Discuss the effectiveness of such tools in a developing country. (15)
 - c) An economy is specified by the following data :
consumption function $C = 0.8 (1-t)Y$
investment function $I = 900 - 60 i$
tax rate $t = 0.25$, $G = 700$
money demand function, $L = 0.25Y - 62.5 i$
real money supply, $M/P = 500$
 - i) Calculate the equations for IS and LM functions.
 - ii) Find the equilibrium level of income (Y) and the interest rate (i). (15)

SECTION - B

Answer the following questions in about 150 words.

(5×10=50)

5. a) What policies would you suggest to combat negative externalities in production?
b) How is sustainable development linked to long run economic development of an economy? What are the main issues of sustainable development?
c) Define dominant strategy and Nash equilibrium. Show when a dominant strategy equilibrium exists, it is the unique Nash equilibrium.
d) Discuss the classical dichotomy that money is neutral.
e) What role commercial banks play in economic growth of a country?
6. a) i) Differentiate between Monopolistic Competition and Duopoly.
ii) Two firms are engaged in Duopoly competition in a market where price of commodity is given by, $P = 250 - 2Q$ and Marginal Costs are given as $MC_1 = MC_2 = 10$. Find equilibrium output, price and profit of both firms. (8+12)
b) What is high powered money? Why is it called so? Explain the derivation of it. (15)
c) Explain the Keynesian theory of determination of national income. How is it an improvement over classical theory? (15)
7. a) Why do some countries focus on producing agricultural products while others focus on technology? What happens when these countries trade? Are there more benefits for a country to produce all types of products, or is it better to focus on a few? (20)
b) Distinguish between balance of trade and balance of payments. How do depreciation and appreciation in the external value of a currency impact a country's Balance of Payments. (15)
c) Distinguish between monetary union and economic union. Do the proliferations in trading blocks virtually effect the free trade in the world. Give reasons for your answer. (15)
8. a) Explain with diagrams, the role of elasticity of demand and supply in determining the incidence of a per unit tax imposed on a commodity. (20)
b) Monetary contraction is a better option than devaluation to improve Balance of payments position of a developing economy under fixed exchange rate system. Discuss. (15)
c) Discuss the balanced and unbalanced growth strategies. Are the two strategies substitute or complementary to each other? Explain. (15)

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

Time Allowed - Three Hours

Maximum Marks-250

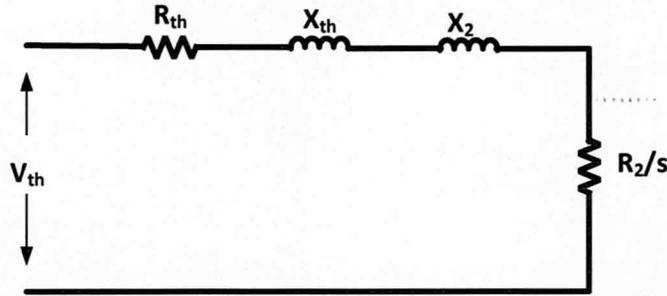
INSTRUCTIONS

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

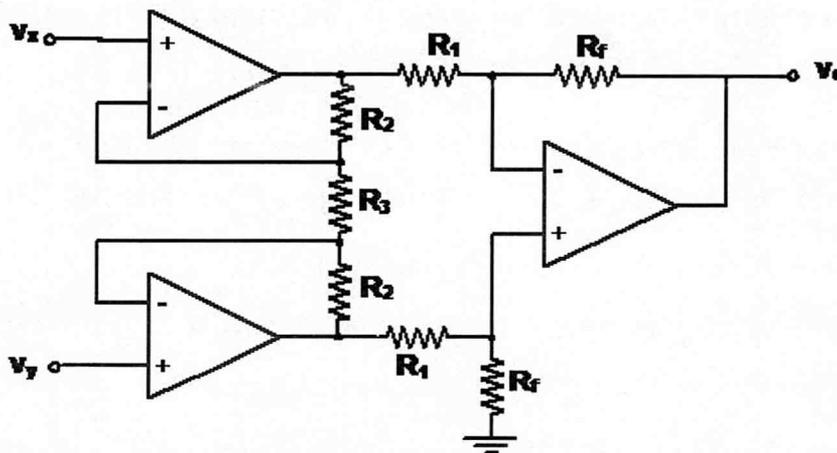
1. a) A 3-phase, Y-connected, 6-pole, 50 Hz induction motor has the following Thevenin equivalent circuit representation: $V_{th} = 250$ V, $R_{th} = R_2 = 1\Omega$, $X_{th} = X_2 = 2\Omega$. If the motor is in regenerative braking mode, calculate the speed for an active load of 120 Nm. (10)



- 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? ($\epsilon_0 = 8.854 \times 10^{-12}$ F/m). (10)
- d) Verify, for the differential amplifier shown in figure, (10)

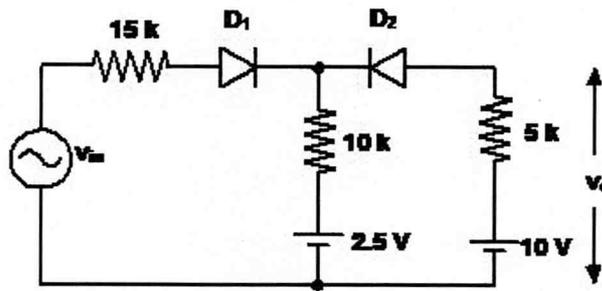
$$v_o = -\left(1 + \frac{2R_2}{R_3}\right) \frac{R_f}{R_1} (v_x - v_y)$$

Assume operational amplifier to be ideal.

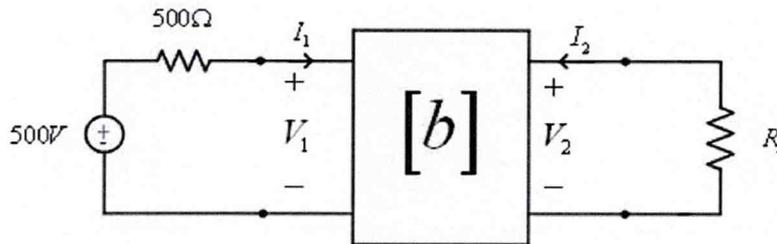


- e) Consider a discrete-time LTI system with impulse response $h[n] = \delta[n] + \delta[n+1]$. Determine the output $y[n]$ of the system for an input $x[n] = \delta[n] + 2\delta[n-1] + 3\delta[n-2]$. (10)

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)

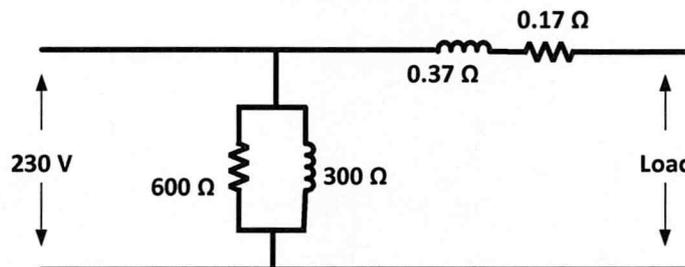


- b) The inverse transmission parameters of a two-port network are given as $b_{11} = -20$, $b_{12} = -3000 \Omega$, $b_{21} = -2 \text{ mS}$, $b_{22} = -0.2$ (20)
The network is terminated with a resistance $R_L = 5 \text{ k}\Omega$ as shown in the figure. Determine the voltage across R_L .



- 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)

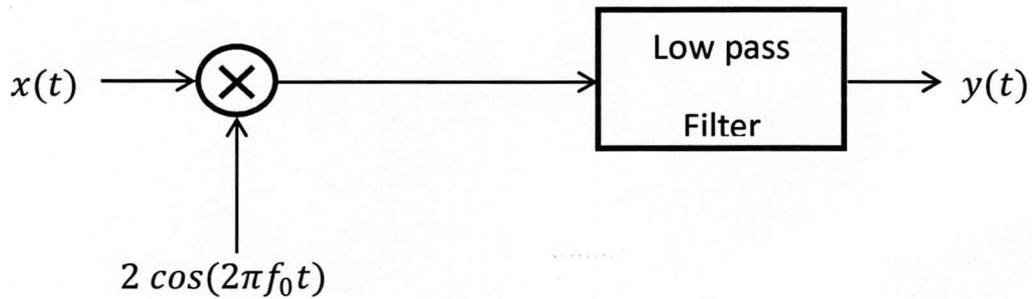
3. a) The equivalent circuit of a single phase 230/415 V, 50 Hz, 6 kVA transformer, connected to source from low voltage side, is illustrated in the figure below. The values shown in the equivalent circuit are referred to the low voltage side (230 V). A current of 10 A at 0.866 lagging pf is flowing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



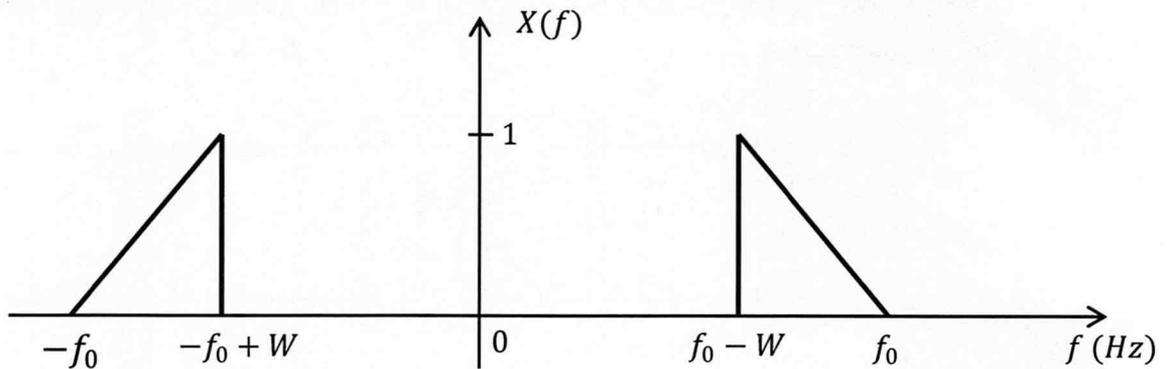
[Turn Over

b) Consider the system shown in figure:

(20)

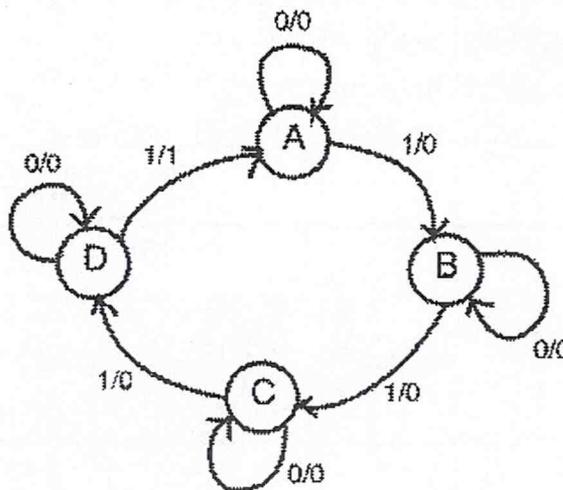


where the lowpass filter is an ideal filter with a cut-off frequency of W Hz. If the spectrum $X(f)$ of the input signal $x(t)$ is as shown in the figure below, determine and sketch the spectrum of the output signal $y(t)$.



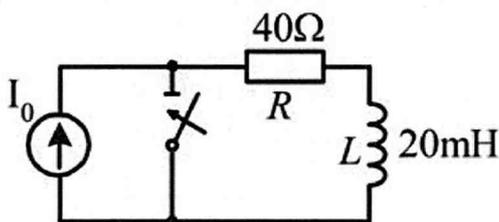
c) Consider a DSB-SC modulated signal with a carrier frequency of 1 MHz. If the bandwidth of the message signal is 5 kHz, what is the bandwidth of the modulated signal? (10)

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)



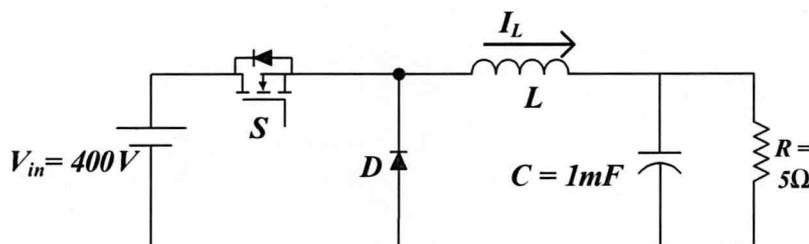
(4)

- 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)**

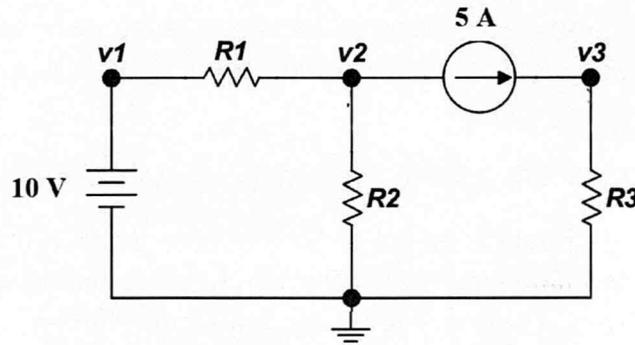


SECTION - B

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 $300 \mu\text{H}$ 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)**



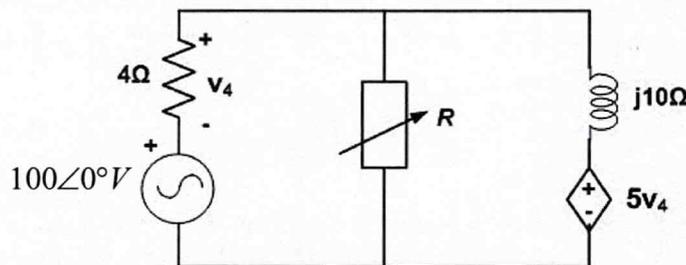
- c) Determine the node voltages v_1 , v_2 and v_3 using nodal analysis. $R_1=R_2=1\Omega$, $R_3=2\Omega$. (10)



- d) Design a combinational circuit for 4-bit addition with ripple through carry. (10)

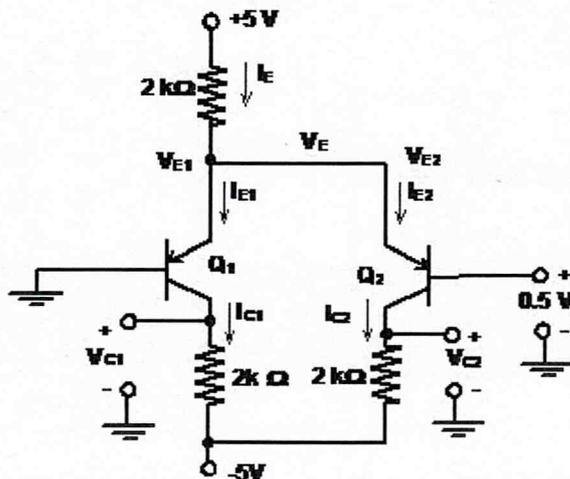
- e) Let X be a continuous random variable with mean zero and variance one. Find the mean and variance of the random variable $Y=1-2X$. (10)

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



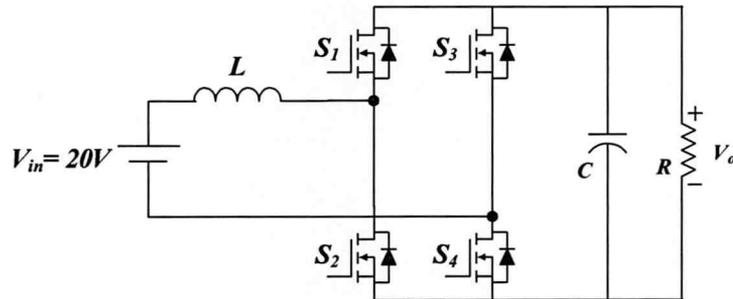
- b) A certain lossless transmission line of 40 m long operating at 2 MHz has $Z_0 = 40 \Omega$. The line is terminated with a load impedance $Z_L = 40 + j60 \Omega$. If the wave velocity is $u = 0.6c$, what is the input impedance of the line? ($c = 3 \times 10^8$ m/s). (20)

- 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)



(6)

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

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 7.2kW 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)
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]

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

Answer the following questions in about 150 words each:

(5×10=50)

1.
 - a) Discuss the views of Penck challenging Davis's concept of cycle of erosion.
 - b) Describe the role of man in global ecological imbalance.
 - c) Give an account of the major gene pool centres of the world.
 - d) Explain the factors responsible for the eustatic changes.
 - e) Explain the increasing cases of marine pollution and its mitigation strategies.

2.
 - a) With suitable diagrams discuss the formation of depositional landforms produced by glaciers. (20)
 - b) Give an account of the factors influencing world distribution of plants and animals. (15)
 - c) Explain the impact of ENSO Modoki on the global climate. (15)

3.
 - a) Describe the significance of the hill ranges of the Peninsular India. (20)
 - b) Explain the role of National Green Tribunal for the environmental awareness in India. (15)
 - c) Discuss the increasing cases of heatwaves in the world and its consequences. (15)

4.
 - a) With suitable diagrams describe the pressure belts and permanent wind systems of the earth. (20)
 - b) Explain the cases and consequences of increasing frequency of cyclones in the Bay of Bengal. (15)
 - c) Give an account of the evidences in support of the Continental Drift Theory. (15)

SECTION - B

Answer the following questions in about 150 words each:

(5×10=50)

5.
 - a) Discuss the Spheres of urban influence in the context of increasing million plus cities in India.
 - b) Explain the geo-political significance of buffer zones.
 - c) Explain 'population as social capital' in Indian context.
 - d) Describe the concept of nation and state in the context of Israel and Palestine war.
 - e) Briefly explain the behavioural approaches in Human Geography.

6. a) How system's approach is different from the regional approach? Explain. (20)
- b) Describe the challenges and ways for the sustainable development of cities in India. (15)
- c) Discuss the current trend of the world population growth and related socio economic problems. (15)
7. a) Critically examine the suitability of the Von Thunen's agricultural locations theory in the Indian conditions. (20)
- b) How Primate City concept is different from Rank-Size rule concept? Explain. (15)
- c) Briefly explain the Laws of international boundaries and frontiers in the context of growing enmity between countries. (15)
8. a) Describe the characteristics and distribution of major groups of mankind in the world. (20)
- b) Explain world food and nutrition problems with special references to the developing countries and suggest the remedies. (15)
- c) Discuss the types and patterns of the rural settlements with suitable examples. (15)
-

Total No. of Printed Pages-3]

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. 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) Draw and describe the layered structure of earth in terms of chemically distinct layers. (10)
b) Distinguish between glacial and mature stage river valleys. (10)
c) Discuss use of primary sedimentary structures in determining the top of the beds. (10)
d) What is isostasy? Briefly describe principal models of isostasy. (10)
e) Draw the electromagnetic spectrum and mark the regions used by optical sensors and microwave sensors in remote sensing? (10)
2. a) List and describe coastal geomorphic processes. Discuss both erosional and depositional landforms. (20)
b) Describe historical context of the theory of Continental drift and evidence supporting it. (15)
c) Describe texture which describe relationship between deformation and metamorphism. Illustrate the answer with sketches. (15)
3. a) Describe in detail the various types of interference patterns of folds, illustrating your answer with suitable sketches. (20)
b) Compare and evaluate the geological data available through modern satellite imagery in comparison to that obtained through aerial photographs? (15)
c) Which type of meteorites preserve the earliest evidence of the nature of solar system? Discuss with examples. (15)
4. a) Discuss the theories of accretion and differentiation of earth. What is Iron Catastrophy and what is generally considered as the source/s of heat for this event? (20)
b) Using topography and geology, how one can estimate dip direction from a geological map? Discuss and illustrate your answer by the use of Rule of V's. (15)
c) What is chemical weathering and how it is related to the carbon cycle. (15)

SECTION-B

Answer the following in about 150 words each:

(5×10=50)

5. a) Describe the genetic classification of sub-surface water. (10)
- b) Briefly describe the Cretaceous-Paleogene boundary in India. (10)
- c) Describe paleoclimatic fluctuations during the deposition of Gondwana sediments inferred through the fossils and sediments. (10)
- d) Discuss the western and eastern syntaxial bends in the context of evolution of Himalaya. (10)
- e) Describe basic features of rain-water harvesting in water-scarce regions. (10)
6. a) Define "Precambrian" and its division with approximate time periods. Discuss in brief the rock sequences representing this time period in India. (20)
- b) Describe significant fossils from marine Palaeozoic rocks of India. (15)
- c) Describe different types of porosity. Differentiate between porosity and permeability. What type of porosity controls groundwater in a granitic terrain? (15)
7. a) Define landslides and describe different types of landslides with illustrations. Differentiate between rotational and translational landslides. (20)
- b) Describe Hadean rock record on earth. (15)
- c) Discuss and describe the types of mineral-walled microfossils with examples, illustrations and age ranges. (15)
8. a) Describe mammal faunal assemblage from the Siwalik and equivalent rocks from India and adjacent regions. Discuss this in the context of evolution of vertebrates. (20)
- b) What do you understand by Indus-Tsangpo-Suture Zone (ITSZ)? What is its significance in understanding the evolution of Himalaya? Describe atleast two localities from where ITSZ has been reported. (15)
- c) Describe engineering properties of rocks relevant for use as construction material. (15)

Total No. of Printed Pages-4]

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

Mark the following places on the map with a short note not exceeding 30 words.

(20×2.5=50)

1.
 - i. Lothal
 - ii. Burzahom
 - iii. Rakhigarhi
 - iv. Langhnaj
 - v. Pattadakal
 - vi. Sankissa
 - vii. Halebidu
 - viii. Bhimbetka
 - ix. Sarnath
 - x. Ellora Caves
 - xi. Poompuhar
 - xii. Bidar
 - xiii. Devagiri
 - xiv. Jajnapur
 - xv. Sirpur
 - xvi. Patan
 - xvii. Muziris
 - xviii. Dasarna
 - xix. Rameshwaram
 - xx. Korkai

2.
 - a) Examine the intricate social, economic, and environmental factors that may have contributed to the sustainability of the Indus Valley Civilization for over 700 years. How did these factors interplay and eventually influence the civilization's continuity and ultimate decline? (20)
 - b) What are some key features that distinguish the Neolithic and Chalcolithic cultures in India, and how did the shift from stone tools to metal tools impact the daily lives of these communities? (15)
 - c) Explore the significance of the later Vedic texts, such as the Brahmanas and Upanishads, in the development of Indian philosophy, religious thought, and social structure. How did these texts pave the way for the evolution of classical Indian civilization, and what were their lasting influences? (15)

3. a) What were some of the main policies and edicts implemented by Emperor Ashoka during his rule, and how did these policies contribute to the promotion of moral and ethical values in ancient India? (20)
 - b) What are the fundamental teachings and beliefs of Buddhism and Jainism, and how did these two ancient Indian religious traditions influence the spiritual and ethical landscape of the Indian subcontinent? (15)
 - c) What economic policies and measures did Ashoka implement as part of his Dhamma to ensure the welfare and prosperity of his subjects, and how did these policies impact the economic stability of the Mauryan Empire? (15)
4. a) What are the distinctive characteristics and artistic contributions of major schools of art in ancient India, such as the Gandhara, Mathura, and Ajanta schools, and how did they reflect the cultural diversity and evolution of artistic expressions in the subcontinent? (20)
 - b) What were the primary functions and roles of guilds in ancient India, and how did they impact local trade, craftsmanship, and community welfare during that time? (15)
 - c) Explore the Gupta Empire's foreign relations and connections with other contemporary civilizations, such as the Roman Empire and Southeast Asian states. How did these interactions influence trade, culture, and the exchange of knowledge during the Gupta Age? (15)

SECTION - B

Write short notes in not more than 150 words in each of the following. (5×10=50)

5. a) Evaluate *Arthashastra* as a source of history.
 - b) What are the primary crops and domesticated animals that were central to the agricultural practices of the Indus Valley people, and how did these resources contribute to the sustenance of their society?
 - c) Who were the Sufi saints, and what was their primary focus in Islamic spirituality?
 - d) What role did Indian Ocean trade play in connecting different regions, and how did it influence the economies and societies of the participating cultures during late ancient history?
 - e) What were the major trade and economic developments in medieval India?
6. a) What were some notable scientific and technological advancements and contributions made by ancient Indian scholars, and how did these innovations influence both Indian society and global knowledge? (20)
 - b) How did the Bhakti movement challenge the established religious and social norms of its time in India, and what were the broader cultural and political implications of this religious reform movement? (15)
 - c) How did the construction techniques and purposes of rock-cut caves, such as the Karla Caves and Badami Cave Temples, differ across various regions in India, and what do these differences reveal about the cultural and religious diversity of ancient India? (15)

7. a) What were the key socio-political challenges faced by the Khilji dynasty during their rule, and how did they manage to navigate these challenges while shaping the medieval history of India, particularly in the context of their administration, military expansion, and economic policies? (20)
- b) What were the key factors that contributed to the downfall of the Lodhi dynasty and the rise of the Mughal Empire in India, and how did this transition impact the subsequent history of the Indian subcontinent? (15)
- c) What were some of the main reasons that foreign travelers like Marco Polo and Hiuen Tsang visited India, and what were the key observations they made about the country during their Journeys? (15)
8. a) How did the development of port cities like Calicut, Masulipatnam, and Surat contribute to the growth of Indian maritime trade during the late medieval period, and what were the key commodities and trade routes that characterized this era of Indian maritime commerce? (20)
- b) How did Shivaji's approach to local governance, including the establishment of forts and the concept of self-sufficient villages, contribute to the stability and prosperity of the Maratha state during his rule? (15)
- c) What were the architectural and artistic achievements during the reign of the Tughlaq dynasty in the Delhi Sultanate, and how did their architectural endeavors, like Tughlaqabad and Firoz Shah Kotla, contribute to the cultural and urban development of the region? (15)
-

Total No. of Printed Pages-3]

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

किन्हीं तीन विषय पर आलोचनात्मक टिप्पणी लिखिए।

(20+15+15)

1. क) पूर्वी हिंदी और पश्चिमी हिंदी में अंतर
ख) देव नगरी लिपि की वैज्ञानिकता
ग) प्रयोजन मूलक भाषा
घ) त्रिभाषा सूत्र
च) यूनिकोड और हिंदी

2. क) काव्यभाषा के रूप में ब्रज भाषा की विशेषताएं बताइए। (20)
ख) हिंदी की प्रमुख बोलियों और उनके परस्पर संबंध पर प्रकाश डालिए। (15)
ग) विज्ञान एवं तकनीकी के क्षेत्र में हिन्दी की स्थिति स्पष्ट कीजिए। (15)

3. क) "हिन्दी नई चाल में ढली" इस कथन के आधार पर भारतेंदु की भाषा शैली पर प्रकाश डालिये। (20)
ख) आरम्भिक हिंदी के विकास में अवहट्ट का योगदान बताइए। (15)
ग) राज भाषा और राष्ट्र भाषा में अंतर स्पष्ट कीजिए। (15)

4. क) हिन्दी सूफी काव्य में निहित सांस्कृतिक समन्वय पर प्रकाश डालिए। (20)
ख) काव्यभाषा के रूप में अवधी भाषा की विशेषताएं बताइए। (15)
ग) दक्खिनी हिन्दी की विशेषताएं बताइए। (15)

खंड-2

किन्हीं तीन विषय पर आलोचनात्मक टिप्पणी लिखिए।

(20+15+15)

5. क) छायावादी काव्य में प्रेम
ख) जायसी अवधी के अरघान हैं।
ग) वर्तमान सन्दर्भ में कबीर की प्रासंगिकता
घ) तुलसी के राम
च) बिहारी की श्रृंगारिकता

6. क) हजारी प्रसाद द्विवेदी की आलोचना दृष्टि पर प्रकाश डालिए। (20)
ख) हिंदी के ललित निबंधों के सांस्कृतिक पक्ष पर प्रकाश डालिए। (15)
ग) समकालीन हिंदी रंग मंच पर प्रकाश डालिए। (15)

7. क) वस्तु और संवेदना की दृष्टि से समकालीन कहानी के वैशिष्ट्य की विवेचना कीजिए। (20)
ख) हिंदी साहित्य के इतिहास लेखन में नामकरण की समस्या पर प्रकाश डालिए। (15)
ग) आत्मकथा और डायरी लेखन के स्वरूप को रेखांकित करते हुए दोनों के अंतर को स्पष्ट कीजिए। (15)
8. क) जयशंकर प्रसाद के नाटकों में व्यक्त राष्ट्रीय एवं सांस्कृतिक चेतना पर प्रकाश डालिए। (20)
ख) 'छायावादी काव्य में व्यक्त राष्ट्रीय चेतना'—पर संक्षिप्त निबंध लिखिए। (15)
ग) प्रगतिवाद की विशेषताओं का उल्लेख कीजिए। (15)
-

CC(M)

KASHMIRI - I

[30]

Time Allowed : 3 Hours

Maximum Marks : 250

(Answer must be written in Kashmiri)

جواب دینے بڑوٹھہ پڑوسوالن متعلق خاص ہدایات۔

- ۱۔ تہہ پرچس چھ اٹھ سوال یم دون حصن (سیکشن) پٹھ مشتمل چھ۔
- ۲۔ توہہ چھ گل پائٹون سوالن ہندی جواب دنی۔
- ۳۔ سوال نمبر 1 (اکھ) تہ سوال نمبر 5 (پائٹوک) جواب دین چھ لازمی۔
- ۴۔ دو یوسیکشنونمز چھ باقی تڑبن سوالن ہندی جواب دنی۔ مگر پڑتھ سیکشن کینو سوالونمز چھ کم کھوتہ کم اکھ سوالنک جواب دین ضروری۔ پڑتھ سوالس تہ سوالکس حصن بڑوٹھہ کنہ چھ نمبر (Marks) درج کرنہ آمت۔
- ۵۔ سوالن ہندی جواب دینہ باپتھ چھ لفظن ہند تعداد مقرر کرنہ آمت۔ ایچ پابندی کرنی چھ لازمی۔
- ۶۔ سوالن ہندی جواب دینہ تڑتیب واراہمیت دینہ۔
- ۷۔ اگر کنہ سوالنک یا تمکھ کنہ حصک لیکھنہ آمت جواب توہہ مجراہ چھنہ پڑھان تھاؤن، تہہ گڑھ کڑاس دین۔ نتیہ پیہ سہ جواب تصور کرنہ۔ یو دوسہ جواب اڈلیونکے تہ آسہ۔
- ۸۔ کانہہ صفحہ یا صفحک حصہ اگر خالی روز تہہ گڑھ کڑاس دین۔

Turn Over

(1)

SECTION - A

1. یمن پڑھ لیکھو نوٹ۔ (پڑتھ سوالک جواب 100 لفظن منز)
- (50)
- (10) (الف) ناو تکی قسم
- (10) (ب) کز او تکی قسم
- (10) (ج) صوتیم تہ امکو قسم
- (10) (د) کاشر جملہ
- (10) (ه) کاشری مصوتہ
2. یمن سوالن لیکھو جواب۔
- (50)
- (20) (الف) کاشر زبانی ہند مؤلہ آگر کیا چھ؟
- (20) (ب) کاشر زبان چھ ہند آریائی زبان؟
- (10) (ج) کاشر زبان کتہ کتہ چھ بولنہ یوان؟
3. یمن سوالن ہندی جواب لیکھو۔
- (50)
- (20) (الف) مصوتس تہ مصمتس در میان فرق کرو واضح۔
(200 لفظن منز)
- (20) (ب) کاشرس منز کتہ کیفیہ چھ کز او تس؟
- (10) (ج) کز او تی ترتیب کتہ چھ ونان؟

4. یمن سوالن ہندو جواب لیکھو۔ (50)
- (الف) سوالہ جملس تہ سار جملس درمیان کیاہ فرق چھے؟ (20)
(200 لفظن منتر)
- (ب) پور و ناوے تہ جملہ ملو ن کتھ چھ و نان؟ (20)
(200 لفظن منتر)
- (ج) کاشرس منر کو قسم چھ جملن؟ (10)
(100 لفظن منتر)

SECTION - B

5. یمن پٹھ لیکھو نوٹ۔ (پڑتھ نوٹس گوھن 100 لفظ آسنر) (50)
- (الف) ل دید تہ شومت (10)
- (ب) شیچہ شکر کر (10)
- (ج) کاشر ڈزاما (10)
- (د) کاشر نظم (10)
- (ه) کاشر افسانہ (10)

6. یمن سوالن ہندو جواب لیکھو۔ (50)
- (الف) لہہ واکن ہندو فنی محاسن گر و بیان۔ (20)
(200 لفظن منتر)
- (ب) شیچہ شکر کن ہند لہجہ کتھ چھ؟ (20)
(200 لفظن منتر)
- (ج) ”واکھ“ کیاہ گو و؟ (100 لفظن منتر) (10)

7. یمن سوالن ہنڈ جواب لکھو۔ (50)

(الف) کاشر ورثو اہم موضوع کیا ہے؟ (20)

(200 لفظن منر)

(ب) ”گلریز“ مثنوی ہنڈ امتیاز کیا ہے؟ (200 لفظن منر) (20)

(ج) محمؤ دگامی چھا کاشر غزلک بانی کار کنہ نہ؟ (100 لفظن منر) (10)

8. یمن سوالن ہنڈ جواب لکھو۔ (50)

(الف) مہور نہ شاعری منر کاشر سماج۔ (200 لفظن منر) (20)

(ب) کاشر ڈرامہک ابتدائے ارتقا۔ (200 لفظن منر) (20)

(ج) کاشر س منر نظم نگاری۔ (100 لفظن منر) (10)

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]

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) Explain the concept of Innovation Management. (10)
b) What is the Semantic Barrier in communication? (10)
c) Suggest ways to make performance appraisal effective. (10)
d) Discuss common leadership styles. (10)
e) What is meant by managerial ethics? (10)
2. a) Define and differentiate between centralisation and decentralisation of authority. Critically evaluate the advantages and disadvantages of the two systems in organisational context. (20)
b) What is process Orientation in organisation context? How is process Orientation related to Customer orientation. (15)
c) What is Flexible Systems Management? What are its advantages? (15)
3. a) What are the main determinants of organizational culture? (20)
b) Discuss individual personality traits that are important in the recruitment process. (15)
c) What is a learning organisation? What are its characteristics? (15)
4. a) Discuss different methods of promotion of a product in consumer market. (20)
b) Describe various types of fringe benefits. (15)
c) Briefly explain different sources of external recruitment. (15)

SECTION - B

Describe the following in about 150 words each.

(5×10=50)

5. a) What are the limitations of financial statements? (10)
b) Explain the various types of media available for advertising. (10)
c) What is Economic Order Quantity? (10)
d) Distinguish between a share and a debenture. (10)
e) Discuss the uses of Marketing Research. (10)
6. a) For a company, sales are Rs.80,000, variable costs are Rs.4,000, and fixed costs are Rs.4,000. Calculate the following:
i) PVR,
ii) BEP (Sales),
iii) Margin of Safety, and
iv) Profit. (5+5+5+5=20)
b) Distinguish between relevant and irrelevant costs in managerial decision making with the help of examples. (15)
c) Discuss types of inventory control. (15)

7. a) Explain the functions of Securities and Exchange Board of India (SEBI). (20)
b) Discuss the determinants of the capital structure of a company. (15)
c) What is working capital? What are its components? (15)
8. a) What do you understand by market segmentation? Discuss criteria for successful market segmentation. (20)
b) Explain the factors that influence consumer buying behaviour. (15)
c) What is meant by internet marketing? Discuss its benefits and challenges. (15)
-

Total No. of Printed Pages-4]

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) Find the characteristic polynomial and minimal polynomial of the symmetric

matrix $A: \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$: Hence or otherwise prove that A is similar to a diagonal matrix. (10)

- b) Find an integrating factor of $(y^2 + 2x^2y)dx - (xy - 2x^3)dy = 0$ and hence solve it. (10)

- c) Find the volume enclosed by the surfaces $x^2 + y^2 = z, x^2 + y^2 = 2x, z = 0$. (10)

- d) If $f''(t) > 0, \forall t \in \mathbb{R}$, show that $f\left[\frac{1}{2}(x+y)\right] \leq \frac{1}{2}[f(x) + f(y)], \forall x, y \in \mathbb{R}$. (10)

- e) Show that the equation $x^2 + 2yz - 1 = 0$ represents a quadric of revolution. Also find the axis of revolution. (10)

2. a) Prove that the shortest distance from the origin to the hyperbola: $x^2 + 8xy + 7y^2 = 225, z = 0$ is 5 units. (20)

- b) Let $T: P_2(\mathbb{R}) \rightarrow P_3(\mathbb{R})$ be the linear transformation defined by

$$T(f(x)) = 2f'(x) + 3 \int_0^x f(t) dt.$$

Verify the rank-nullity theorem for T , and prove that T is one-to-one, but not onto. ($P_n(\mathbb{R})$ is the vector space of all polynomials with real coefficients having degree $\leq n$). (15)

- c) Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = x^{-2}e^{-x}$ by the method of variation of parameters. (15)

3. a) Discuss the convergence of the following improper integrals: (20)

i) $\int_0^{\pi/2} \frac{\sin^p x}{x^q} dx$

(ii) $\int_0^\infty \left(\frac{1}{1+x} - \frac{1}{e^x} \right) \frac{dx}{x}$.

- b) Let A be a unitary matrix such that $\lambda = -1$ is *not* an eigenvalue of A , then show that

$$A = (I + iH)^{-1}(I - iH), \text{ for some Hermitian matrix } H. \quad (15)$$

- c) Find the equations of the line drawn parallel to $\frac{x}{4} = \frac{y}{1} = \frac{z}{1}$ so as to meet the lines

$$z = 5x - 6 = 4y + 3$$

$$z = 2x - 4 = 3y + 5.$$

4. a) Investigate for what values of λ, μ the simultaneous non-homogeneous linear equations

$$x + 2y + z = 8$$

$$2x + y + 3z = 13$$

$$3x + 4y + \lambda z = \mu$$

have (i) no solution (ii) a unique solution (iii) infinitely many solutions. (20)

- b) Show that all the spheres that can be drawn through the origin and each set of points

where planes parallel to the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 0$ cut the coordinate axes, form a

system of spheres which are cut orthogonally by the sphere $x^2 + y^2 + z^2 + 2bx - 2ay = 0$ (15)

- c) Evaluate

$$\int_0^1 \int_0^{\sqrt{x-x^2}} \frac{xy(x^2 + y^2)}{\sqrt{x^2 - (x^2 + y^2)^2}} dx dy. \quad (15)$$

SECTION - B

5. a) Determine the orthogonal trajectories of the family of curves $y^2 - 2cx = c^2$.

Is this family of curves self-orthogonal? Justify. (10)

- b) If a particle moving along a space curve has velocity \vec{v} and acceleration \vec{f} , show

that the radius of curvature ρ is given by $\frac{|\vec{v}|^3}{|\vec{v} \times \vec{f}|}$ (10)

- c) Solve $\left(4y \frac{d^2 y}{dx^2} - \left(\frac{dy}{dx}\right)^2\right) \left(\frac{dy}{dx}\right)^2 = 3$ (10)
- d) Show that the locus of the point of intersection of three mutually perpendicular tangent planes to a central conicoid $ax^2 + by^2 + cz^2 = 1$ is a sphere centre at origin, the same as that of the given conicoid. What this sphere is called? (10)
- e) A particle moves in a straight line towards a centre of force varying inversely as the cube of the distance from the centre, starting from rest at a distance a from the centre of the force. Find its velocity and the time of reaching a point distant b from the centre of force. (10)
6. a) Let V and W be finite - dimensional vector spaces (over the same field). Prove that V is isomorphic to W if and only if $\dim(V) = \dim(W)$. (20)
- b) Find the locus of a line which meets the lines $y = mx, z = \pm c$ and the circle $x^2 + y^2 = 1, z = 0$. (15)
- c) Use Laplace transforms to solve $\frac{d^2 y}{dt^2} + 4\frac{dy}{dt} + 4y = t^3 e^{-2t}, y(0) = 0, y'(0) = 0$. (15)
7. a) Show that the plane $z = 0$ cuts the enveloping cone of the sphere $x^2 + y^2 + z^2 = 11$ which has its vertex at $(2, 4, 1)$, in a rectangular hyperbola. (20)
- b) Solve $x^2 \frac{d^2 y}{dx^2} + 3x \frac{dy}{dx} + y = \frac{1}{(1-x)^2}, x > 1$. (15)
- c) A uniform beam of length $2a$ rests with its ends on two smooth planes which intersect in a horizontal line. If the inclinations of the planes to the horizontal are α and β ($\beta > \alpha$). Show that the inclination of the beam to the horizontal in one of the equilibrium positions is $\tan^{-1}((\cot \alpha - \cot \beta) / 2)$, and the beam is unstable in this position. (15)
8. a) A particle, inside and at the lowest point of a fixed smooth hollow sphere of radius a , is projected horizontally with velocity $\sqrt{7ga/2}$. Show that it will leave the sphere at a height $3a/2$ above the lowest point and that its subsequent path meets the sphere again at the point of projection. (20)
- b) Solve $x(x \cos x - 2 \sin x) \frac{d^2 y}{dx^2} + (x^2 + 2) \sin x \frac{dy}{dx} - 2(x \sin x + \cos x)y = 0$. (15)
- c) If $\vec{F} = (x^2 + y - 4)\hat{i} + 3xy\hat{j} + (2xz + z^2)\hat{k}$, evaluate $\iint_S (\vec{\nabla} \times \vec{F}) \cdot \hat{n} dS$, where S is the surface of the sphere $x^2 + y^2 + z^2 = 16$ above the xy plane. (15)

CC(M)

MECHANICAL ENGINEERING

(OPTIONAL)

PAPER - I

(39)

Time Allowed - Three Hours

Maximum Marks-250

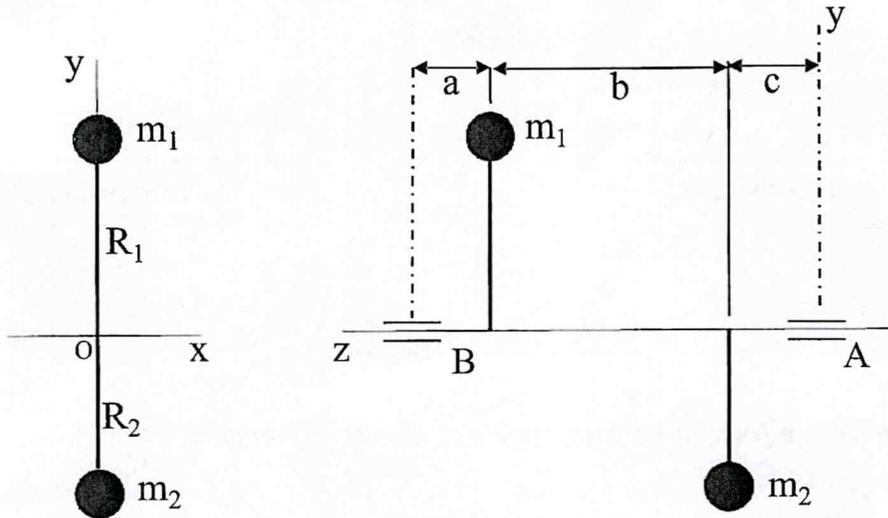
INSTRUCTIONS

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

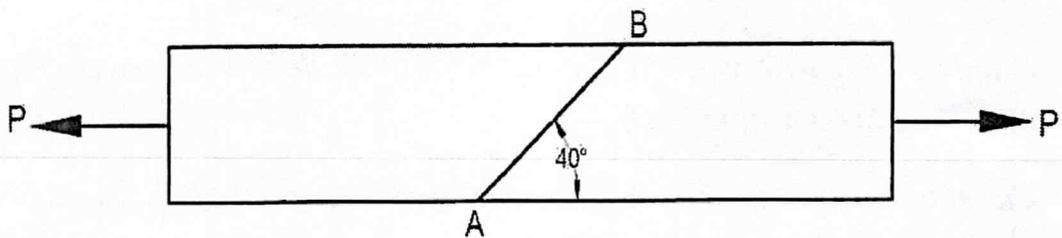
- i) *There are **Eight** questions divided in **Two** Sections and printed in English. Candidate has to attempt **Five** questions in all. Questions **No.1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section. The 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)

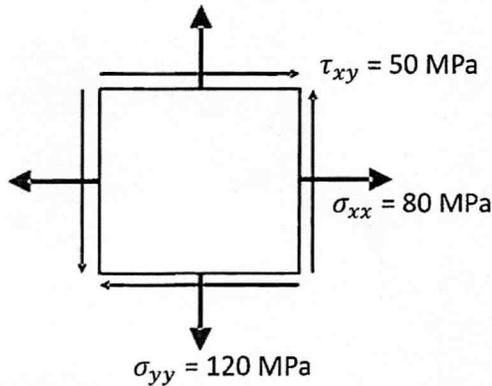


- b) Two wooden joists 50 mm x 100 mm are glued together along the joint AB as shown in figure below. Determine the values of normal stress and shearing stress in the glue if $P=200$ kN. (10)



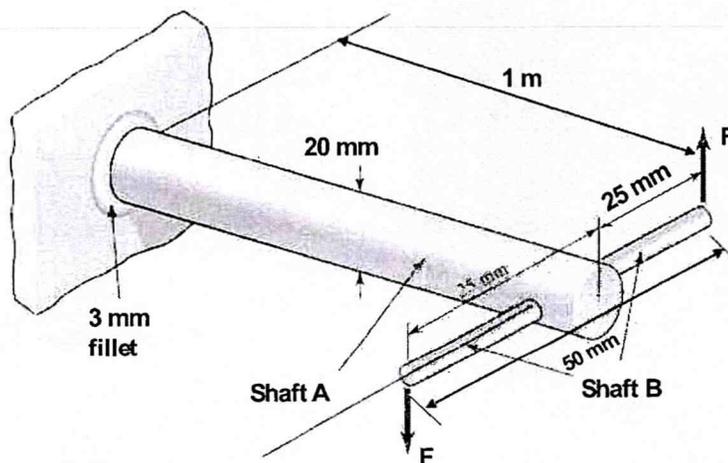
- c) The design loads of a member made of a brittle material produce the following non-zero stress components at the critical section in the member: The ultimate strength and Poisson's ratio of the material is 460 MPa and 0.2, respectively. Determine the factor of safety used in the design. (10)

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

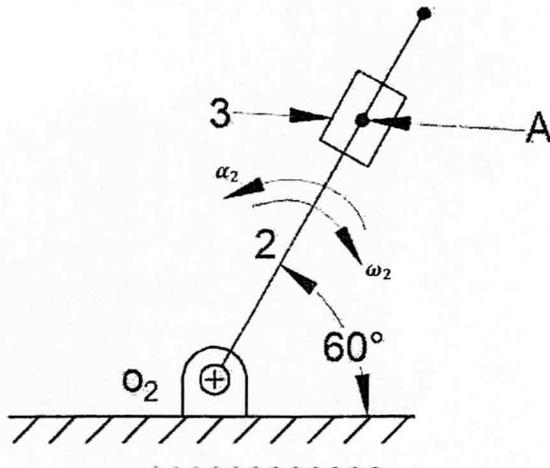


- e) A glass/epoxy specimen weighing 0.98 gm was burnt and the weight of the remaining fibers was found to be 0.49 gm. Densities of glass and epoxy are 2.4 gm/ml and 1.20 gm/ml, respectively. Determine the density of composite in the absence of voids. If the actual density of the composite was measured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

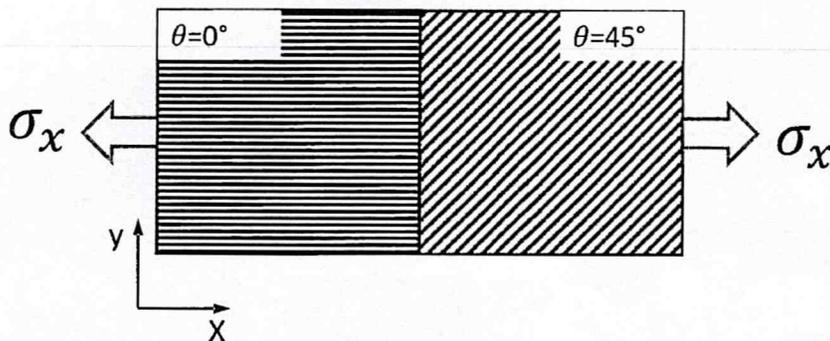


- b) The figure shows a point A on link 3 which is moving on link 2, at the same time link 2 is also rotating. Determine the acceleration of the point on link 3 which is coincident with a point on link 2. (Take, $v_{A/B}$, velocity of point with respect to is outwards (i.e. away from the centre of rotation),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

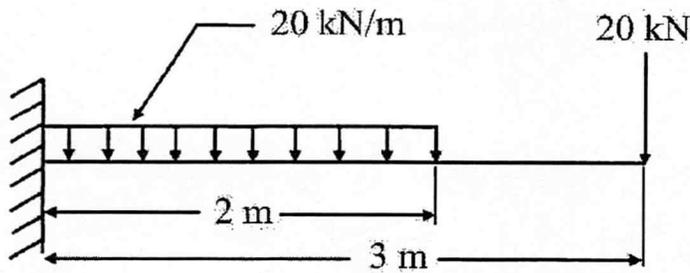


- c) Two laminae are joined as shown in the figure. Both are unidirectional lamina-fibres of one inclined at 0° and the other at 45° to the loading axis. Calculate the lateral deformation in both the laminae as a function of σ_x . Assuming that both the sections contain same fiber and fiber volume fraction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

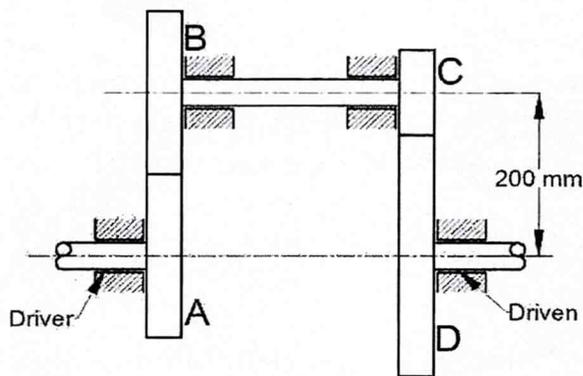
PROPERTY	VALUE
Longitudinal young's modulus (E_1)	145 GPa
Transverse young's modulus (E_2)	10.45 GPa
Shear modulus (G_{12})	6.9 GPa
Major poisons ratio ν_{12}	0.28



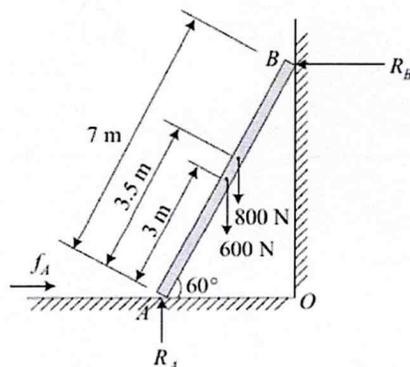
3. a) Determine the displacement of free end of cantilever beam as shown in Figure below. Take $E=2 \times 10^5 \text{ N/mm}^2$, $I=180 \times 10^6 \text{ mm}^4$. (20)



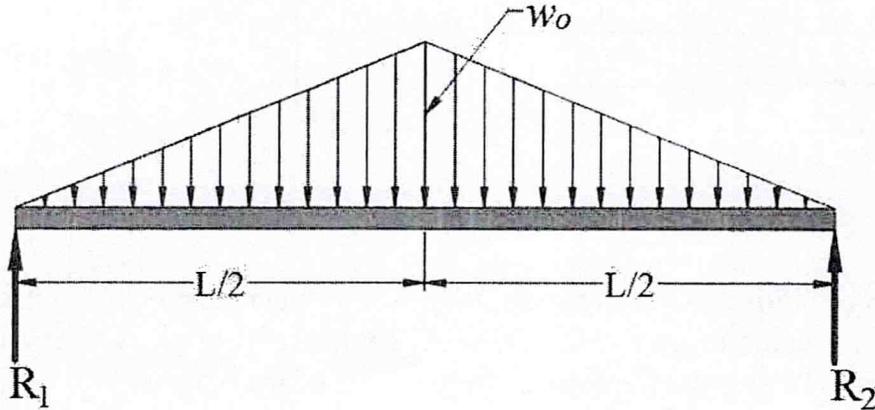
- b) The speed ratio of the reverted gear train, as shown in Figure below, is to be maintained 12. The module of gears A and B is 3.125 mm, and of gears C and D is 2.5 mm. Calculate the suitable numbers of teeth for the gears. No gear is to have less than 24 teeth. (15)



- c) A uniform ladder of weight 800 N and length 7 m 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 4 m 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)



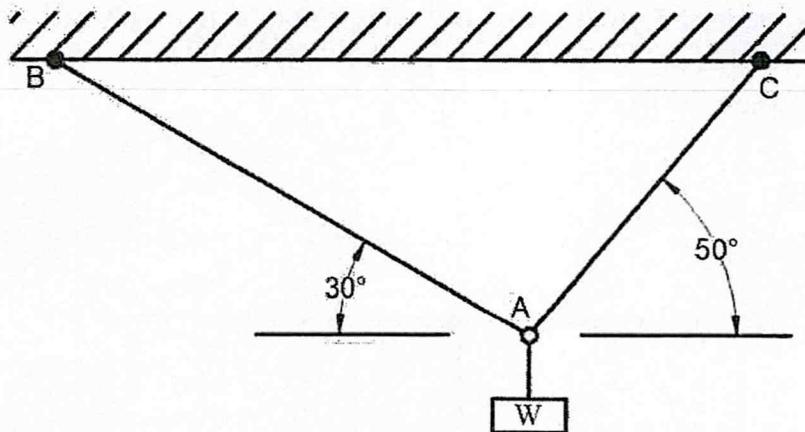
4. a) A beam carries a triangular loading as shown in figure below. Consider 'x' to be distance measured from the left end of the beam. Write the shear force and bending moment equations. Draw the shear force and bending moment diagrams, specifying the values at all change of loading position and point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

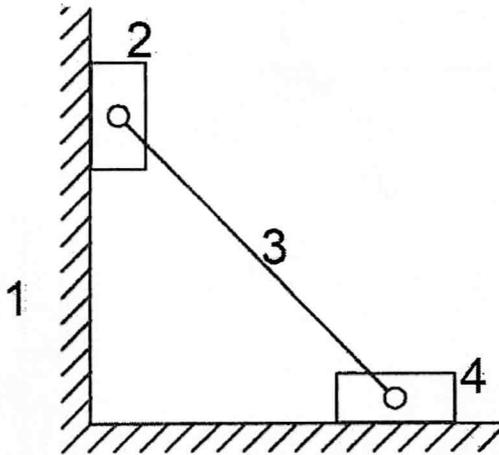
$$\delta = \frac{pl}{AE} + \frac{wl^2}{2AE}$$

- 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)

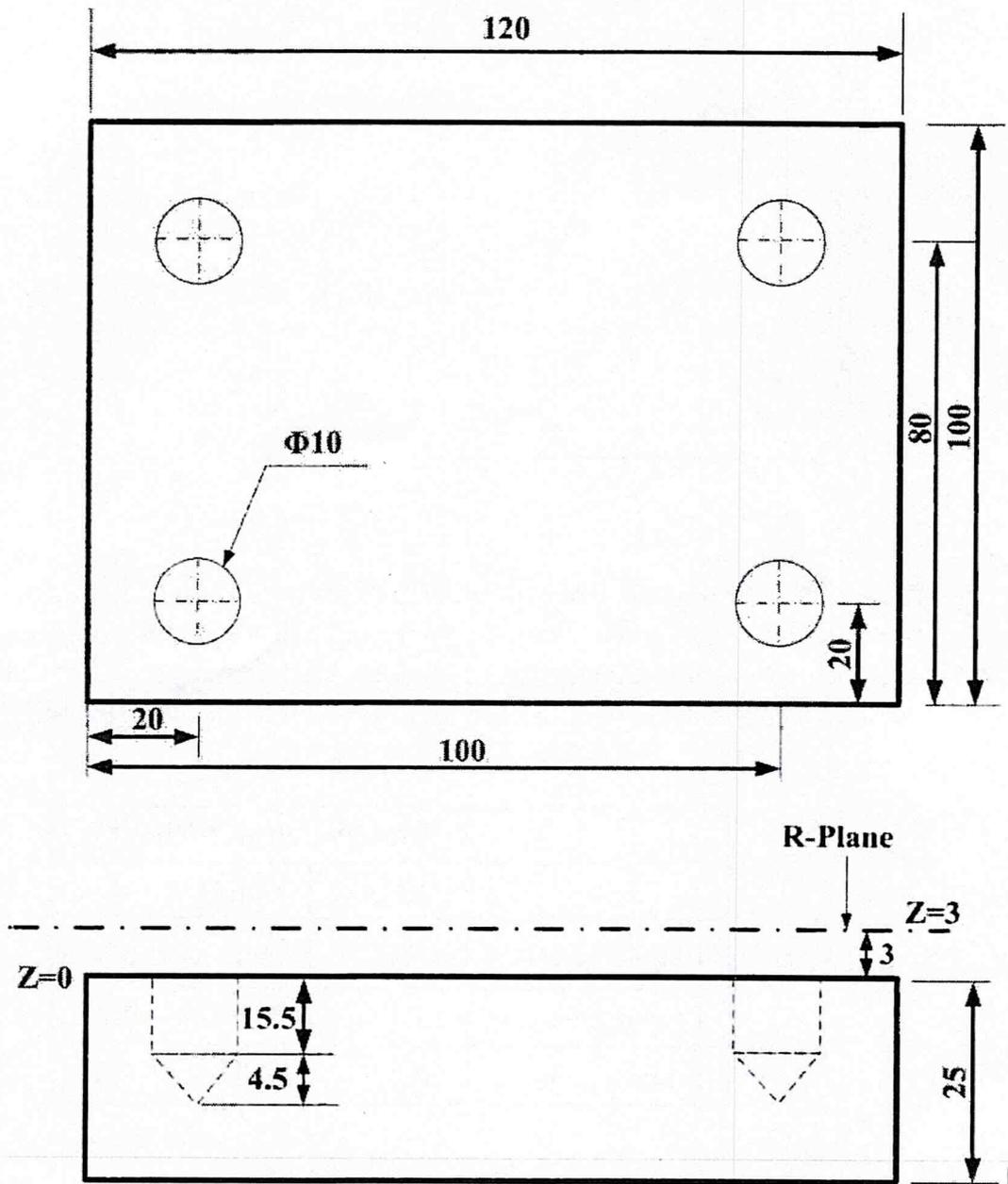


- b) On a particular day, the manager of a small print shop finds that three jobs must be handled on a “rush” basis. There are three employees available to work on these jobs, and each will handle exactly one of the jobs. Each employee has a slightly different estimated completion time for each job,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

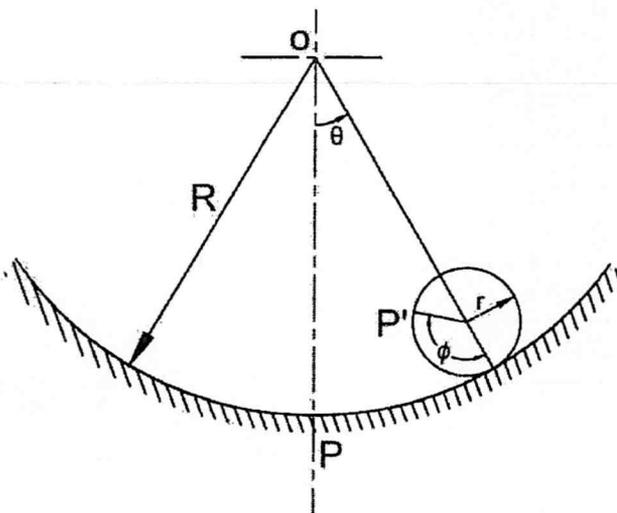
Formulate this as Linear Programming Problem (do not solve) to determine how to assign the employees to jobs so that the total completion time of all the three jobs is minimum.

- 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 " 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)**
- Shear stress along the shear plane
 - Chip velocity
 - 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-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 aphasia. **(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)
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 Īs'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 \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.

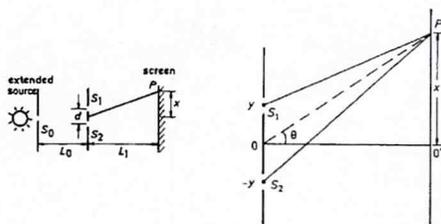


Figure 1:

- (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)

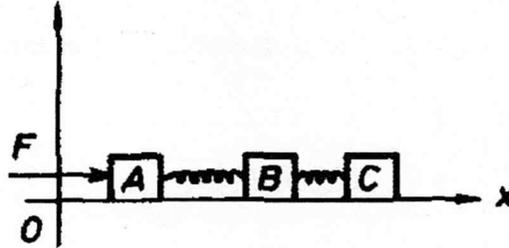
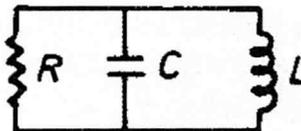


Figure 2:

- (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) $v = v_0 \sqrt{\frac{1+\beta}{1-\beta}}$ When the source and observer are approaching. (10)
- ii) $v = v_0 \sqrt{\frac{1-\beta}{1+\beta}}$ When the source and observer are receding. (10)
- iii) $v = v_0 \frac{1}{\sqrt{1-\beta^2}}$ 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)

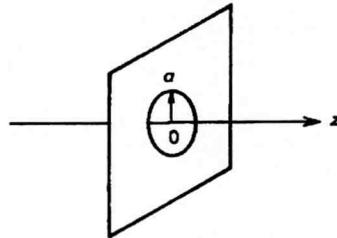


Figure 3:

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	=	$6.673 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

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 questions in about 150 words each:

(5×10=50)

1. a) 'Each political theory is advanced in response to some specific situation'. Comment. (10)
b) Write a note on 'Post-Colonial Theory of State'. (10)
c) 'Human rights are Universal and Inalienable; Indivisible; Interdependent and Interrelated'. Elucidate. (10)
d) 'Justice is a dynamic idea'. Discuss. (10)
e) Examine the relevance of Machiavelli's conception on religion and politics. (10)
2. a) 'A functioning, robust democracy requires a healthy educated, participatory follower-ship and an educated, morally grounded leadership'. Comment. (20)
b) Explain the Gandhian Idea of 'greatest good of all' and strategies for its realization. (15)
c) 'Authority and legitimacy are complimentary to each other'. Discuss. (15)
3. a) In the words of J.S.Mill, 'A person may cause evil to others not only by his actions but by his inaction, and in either case, he is justly accountable to them for the injury'. Discuss. (20)
b) Analyze the contribution and influence of the thoughts of Sir Syed Ahmed Khan on Indian society. (15)
c) Elucidate the distinctiveness and central aspects of Radical Humanism of M.N.Roy? (15)
4. a) 'Aristotle's theory of revolution offers valuable insights into the causes and consequences of political upheaval'. Comment. (20)
b) Critically examine the tenets of Eco feminism? (15)
c) Discuss the changing contours of Affirmative Action in India? (15)

SECTION-B

Answer the following questions in about 150 words each:

(5×10=50)

5. a) Examine the rise and effects of peasants' and workers' movements on Indian National Movement. (10)
b) Relevance of Satyagraha as a means of conflict resolution. (10)
c) Discuss the debate centered around 'One Nation-One Election'? (10)
d) 'In India caste needs politics as much as politics need caste'. Comment. (10)
e) Enumerate the basic challenges involved in the implementation of 106th Constitution Amendment Act. (10)

6. a) 'The Indian National Movement played a pivotal role in transforming mosaic of identities into a cohesive force'. Critically examine the major perspectives on Indian National Movement? (20)
- b) Trace the various stages in the making of the Indian Constitution, identifying the diverse institutions associated with the process? (15)
- c) 'The emergence of regional parties is largely based on vested interests than the ideology'. Comment. (15)
7. a) 'The basic structure doctrine is implicit in Indian Constitution; the supreme court has only given an explicit form'. Discuss. (20)
- b) Examine the functioning of National Commission for Backward Classes(NCBC) in the light of its constitutional status? (15)
- c) 'The rise and continuance of Bharatiya Janata Party (BJP) represents another phase of one-party dominant system in Indian politics which is different from the one led by congress prior to the era of coalition politics. Discuss. (15)
8. a) Discuss the role of Panchayat Extension in Schedule Areas (PESA) Act in ensuring self-governance in tribal areas? (20)
- b) Identify the major contested areas in Centre-State relations hindering the spirit of cooperative federalism and suggest measures to address the issues of concern. (15)
- c) 'The social transformation in India could be characterized as 'revolutionary' in content and 'evolutionary' in strategy'. In the light of the statement, discuss the role of social movements in India? (15)
-

Total No. of Printed Pages-3]

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. 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 questions in about 150 words each .

(5×10=50)

1.
 - a) How does declarative knowledge interact with procedural knowledge?
 - b) Discuss the altered states of consciousness induced by hypnosis and drug use.
 - c) Differentiate between the terms “internal validity” and “external validity” in experimental research.
 - d) What is understood by causal supersession in causal reasoning?
 - e) How does metamemory influence learning strategies?

2.
 - a) Explain the key features of a well-designed survey. What are the common pitfalls to avoid, and how can researchers ensure clarity and precision in their survey questions? (20)
 - b) Compare and contrast the elaboration likelihood model (ELM), the theory of planned behaviour (TPB), and the social identity theory (SIT) in explaining how attitudes are formed and modified. (15)
 - c) Compare and contrast projective and objective personality tests. (15)

3.
 - a) Discuss the key components of effective communication training, and provide examples of successful interventions or programs. (20)
 - b) Discuss how motivational and emotional factors influence decision-making. (15)
 - c) How do different brain regions contribute to language comprehension and production, and how might this knowledge inform language-related therapies? (15)

4.
 - a) Discuss the epistemological challenges associated with applying scientific methods to study psychological phenomena. Provide examples of areas within psychology where the scientific method encounters inherent limitations. (20)
 - b) Critically assess the concept of multiple intelligence. How does the recognition of diverse intelligences challenge traditional views of intelligence? (15)
 - c) What factors influence intrinsic motivation? Discuss the role of autonomy, competence and relatedness in fostering or hindering intrinsic motivation. (15)

SECTION-B

Answer the following questions in about 150 words each.

(5×10=50)

5.
 - a) Contrast Skinner’s operant conditioning theory with Chomsky’s nativist theory regarding language development.
 - b) How is distributed representation related to the multidimensional nature of experience?
 - c) Discuss how the pandemic lockdown affected face processing in infants.
 - d) Discuss the significance of using a Likert scale in the measurement of attitudes.
 - e) Contrast the processes of extinction and generalization in classical conditioning.

6. a) Using suitable examples, differentiate between theory, construct, hypothesis and operational definition. (20)
- b) How is quasi-experimental research design useful in psychological research? Elaborate using suitable research examples. (15)
- c) How is self related to culture? Discuss in light of research on self-construal. (15)
7. a) Explain the fundamental principles of signal detection theory and how it is applied to the analysis of perceptual decision-making. (20)
- b) Explain the key components of a Two-Way ANOVA design, including main effects and interaction effects. (15)
- c) Discuss how the different brain structures and networks contribute to various facets of cognitive functioning and intelligence using evidence from brain imaging studies. (15)
8. a) Discuss the strengths and challenges associated with mixed-method research in psychology. Provide examples of research questions where using both qualitative and quantitative methods could enhance the study. (20)
- b) Discuss the potential benefits of incorporating artificial intelligence in psychological testing using suitable examples. (15)
- c) Examine the psychological mechanisms underlying the effectiveness of different types of reinforcement in behaviour modification. (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]

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. **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

ਪ੍ਰਸ਼ਨ:1

- ੳ. ਸਵਰ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦੋਦੇ ਹੋਏ ਪੰਜਾਬੀ ਸਵਰ ਧੁਨੀਆਂ ਦੇ ਵਰਗੀਕਰਨ 'ਤੇ ਨੋਟ ਲਿਖੋ। (10)
- ਅ. ਅਖੰਡੀ ਧੁਨੀਆਂ ਤੋਂ ਕੀ ਭਾਵ ਹੈ ? ਪੰਜਾਬੀ ਦੀਆਂ ਅਖੰਡੀ ਧੁਨੀਆਂ ਕਿਹੜੀਆਂ ਹਨ ? ਸਖੇਪ ਚਰਚਾ ਕਰੋ। (10)
- ੲ. ਭਾਸ਼ਾ ਅਤੇ ਉਪਭਾਸ਼ਾ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦੋਦੇ ਹੋਏ ਇਨ੍ਹਾਂ ਵਿਚਲੇ ਅੰਤਰ ਸੰਬੰਧ ਦੀ ਚਰਚਾ ਕਰੋ। (10)
- ਸ. ਵਧੇਤਰ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦੋਦੇ ਹੋਏ ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ ਸੰਬੰਧੀ ਉਦਾਹਰਨਾਂ ਸਹਿਤ ਨੋਟ ਲਿਖੋ। (10)
- ਹ. ਗੁਰਮਤਿ ਸਾਹਿਤ ਦੀਆਂ ਪ੍ਰਮੁੱਖ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ 'ਤੇ ਚਾਨਣਾ ਪਾਓ। (10)

ਪ੍ਰਸ਼ਨ: 2

- ੳ. ਕਿੱਸਾ ਕਾਵਿ ਦੇ ਆਰੰਭ ਬਾਰੇ ਚਰਚਾ ਕਰਦੇ ਹੋਏ ਇਸ ਦੇ ਵਿਕਾਸ 'ਤੇ ਚਾਨਣਾ ਪਾਓ। (15)
- ਅ. ਮਾਝੀ ਉਪਭਾਸ਼ਾ ਦੇ ਖੇਤਰ ਦੱਸਦੇ ਹੋਏ ਇਸ ਦੀਆਂ ਪ੍ਰਮੁੱਖ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ 'ਤੇ ਰੋਸ਼ਨੀ ਪਾਓ। (15)
- ੲ. ਰੂਪ ਵਿਗਿਆਨ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦੋਦੇ ਹੋਏ ਵਰਤੋਂ ਦੇ ਆਧਾਰ 'ਤੇ ਰੂਪਗ੍ਰਾਮ ਦੀ ਵਰਗ ਵੰਡ ਕਰੋ। (20)

ਪ੍ਰਸ਼ਨ: 3

- ੳ. ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੇ ਜਨਮ ਤੇ ਵਿਕਾਸ 'ਤੇ ਵਿਸਥਾਰ ਨੋਟ ਲਿਖੋ। (20)
- ਅ. ਸੂਫੀਮੱਤ ਅਨੁਸਾਰ ਅਧਿਆਤਮਕ ਵਿਕਾਸ ਦੀਆਂ ਕਿੰਨੀਆਂ ਮੰਜ਼ਲਾਂ ਹਨ ? ਵਿਸਥਾਰ ਵਿਚ ਲਿਖੋ। (15)
- ੲ. ਪੰਜਾਬੀ ਨਾਂਵ ਵਾਕੰਸ਼ ਅਤੇ ਕਿਰਿਆ ਵਾਕੰਸ਼ ਦੀ ਉਦਾਹਰਨਾਂ ਸਹਿਤ ਵਿਸਥਾਰ ਚਰਚਾ ਕਰੋ। (15)

ਪ੍ਰਸ਼ਨ:4

- ੳ. ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਵਿਕਾਸ ਦੇ ਵੱਖ ਵੱਖ ਪੜਾਅ ਦੱਸਦੇ ਹੋਏ ਇਸ ਦੀ ਵਰਤਮਾਨ ਸਥਿਤੀ 'ਤੇ ਚਾਨਣਾ ਪਾਓ। (20)
- ਅ. ਮੱਧਕਾਲ ਵਿਚ ਕਿਹੜੀਆਂ ਜਨਮ ਸਾਖੀਆਂ ਲਿਖੀਆਂ ਗਈਆਂ ਹਨ। ਉਨ੍ਹਾਂ ਸੰਬੰਧੀ ਵਾਰਤਕ ਕਲਾ ਦੀ ਦ੍ਰਿਸ਼ਟੀ ਤੋਂ ਚਰਚਾ ਕਰੋ। (15)
- ੲ. ਲਿੰਗ ਤੋਂ ਕੀ ਭਾਵ ਹੈ ? ਲਿੰਗ ਕਿੰਨੀ ਤਰ੍ਹਾਂ ਦੇ ਹੁੰਦੇ ਹਨ ? ਪੰਜਾਬੀ ਵਿਚ ਲਿੰਗ ਪਰਿਵਰਤਨ ਦੇ ਕੀ ਨਿਯਮ ਹਨ ? (15)

SECTION - B

ਪ੍ਰਸ਼ਨ: 5

- ੳ. ਪੰਜਾਬੀ ਦੇ ਪ੍ਰਮੁੱਖ ਕਵਿਤਰੀ ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ ਦੀ ਕਵਿਤਾ ਦੇ ਕਾਵਿ ਪੜਾਅ ਨਿਸ਼ਚਿਤ ਕਰੋ। (10)
- ਅ. ਬੁਝਾਰਤਾਂ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦਿੰਦੇ ਹੋਏ ਇਨ੍ਹਾਂ ਦੀ ਬਣਤਰ ਸੰਬੰਧੀ ਵਿਚਾਰ ਚਰਚਾ ਕਰੋ। (10)
- ੲ. ਨਾਨਕ ਸਿੰਘ ਨੂੰ ਸੁਧਾਰਵਾਦੀ ਨਾਵਲਕਾਰ ਕਿਉਂ ਕਿਹਾ ਜਾਂਦਾ ਹੈ? ਨਾਵਲਾਂ ਦੀਆਂ ਉਦਾਹਰਨਾਂ ਦੇ ਕੇ ਦੱਸੋ। (10)
- ਸ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਦੀਆਂ ਪੰਜਾਬ ਸੰਕਟ ਨਾਲ ਸੰਬੰਧਤ ਕਹਾਣੀਆਂ ਦੀ ਸੰਖੇਪ ਚਰਚਾ ਕਰੋ। (10)
- ਹ. ਪੰਜਾਬੀ ਆਲੋਚਨਾ ਵਿਚ ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ ਦਾ ਕੀ ਸਥਾਨ ਹੈ? ਚਰਚਾ ਕਰੋ। (10)

ਪ੍ਰਸ਼ਨ: 6

- ੳ. ਨਿਬੰਧ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦਿੰਦੇ ਹੋਏ ਪੂਰਨ ਸਿੰਘ ਦੀ ਨਿਬੰਧ ਕਲਾ 'ਤੇ ਨੋਟ ਲਿਖੋ? (15)
- ਅ. ਲੋਕ ਕਹਾਣੀ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦਿੰਦੇ ਹੋਏ ਲੋਕ ਕਹਾਣੀਆਂ ਦਾ ਵਰਗੀਕਰਣ ਕਰੋ। (20)
- ੲ. ਜਸਬੀਰ ਸਿੰਘ ਆਹਲੂਵਾਲੀਆ ਪ੍ਰਯੋਗਸ਼ੀਲ ਪੰਜਾਬੀ ਕਵਿਤਾ ਦੇ ਮੋਢੀ ਵਜੋਂ ਜਾਣੇ ਜਾਂਦੇ ਹਨ। ਚਰਚਾ ਕਰੋ। (15)

ਪ੍ਰਸ਼ਨ: 7

- ੳ. ਆਈ.ਸੀ. ਨੰਦਾ ਨੇ ਪੰਜਾਬੀ ਨਾਟਕ ਨੂੰ ਆਦਰਸ਼ਕ, ਧਾਰਮਿਕ, ਇਤਿਹਾਸਕ ਅਤੇ ਮਿਥਿਹਾਸਕ ਘੁੰਮਣਘੇਰੀ ਵਿਚੋਂ ਕੱਢ ਕੇ ਯਥਾਰਥਵਾਦ ਦੀ ਲੀਹ 'ਤੇ ਚਾੜਿਆ। ਚਰਚਾ ਕਰੋ। (15)
- ਅ. ਮਹਾਂਕਾਵਿ ਦੀ ਪਰਿਭਾਸ਼ਾ ਦਿੰਦੇ ਹੋਏ ਅਵਤਾਰ ਸਿੰਘ ਆਜ਼ਾਦ ਦੇ ਲਿਖੇ ਮਹਾਂਕਾਵਿ 'ਤੇ ਵਿਸਥਾਰ ਨੋਟ ਲਿਖੋ। (20)
- ੲ. ਨਜ਼ਮ ਹੁਸੈਨ ਸੱਯਦ ਦੀ ਪੰਜਾਬੀ ਆਲੋਚਨਾ 'ਤੇ ਨੋਟ ਲਿਖੋ। (15)

ਪ੍ਰਸ਼ਨ: 8

- ੳ. ਪੰਜਾਬੀ ਸਾਹਿਤ ਉੱਤੇ ਪਏ ਵਿਦੇਸ਼ੀ ਪ੍ਰਭਾਵਾਂ 'ਤੇ ਚਾਨਣਾ ਪਾਓ। (20)
- ਅ. ਜਸਵੰਤ ਸਿੰਘ ਕੰਵਲ ਦੇ ਮਾਰਕਸਵਾਦੀ ਵਿਚਾਰਧਾਰਾ ਪ੍ਰਭਾਵ ਅਧੀਨ ਲਿਖੇ ਨਾਵਲਾਂ ਬਾਰੇ ਚਰਚਾ ਕਰੋ। (15)
- ੲ. ਪੰਜਾਬੀ ਕਵਿਤਾ ਵਿਚ ਪ੍ਰਗੀਤ ਸੰਬੰਧੀ ਚਰਚਾ ਕਰਦੇ ਹੋਏ ਸੁਰਜੀਤ ਪਾਤਰ ਦੀ ਪ੍ਰਗੀਤ ਕਾਵਿ ਨੂੰ ਦੇਣ ਉੱਤੇ ਰੋਸ਼ਨੀ ਪਾਓ। (15)

Total No. of Printed Pages-3]

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. **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 questions in about 150 words each.

(5×10=50)

1. a) What is Science? (10)
b) What is reliability? (10)
c) What is social equilibrium? (10)
d) What is beliefs and rites? (10)
e) What is anticipatory socialization? (10)
2. a) Critically discuss Talcott Parsons idea of Social Systems. (20)
b) Discuss S.M.Lipset's idea of legitimacy with suitable examples. (15)
c) What is Static and Dynamic in Sociology according to August Comte? (15)
3. a) Discuss Max Weber's idea of class, status and party. (20)
b) Discuss various theories of origin of state. (15)
c) Discuss Randal Collins's idea of stratification by education. (15)
4. a) Discuss the role of Enlightenment and rise of Sociology in Europe. (20)
b) Discuss the relationship between Psychology and Sociology. (15)
c) What is relative deprivation? Discuss with suitable examples. (15)

SECTION - B

Answer the following questions in about 150 words each.

(5×10=50)

5. a) What is religious revivalism? (10)
b) What is *Social fact*? (10)
c) What is *Retreatism*? (10)
d) What is "significant others"? (10)
e) What is status group? (10)
6. a) Discuss the critique of Positivism. (20)
b) Discuss C.Wright Mills idea of Power Elite. (15)
c) Discuss and differentiate between subjectivity and objectivity in social research. (15)

7. a) Discuss Robert K Merton's paradigm for functional analysis. (20)
- b) What is ideological class domination? Illustrate. (15)
- c) Critically discuss Ogburn's idea of Cultural lag with suitable examples. (15)
8. a) Emile Durkheim considers suicide is not an individual phenomenon rather a social phenomenon. Critically discuss. (20)
- b) Discuss and differentiate between animism, monism and pluralism. (15)
- c) What is Hierarchy of Sciences? (15)
-

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۔

SECTION - A.

(5×10=50)

1. درج ذیل پر مختصر تنقیدی نوٹ (100 الفاظ میں) لکھئے۔

(10)

(الف) وسطی ہند آریائی دور

(10)

(ب) مغربی ہندی کی بولیاں اور ان کی خصوصیات

(10)

(ج) اُردو کی سماجی و تہذیبی بنیادیں

(10)

(د) اُردو زبان رسم الخط اور اس کے امتیازی پہلو

(10)

(ه) جدید ہند آریائی زبانیں اور اُردو

(20+15+15=50)

2. درج ذیل پر تنقیدی نوٹ لکھئے۔

(20)

(الف) اُردو کی ابتداء سے متعلق اہم نظریات (200 الفاظ میں)

(15)

(ب) ہندی زبان سے اُردو کا رشتہ (150 الفاظ میں)

(15)

(ج) اُردو کا صر فی و نحوی نظام (150 الفاظ میں)

(20+15+15=50)

3. درج ذیل پر تنقیدی مضمون لکھئے۔

(20)

(الف) دکنی ادب کی خصوصیات (200 الفاظ میں)

(15)

(ب) دکنی اُردو پر مقامی زبانوں اور ثقافت کے اثرات (150 الفاظ میں)

(15)

(ج) گولکنڈہ کی لسانی و ادبی خدمات (150 الفاظ میں)

(20+15+15=50)

4. درج ذیل پر تنقیدی مضمون لکھئے۔

(20)

(الف) دکن میں فروغ پانے والی اہم ادبی اصناف (200 الفاظ میں)

(15)

(ب) دکن میں اُردو نثر کا آغاز و ارتقاء (150 الفاظ میں)

(15)

(ج) وٹی دکنی کی شاعری کی خصوصیات (150 الفاظ میں)

SECTION - B

(5×10=50)

5. درج ذیل پر مختصر تنقیدی نوٹ (100 الفاظ میں) لکھئے۔

(10)

(الف) اُردو میں قصیدہ نگاری کی روایت

(10)

(ب) دبستان دہلی کی ادبی خدمات

(10)

(ج) مرثیہ نگاری اور دبستان لکھنؤ

(10)

(د) عہد میر میں غزل گوئی

(10)

(ه) اُردو میں داستان نگاری

(20+15+15=50)

6. درج ذیل پر تنقیدی مضمون لکھئے۔

(20)

(الف) اُردو میں افسانہ نگاری کی روایت (200 الفاظ میں)

(15)

(ب) ڈراما "انارکلی" کی خصوصیات (150 الفاظ میں)

(15)

(ج) ترقی پسند تحریک کی ادبی خدمات (150 الفاظ میں)

(20+15+15=50)

7. درج ذیل پر تنقیدی مضمون لکھئے۔

(20)

(الف) اُردو میں انشائیہ نگاری کی روایت (200 الفاظ میں)

(15)

(ب) شبلی کی سوانح نگاری (150 الفاظ میں)

(15)

(ج) اُردو ناول نگاری میں گنودان کی اہمیت (150 الفاظ میں)

(20+15+15=50)

8. درج ذیل پر تنقیدی مضمون لکھئے۔

(20)

(الف) الطاف حسین حالی کی نثری خدمات (200 الفاظ میں)

(15)

(ب) شبلی کی تنقید نگاری (150 الفاظ میں)

(15)

(ج) جدیدیت کے بنیادی تصورات (150 الفاظ میں)

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.

(5×10=50)

1.
 - a) Describe Sulphur cycle and explain the effect of human activities on it. (10)
 - b) What are the causes and symptoms of cholera? Add a note on its prevention and treatment. (10)
 - c) Explain the Sol-gel hypothesis of Protozoan locomotion. (10)
 - d) With suitable examples, explain the difference between a predator and a parasite. Add a note on the key aspects governing predator-prey relationship. (10)
 - e) Give an account of the general characteristics of monotremes. (10)

2.
 - a) Describe modifications in the structure of insect mouthpart, giving specific examples of each type. Discuss the adaptive significance of these modifications in feeding strategies. (20)
 - b) Explain the concepts of polyethism and polymorphism in the social organization of insect colonies using suitable examples and discuss their contribution to the efficiency, adaptability, and overall success of these insects. (15)
 - c) With the help of suitable diagrams, explain skull types in reptiles. (15)

3.
 - a) Define sustainable development and discuss the application of sustainable development principles in the conservation and management of natural resources. (20)
 - b) Define and compare Protostomes and Deuterostomes, emphasizing their embryonic development patterns, morphological characteristics, and providing examples for each. (15)
 - c) Give a detailed account of the changes occurring in ovary and uterus during menstrual cycle in human females. Highlight the role of hormones in initiating and orchestrating these changes. (15)

4.
 - a) Describe various sources of air pollution. What are its harmful effects on the environment? Add a note on the steps are being taken by the government to reduce the vehicular emission? (20)
 - b) Give a general structure of a typical tetrapod limb. Explain various adaptations in the tetrapod limb with suitable diagrams and examples. (15)
 - c) Discuss the life cycle, habitat, and significance of stable flies in transmitting cattle diseases. Analyze the impact of vector-borne diseases on livestock health and productivity. Add a note on the current control methods and suggest strategies for effective disease management in cattle and other livestock. (15)

SECTION-B

Answer the following in about 150 words each.

(5×10=50)

5.
 - a) Write a brief note on the parental care in Amphibians. (10)
 - b) Explain metagenesis in cnidarians, and discuss its ecological significance and adaptive advantages. (10)
 - c) Explain the concept of DNA fingerprinting in forensics and discuss how DNA fingerprints aid in identifying individuals in criminal cases. (10)
 - d) Outline the key steps involved in sericulture and explain the different aspects of rearing technology crucial for ensuring the production of high-quality silk. (10)
 - e) Explain reciprocal altruism with example? How it is different from altruism? (10)

6.
 - a) With the help of suitable examples, explain diadromous migration in fishes. Comment on the other types of migration seen in fishes. How is migration in fishes different from that in birds? (20)
 - b) What is conditioning? Describe different types of conditioning with suitable examples. (15)
 - c) Explain the principles of experimental design. Discuss with the help of examples how randomization and replication are essential components in designing experiments. Add a note on the concept of null and alternate hypothesis and their role in hypothesis testing. (15)

7.
 - a) Define parasitism. Explain the life cycle of *Wuchereria bancrofti* and discuss its parasitic adaptations and pathogenicity. Add a note on control strategies for the disease it causes. (20)
 - b) Explain the principles and applications of transmission electron microscopy (TEM) and scanning electron microscopy (SEM). Highlight the differences in specimen preparation and imaging between TEM and SEM. (15)
 - c) Discuss the concept of climax community in ecological succession. What factors contribute to the establishment of a climax community, and how does it maintain stability over time. (15)

8.
 - a) What are genetic disorders? Classify them according to their inheritance patterns and molecular origins. Describe the role of genetic counseling and assisting individuals and families affected by genetic disorders. (20)
 - b) With the help of a labelled diagram, explain the structure and functions of respiratory organ of *Lamellidens branchiata*. (15)
 - c) Give an account of life history and parasitic adaptations of leech. (15)