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Total No. of Printed Pages-3

Roll No. _____

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

*Time Allowed : **Three Hours***

Maximum Marks-250

INSTRUCTIONS

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SECTION-A

1. Describe the following in about 150 words each. (5×10=50)
- a) Explain the relevance of Agro-ecological zoning in Indian Agriculture (10)
 - b) Application of Remote sensing and Geographical information system in forecasting and forewarning in Agriculture (10)
 - c) Integrated Farming systems (10)
 - d) Agro-forestry systems in Hilly states of country. (10)
 - e) Erratic weather pattern and climate change (10)
- 2.
- a) What are the basic principles of cropping systems ? Enumerate the popular cropping systems adopted in different Himalayan states. (20)
 - b) What is the relevance of Safe agriculture and Good Agricultural Practices ? Explain the procedures for obtaining GAP certification. (20)
 - c) Explain the type of rural agriculture markets existing in the country. What are the recent initiatives in this sector ? (10)
- 3.
- a) What is the current status of *Krishi Vigyan Kendra* network existing in the country ? Explain their mandates and objectives. (20)
 - b) What are the new initiatives in agriculture price management including the TOP crops. What is the current status of pulse production in india ? (20)
 - c) Discuss the significance of Self-Help Groups & FPOs for rural development with suitable examples. (10)
- 4.
- a) What are the objectives of Drip and sprinkler irrigation systems ? Explain the procedure to standardize irrigation schedule in annual and perennial field crops. (20)
 - b) Explain Integrated Nutrient Management (INM) in Agriculture ? List the components of INM .What are the different bio-fertilizers and customized fertilizers ? (20)
 - c) What are the major weeds occurring in wheat and their management practices. Enumerate the crop-weed competition with examples. (10)

SECTION-B

- 5. Describe the following in about 150 words each (10×5=50)**
- a) Explain the commercial propagation methods of bamboo and teak. (10)
 - b) Soil conservation strategies in Himalayan states. (10)
 - c) What are the major irrigation projects in the Himalayan states? (10)
 - d) Value added Forest products and livelihood security. (10)
 - e) Differentiate between soil productivity and soil fertility. (10)
- 6.**
- a) Differentiate between Agroforestry and Agrostology. (10)
 - b) SRI Technology of paddy cultivation. (10)
 - c) Soil fertility management under temperate ecosystems. (10)
 - d) Agriculture production technologies in cold desert region. (10)
 - e) Soil and water pollution in agriculture. (10)
- 7.**
- a) Explain the production strategies of chick pea and pigeon pea in dryland areas and assured irrigation conditions. (20)
 - b) Strategies for minimizing greenhouse gas emission from Agriculture farms. Enlist the strategies to manage burning of crop residues. (20)
 - c) Explain the significance of water-use efficiency and scheduling irrigations in critical stage of crop growth. (10)
- 8.**
- a) Enumerate the principles of soil fertility. Explain the standard soil sampling for field and horticultural crops. Explain the role of soil testing based fertilizer nutrient recommendations. (20)
 - b) What do you understand by integrated watershed development? Suggests different models for Hills, Northern plain and arid regions. (20)
 - c) What are the different tools for planning and managing farms. (10)
-

Total No. of Printed Pages-4

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

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SECTION-A

1. a) Air sacs are important in fowl (birds). Explain and discuss its significance. (10)
- b) How do you measure the energy retention in animal body by carbon - nitrogen balance study? How does it differ from that of comparative slaughter method? (10)
- c) In animal and poultry nutrition many non-nutritive substances are often being mixed as growth-promoters. Discuss the uses and abuses of such growth promoters. (10)
- d) In advanced countries dairy farming is viable comparatively to developing countries! Compare the dairy farming in Indian scenario with that of advanced countries? (10)
- e) Write about the physiochemical properties of ejaculated semen in domestic animals? (10)
2. a) Brief the following (5×4=20)
- i) Blood brain barrier
 - ii) Growth curve
 - iii) Feeding schedule for calves from birth to 3 months of age
 - iv) Feeding of lambs for mutton production
 - v) Factors affecting digestibility
- b) Differentiate between the following (5×4=20)
- i) Green fodder vs straws
 - ii) Fatty Liver Kidney Syndrome vs Fatty Liver Haemorrhagic Syndrome
 - iii) Metabolic faecal nitrogen vs Endogeneous urinary nitrogen
 - iv) Probiotics vs antibiotics
 - v) Sex - Linked inheritance vs sex -influenced inheritance
- c) Explain the different types of colorimetry? (10)
3. a) Prepare protocols for feeding strategies for Breeding Bull. Pregnant Animal and Lactating Animal. (15)
- b) What is repeat breeder? Enumerate the causes and how do you manage the repeat breeding cow at field level? (10)

- c) Why should we pack the milk and milk products. Substantiate ? Describe the various types and forms of packaging materials used for milk and milk products? (15)
- d) Define balanced ration ? And describe the characteristics of balanced ration. (10)
4. a) What is "pre-natal and post natal growth". Discuss various influencing factors responsible for post-natal growth in animals. (10)
- b) Explain about modified Mendalian ratio of monohybrid cross with example. (5)
- c) Discuss various managemental practices to be adopted to overcome the heat stress during summer for dairy cattle and emphasize on buffalo. (15)
- d) How will you assess the quantitative trait which is affected by additive or non-additive gene action or both? Discuss the methods of selection for simultaneous improvement of multitraits? (15)
- e) Mucosal black theory of Iron absorption. (5)

SECTION-B

5. a) Describe the managemental practices to be adopted during the transport of dairy cattle through rail and road. (15)
- b) Describe the procedure and protocol about preparation of metaphase chromosome spread through peripheral blood leukocyte culture for chromosome analysis. (15)
- c) What are the modern managemental practices for enhancing the productivity of pigs in Indian scenario. (10)
- d) What is the role played by pulmonary circulation in the animal body ? How are the oxygen and corbondioxide gasses exchanged in this process? (10)
6. a) Prepare a project report for **ANY THREE** of the following (3×5=15)
- i) 20+1 Sheep unit
 - ii) 10+1 piggery unit
 - iii) 100 crossbred dairy cattle
 - iv) 1000 broiler poultry
- b) How the carbohydrates and proteins are digested in ruminants and non-ruminants? Explain . (15)
- c) How is the DNA technology influencing the livestock production in India? Explain (10)
- d) Make a contingency plan for supply of green fodder throughout the year to a commercial dairy farm? (10)

7. a) There is huge demand for milk and milk products in India! But entrepreneurs are not willing to ventures in this sector! Narrate the various discouraging technological constraints responsible for the scenario. (10)
- b) Answer the following (4×5=20)
- i) Importance of gene mutation in farm animals
 - ii) Production of transgenic animals
 - iii) Importance of colostrum feeding
 - iv) Individual and group contact methods of extension.
- c) What is herd recording? Explain the purpose and types of records to be maintained in an organized livestock farm. (10)
- d) What is the importance of progeny testing? Compare the traditional and modern methods of progeny testing in cattle? (10)
8. a) What do you mean by natural disaster? How is the Indian livestock being affecting with different natural disasters? What advanced preparations should be made to save the livestock and to ensure milk production during natural disasters? (10)
- b) What is the importance of extension programmes in the Indian farming systems and what are the different extension methods utilized to train the farming community in India. (10)
- c) What do you understand by term “genetic code”? Discuss the importance of genetic code. (10)
- d) Why is the Hardy-Weinberg law considered as the back bone of population genetics. What are the different factors that lead to a drift from Hardy-Weinberg law? (10)
- e) What are the primary causes for infertility in cattle and buffaloes in field conditions? What is your contingency plan to treat ameliorate the infertility problems in field conditions? (10)
-

Total No. of Printed Pages-3

Roll No. _____

CC(M)
ANTHROPOLOGY
(OPTIONAL)
PAPER-I
[11]

Time Allowed : Three Hours

Maximum Marks-250

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SECTION-A

1. Write notes on the following in about 150 words each: **(5×10=50)**
 - a) Historical Particularism
 - b) Incest Taboo
 - c) Copper-Bronze Age
 - d) Descent Groups
 - e) Post-modernism
2.
 - a) Describe diffusionism and evolutionism as explanations of culture change. **(15)**
 - b) Discuss the basis of disagreement between economic formalists and substantivists **(15)**
 - c) Explain the concepts of binary oppositions and exchange that figure in Levi-Straus's structural analysis of kinship. **(20)**
3.
 - a) Explain the differentiation of Multilinear, Unilineal and Universal versions of cultural evolution **(20)**
 - b) Critically examine different Anthropological approaches to the study of religion **(15)**
 - c) Discuss the difference between emic and etic, and how does the difference derive from the study of language? **(15)**
4.
 - a) Explain Malinowski's theory of functionalism contrasting with Structural functionalism **(20)**
 - b) Critically examine the 'universality of family' with suitable examples **(15)**
 - c) Discuss different means of social control in simple societies **(15)**

SECTION-B

5. Write notes on the following in about 150 words each: **(5×10=50)**
 - a) Pedigree analysis
 - b) Genetic Polymorphism
 - c) Autosomal aberrations
 - d) Hybridization
 - e) Forensic Anthropology

6. a) Explain the Mendelian principle and its application to human populations. **(15)**
- b) What do you understand by 'Gene therapy. Elucidate its technological aspects **(15)**
- c) Discuss the adaptive significance of physiological characteristics of human beings **(20)**
7. a) Critically examine different factors affecting growth and development **(20)**
- b) Enumerate nutritional deficiency diseases highlighting the root causes. **(15)**
- c) Describe the process of genetic screening and counseling for genetic disorders **(15)**
8. a) Critically examine the synthetic theory of evolution **(15)**
- b) Describe the major races and their sub-divisions differentiating them with characteristic traits **(20)**
- c) Discuss the genetic affects of consanguineous marriages. **(15)**
-

Total No. of Printed Pages-3

Roll No. _____

CC(M)
BOTANY
(OPTIONAL)
PAPER-I
[13]

Time Allowed - **Three Hours**

Maximum Marks-**250**

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SECTION - A

1. Describe the following in about 150 words each.
 - a) Differentiate between gram-positive and gram-negative bacteria. (10)
 - b) Gymnosperms in time and space in India. (10)
 - c) Significance of phytochemistry in taxonomy. (10)
 - d) Write about cybrids, cybridization and its significance. (10)
 - e) Describe the general characters of cycadofilicales. (10)
2.
 - a) Write an account on general characters of mycoplasma and discuss the difference among mycoplasma, bacteria and plant viruses. (300 words) (20)
 - b) How palynology is having significance in pollenosis, honey production and crime detection. (200 words) (15)
 - c) What is Acharya Jagadesh Chandra Bose Indian Botanic Garden and describe its role in conservation. (200 words) (15)
3.
 - a) Describe the physiology of parasitism and control method. (300 words) (20)
 - b) Ginkgo is living fossil-discuss. (200 words) (15)
 - c) Describe organ and protoplast culture. (200 words) (15)
4.
 - a) Explain Geological-Time Scale and its significance. (300 words) (20)
 - b) What is A.P.G and how that differs with other types of classifications. (200 words) (15)
 - c) Discuss about phloem as a complex tissue. (200 words) (15)

SECTION - B

5. Describe the following in about 150 words each.
 - a) Leaf anatomy of C_3 and C_4 plants (10)
 - b) Pollen storage and test-tube fertilization (10)
 - c) Plants as source for insecticides (10)
 - d) Gynostegium and Translator mechanism (10)
 - e) Cross field pits in coniferales. (10)

6. a) Stelar evolution in pteridophytes. (300 words) (20)
- b) Compare among floral characters of euphorbiaceae, cucurbitaceae and Aracaceae. (200 words) (15)
- c) Compare between types of gums and resins and their uses. (200 words) (15)
7. a) Write an account on origin and evolution of angiosperms based on palynological evidences. (300 words) (20)
- b) Describe 3-D anatomical structure of wood. (200 words) (15)
- c) Write an account on the importance of ethnobotany in Indian context. (200 words) (15)
8. Describe the following in about 150 words.
- a) Define holotype, Lectotype, syntype and Isotype (10)
- b) Write about development, types and function of endosperm (10)
- c) Describe lichens and its types. (10)
- d) What are vavilov's centres of origin (10)
- e) Write about botanical names, systematic position and economic importance of the following given below. (10)
- i) Cauliflower
- ii) Brazilian Para-rubber
- iii) Fennel
- iv) Aswagandha
- v) Banana
- vi) Chickory
-

Total No. of Printed Pages-6

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

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SECTION-A

1. a) i) Allowing 0.1 % error in velocity measurement, calculate the uncertainty in position of (a) an electron moving in an atom with a velocity of 2000 km s^{-1}
- ii) A ball of mass 200 g moving with a velocity of 10 ms^{-1} . What inference do you get from the result? **(10)**
- b) Define the terms:
- i) Critical temperature and
- ii) Critical pressure
- Describe the method for determination of critical temperature. **(10)**
- c) The e.m.f of a cell consisting of a quinhydrone electrode and a saturated calomel electrode is 0.2640 volts at 300 K , what will be the pH of a solution?
Given $E^0_{\text{SCE}} = +0.2422 \text{ V}$ and $E^0_{\text{Q/QH}_2} = +0.6996 \text{ V}$ **(15)**
- d) Starting from the definition of $G = H - TS$, show that for 'n' moles of ideal gas
$$\Delta G = 2.303 nRT \log \frac{V_1}{V_2}$$
 (15)
2. a) i) Explain the effect of temperature on reaction rate. **(10)**
- ii) A sample of milk kept at 25°C is found to sour 40 times as rapidly as when it is kept at 4°C . Estimate the activation energy for the souring process. **(5)**
- b) What are the point defects? Explain Schottky and Frenkel defects. **(10)**
- c) Define the terms:
- i) Internal conversion and
- ii) Inter system crossing. **(5)**

(15)**(2)**

- d) A radiation of 253 nm incident on HI results in the decomposition of 1.85×10^{-2} mole per 1000 cal of radiant energy. Calculate the quantum efficiency. (10)
- e) Define and explain the various terms involved in phase rule equation with suitable examples. (10)
3. a) Draw the molecular orbital energy level diagram of O_2 molecule and explain its paramagnetic nature and calculate its bond order. (15)
- b) Define the terms "surface tension" and "surface energy". How do you measure surface tension of a liquid by using stalagmometer? Explain. (15)
- c) The vapour pressure of water at $100^\circ C$ is 760 mm of Hg. What will be the vapour pressure at $95^\circ C$? The heat of vapourisation of water in this temperature range is 41.27 kJ per mole. (10)
- d) What are Maxwell's relationships? Show that $\left(\frac{\partial T}{\partial V}\right)_s = -\left(\frac{\partial P}{\partial S}\right)_v$. (10)
4. a) Write the normalized wave function for the particle in a one-dimensional box and derive the expression for the energy of the particle. (15)
- b) One mole of liquid water is converted to steam at 1 atm pressure and 373 K. In this process 40 kJ of heat is absorbed. What is the ΔE value in $J \cdot mol^{-1}$? (10)
- c) Explain Langmuir theory of absorption. (10)
- d) Discuss the Debye - Huckel theory of strong electrolytes. (15)

SECTION-B

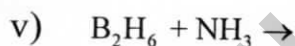
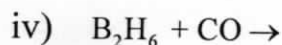
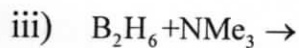
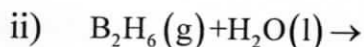
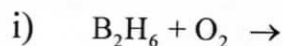
5. a) Write in detail the importance of Sodium, Potassium and Chlorine in the body (10)
- b) i) Give the chemical formula of penta ammine chlorocobalt(III) chloride (10)
- ii) Write the IUPAC name of the complex $[Pt(NH_3)_2Cl_2]$.
- iii) Give the chemical formula of potassium trioxalato ferrate(III)

- iv) Write the chemical formula of the complex compound sodium (ethylene diamine tetraacetate) chromate(III)
- v) Give the chemical formula of potassium hexacyanoferrate(II)
- c) What is the coordination entity formed when excess of aqueous KCN is added to an aqueous solution of copper sulphate? Why is it that no precipitate of copper sulphide is obtained when H_2S gas is passed through this solution? (10)
- d) Give the formula and describe the structure of noble gas species which is isostructural with
- i) $[ICl_4]^-$ ii) $[IBr_2]^-$ iii) $[BrO_3]^-$ (10)
- e) Nandhu and his group was excited. They were visiting an iron plates and pipes factory. They were very anxious to know how the plates and pipes manufactured. The engineers working there took them around various divisions. An engineer told them that for good quality sheets and pipes, alloy steels are used. He asked the students whether they knew of any alloy steel. Nobody could reply. Then the engineer said that a well-known alloy is mischmetall. (10)
- i) What is the composition of mischmetall?
- ii) Besides, in the manufacture of plates and pipes, what are the other uses of mischmetall and other lanthanide oxides?
- iii) Give the chemical reactions of lanthanides.
6. a) Write about Bohr effect and consequences of Bohr effect. (10)
- b) Draw all the geometrical and optical isomers of (10)
- i) $[CoCl_2(en)_2]^+$
- ii) $[Co(NH_3)Cl(en)_2]^{2+}$
- iii) $[Co(NH_3)_2Cl_2(en)]^+$

- c) Chemistry teacher of Murali and Raju had done some research work in the area of coordination compounds. He had as a part of his research project had prepared certain coordination compounds of cobalt. Interestingly these compounds had widely differing colors. $[\text{CoCl}(\text{NH}_3)_5]^{2+}$ was yellow, $[\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{3+}$ was blue green, $[\text{Co}(\text{NH}_3)_6]^{3+}$ was blue. So when he was to teach color in coordination compounds, he brought these samples prepared by him to the class (10)

- i) How does a coordination compound look colored?
- ii) Explain the color in coordination compound in terms of crystal field theory by taking an example.
- iii) What is meant by weak field ligand and strong field ligand?

- d) Complete the following reactions (10)



- e) i) Why do Zr and Hf exhibit similar properties (10)

ii) What is lanthanides contraction?

iii) What is the difference between the electronic configuration of lanthanides and actinides?

7. a) Discuss the nature of bonding in the following coordination ions based on valence bond theory. (10)



- b) The chemistry of the actinide elements is not as smooth as that of the lanthanides. Justify this statement by giving some examples from the oxidation state of these elements. (10)
- c) Explain the functions of Hb and Mb and Cooperativity (10)
- d) Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give the stereochemistry and magnetic moment of the complex.
- $\text{K}[\text{Cr}(\text{H}_2\text{O})_2(\text{C}_2\text{O}_4)_2]3\text{H}_2\text{O}$
 - $\text{CrCl}_3(\text{py})_3$
 - $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (10)
- e) Munni and Shiny were performing an experiment on volumetric analysis in the chemistry laboratory. Munni Said to Rajani, "We heat glass test tubes, beakers or titration flasks in our experiments. It is surprising that these vessels do not break. If we heat glass plates or glasses at home, they immediately crack. Can you explain, why?" Shiny said to Radha, Yes, I can, The laboratory glassware that we use for heating contains borax and boric acid. These materials when mixed with glass make it heat-resistant and unbreakable."
- What is borax bead test? Write the steps involved in this test.
 - Explain the bonding in diborane.
 - Apart from preparing heat resistant glasses, what are the other uses of boron compounds (10)
8. a) i) PH_3 forms bubbles when passed slowly in water but NH_3 dissolves. Explain why? (10)
- Give reasons to explain why ClF_3 exists but FCl_3 does not.
 - Write an example of a neutral molecule which is isoelectronic with ClO^- .
- b) On the basis of lanthanide contraction, explain the following. (10)
- Nature of bonding in La_2O_3 and Lu_2O_3 .
 - Trends in the stability of oxo salts of lanthanides from La to Lu.
 - Stability of the complexes of lanthanides.

- iv) Radii of 4d and 5d block elements
- v) Trends in acidic character of lanthanide oxides.
- c) Compare the following complexes with respect to structural shapes of units, magnetic behaviour, and hybrid orbitals involved in units $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Cr}(\text{NH}_3)_6]^{3+}$, $\text{Ni}(\text{CO})_4$ (10)
- d) Explain the difference between the roles of Na^+ and K^+ ions. (10)
- e) Explain the following terms giving suitable example in each case: (10)
- Ambident ligand
 - Density of a ligand
 - Crystal field splitting in octahedral complex.

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Total No. of Printed Pages-7

Roll No. _____

CC(M)
CIVIL ENGINEERING
(OPTIONAL)
PAPER - I
[17]

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

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SECTION - A

1. a) A wire rope is fixed at two points A and D as shown in fig.-1. Two weights 20 kN and 30 kN are attached to it at B and C respectively. The weights rest with portion AB and BC inclined at angles 30° and 50° respectively to the vertical as shown in fig.-1. Find the tension in the wire in segments AB, BC and CD and also the inclination of the segment CD to vertical. (10)

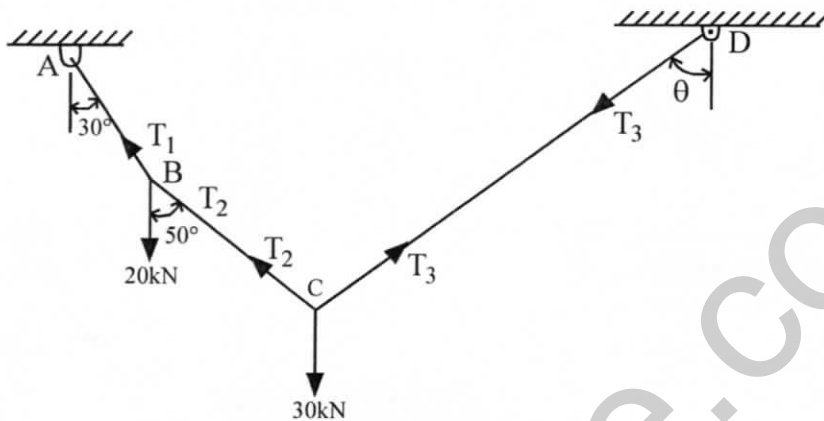


Fig.-1

- b) Two plates $12\text{ mm} \times 60\text{ mm}$ thick are connected on a lap joint with four bolts of 16 mm diameter as shown in fig.-2. Determine the strength of the joint. Take ultimate strength of bolt material as 400 N/mm^2 and ultimate strength of the plate as 410 N/mm^2 . (10)

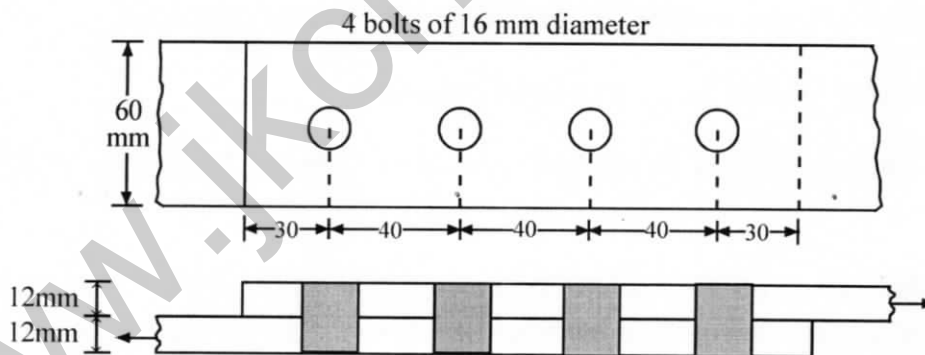


Fig. 2

- c) Determine the area of tensile reinforcement for a singly reinforcement beam section of size $300 \times 550\text{ mm}$ effective to carry a factored moment of 175 kN-m . The concrete mix used is M20 and tensile steel is of grade Fe415. (10)
- d) A Newtonian fluid of viscosity 10 poise flows between two parallel fixed plates which are kept at a distance of 50 mm apart. Find the rate of flow of fluid between the plates if the drop of pressure in a length of 1.2m be 0.30 N/cm^2 . The width of the plate is 200mm. (10)

(17)

(2)

- e) The dry unit weight of a sand sample in the loosest is 13.34 KN/m^3 and in the densest state, it is 21.19 KN/m^3 . Determine the density index of this sand when it has a porosity of 33%. Assume the grain specific gravity as 2.68. (10)
2. a) A continuous beam ABC is supported on an elastic column BD and is loaded as shown in Fig.-3. Treating joint B as rigid, analyze the frame and plot the bending moment diagram and the deflected shape of the structure. Use the slope deflection method. (20)

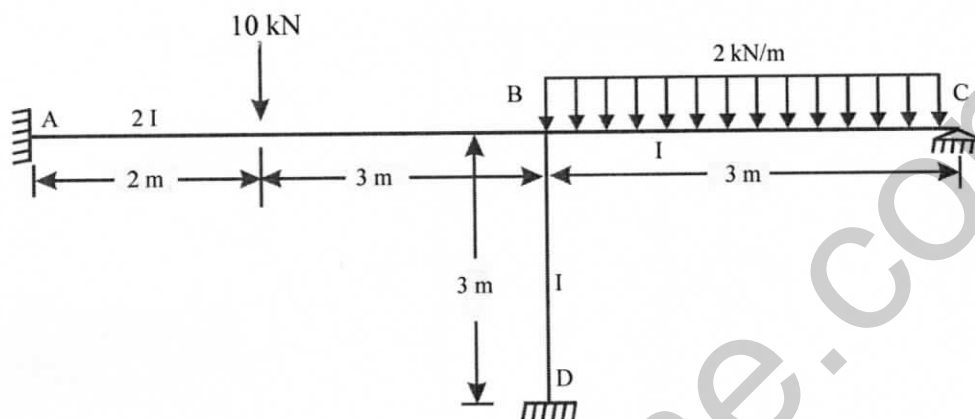


Fig. - 3

- b) A T-beam floor system has 120 mm thick slab supported on beams. The width of beam is 300 mm and effective depth is 580mm. The beam is reinforced with 8 bars of 20 mm diameter. Use M20 grade of concrete and Fe415 steel. The beams are spaced 3m centre to centre. The effective span of beam is 3.6 mm. Determine the moment of resistance of the beam section. (15)
- c) Water is flowing through a pipe of diameter 30 cm at a velocity of 4 m/s. Find the velocity of oil flowing in another pipe of diameter 10 cm, the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.01 poise and 0.025 poise respectively. Take specific gravity of the oil as 0.8. (15)
3. a) A layer of soft clay is 6 m thick and lies under a newly constructed building. The weight of sand overlying the clay layer produces a pressure of 260 KN/m^2 and the newly construction increases the pressure by 100 KN/m^2 . If the compression index is 0.5. Compute the settlement. The water content is 40% and the specific gravity of grain is 2.65. (15)
- b) A symmetrical three hinged parabolic arch of span 40 m and rise 8 m carries an u.d.l of 30 kN/m over the left half of the span. The hinges are provided at the supports and at the centre of the arch. Calculate the reactions at the supports. Also calculate the bending moment, radial shear and normal thrust at a distance of 10 m from left support. (20)

- c) Determine the maximum load P that can be resisted by the bracket shown below, by fillet weld of size 6 mm, if it is shop welding. The fillet welding is done on AB, BC and CD sides. (15)

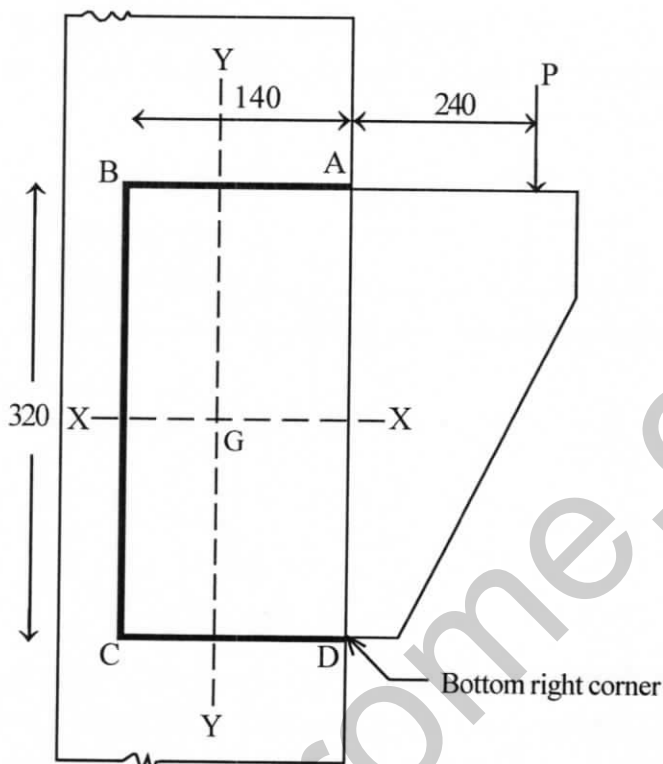


Fig. - 4

All dimensions are in mm.

4. a) Three pipes of lengths 800 m, 500 m and 400 m and of diameters 500 mm, 400 mm and 300 mm respectively are connected in series. These pipes are to be replaced by a single pipe of length of 1700 mm. Find the diameter of the single pipe. (10)
- b) A column carries a load of 1000 kN. The soil is a dry sand weighing 19 kN/m^3 and having an angle of internal friction (ϕ) of 40° . A minimum factor of safety of 2.5 is required and Terzaghi factors are required to be used as $N_\gamma=42$ and $N_q=21$ for $\phi=40^\circ$.
- Find the size of square footing, if placed at the ground surface, and
 - Find the size of square footing required if it is placed at 1 m below the ground surface with water table at the ground surface. Assume saturated weight density as 21 kN/m^3 . (20)
- c) A bar of 25 mm diameter is subjected to a pull of 40 kN. The measured extension on gauge length of 200 mm is 0.085 mm and the change in diameter is 0.003 mm. Calculate the Poisson's ratio, Modulus of elasticity, Modulus of rigidity and Bulk modulus. (20)

(17)

(4)

SECTION-B

5. a) A soil sample has a porosity of 40 percent. The specific gravity of solids is 2.70. Calculate (10)
- i) Voids ratio
 - ii) Dry density
 - iii) Unit weight if the soil is 50% saturated and
 - iv) Unit weight if the soil is completely saturated.
- b) A rectangular concrete beam of cross-section 30 cm deep and 20 cm wide is prestressed by means of means of 15 wires of 5 mm diameter located 6.5 cm from the bottom of the beam and 3 wires of diameter of 5 mm, 2.5 cm from the top. Assuming the prestress in the steel as 840 N/mm^2 , calculate the stresses at the extreme fibers of the mid-span section when the beam is supporting its own weight over a span of 6m. If a uniformly distributed live load of 6 kN/m is imposed, evaluate the maximum working stress in concrete. The density of concrete is 24 kN/m^3 . (10)
- c) A simply supported beam is 25 cm by 50 cm and has 2-20 mm HYSD bars going into the support. If the shear force at the centre of support is 110 kN at working loads, determine the anchorage length. Assume M20 mix and Fe 415 HYSD grade steel. (10)
- d) A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200 mm diameter at a position A to 500 mm diameter at a position B which is 4 meters at a higher level. If the pressures at A and B are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200 liter/s determine the loss of head and direction of flow. (10)
- e) Design a bridge truss diagonal subjected to a factored tensile load of 300 kN. The length of the diagonal is 3.0 m. The tension member is connected to a gusset plate 16 mm thick with one line of 20 mm diameter bolts of grade 8.8. (10)
6. a) The water table in a certain area is at a depth of 4 m below the ground surface. To a depth of 12 m, the soil consists of very fine sand having an average voids ratio of 0.70. Above the water table the sand has an average degree of saturation of 50%. Calculate the effective pressure on a horizontal plane at a depth 10 meters below the ground surface. What will be the increase in the effective pressure if the soil gets saturated by capillarity upto a height of 1 m above the water table? Assume $G = 2.65$. (20)
- b) A pretension, T-section has a flange 1200 mm wide and 150 mm thick. The width and depth of the rib are 300 and 1500 mm respectively. The high-tensile steel has an area of 4700 mm^2 and is located at an effective depth of 1600 mm. If the characteristics cube strength of the concrete and the tensile strength of steel are 40 and 1600 N/mm^2 respectively, calculate the flexural strength of the T-section. (15)

- c) A rectangular channel is 3.5 m wide and conveys a discharge of 15.0 m³/s at a depth of 2.0 m. It is proposed to reduce the width of the channel at a hydraulic structure. Assuming the transition to be horizontal and the flow to be frictionless determine the water surface elevations upstream and downstream of the construction when the constricted width is (a) 2.50 m, and (b) 2.20 m. **(15)**
7. a) For the velocity profile for laminar boundary flow $\frac{u}{U} = \sin\left(\frac{\pi y}{2\delta}\right)$. Obtain an expression for boundary layer thickness, shear stress and drag force on one side of the plate and co-efficient of drag in terms of Reynolds number. **(20)**
- b) A 2 m wide rectangular channel ($n=0.015$), carries a discharge of 4.0 m³/s. The channel is laid on slope of 0.0162. A downstream sluice gate raises the water surface to 7.0 m immediately behind it. Find the transitional depth. **(15)**
- c) A strip footing 1.2 m wide is located at a depth of 1.5 m in a non-cohesive soil deposit for which the corrected N-value of SPT is 20. Water table is located at a depth of 2 m below the ground surface. Find the allowable bearing pressure for the soil. **(15)**
8. a) A Pelton wheel is supplied with water under a head of 35 m at the rate of 40.5 kilo litre/min. the bucket deflects the jet through an angle of 160° and the mean bucket speed is 13 m/s. Calculate the power and hydraulic efficiency of the turbine. **(20)**
- b) A spillway model is to be built to a geometrically similar scale of 1/50 across a flume of 600 mm width. The prototype is 15 m high and maximum head on it expected to be 1.5 m. **(15)**
- What height of model and what head on the model should be used?
 - If the flow over the model at a particular head is 12 liters per second, what flow per metre length of the prototype is expected?
 - If the negative pressure in the model is 200 mm, what is the negative pressures in prototype? Is it practicable?

- c) A new canal is excavated to a depth of 5 m below ground level. Through a soil having the following characteristics $c=14 \text{ kN/m}^2$, $\phi=15^\circ$; $e=0.80$ and $G=2.70$. The slope of banks is 1 in 1. Calculate the factor of safety with respect to cohesion when the canal runs full. If it is suddenly and completely emptied. What will be the factor of safety? **(15)**
-

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Total No. of Printed Pages-7

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

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

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SECTION-A

1. Explain the following in about 150 words each: (5×10=50)
- Requirements for installing activity based costing. (10)
 - Procedure for setting the accounting standards (10)
 - Non-economic considerations for Make or Buy (10)
 - Forms required for tax audit (10)
 - Agricultural income (10)
2. a) Following are the Balance Sheet of A Ltd. and B Ltd. as on 31.3.2018:

Liabilities	A Ltd.	B Ltd.	Assets	A Ltd.	B Ltd.
	Rs.	Rs.		Rs.	Rs.
Equity Shares			Land & Building	29,00,000	12,00,000
Capital (Rs. 10)	50,00,000	20,00,000	Plant &		
14% Pref. Share			Machinery	45,00,000	18,00,000
Capital (Rs. 100 each)	20,00,000	10,00,000	Furniture	5,00,000	2,00,000
General Reserve	8,00,000	2,00,000	Stock	15,00,000	5,00,000
Investment			Debtors	10,00,000	7,00,000
Allowance	7,00,000	2,00,000	Cash at bank	5,00,000	3,00,000
Profit & Loss A/c	10,00,000	5,00,000			
12% Debentures					
(Rs.100)	5,00,000	3,00,000			
Creditors	5,00,000	3,00,000			
Other Current					
Liabilities	4,00,000	2,00,000			
	1,09,00,000	47,00,000		1,09,00,000	47,00,000

(19)

(2)

A Ltd. takes over B Ltd. as on 31.3.2018 on the following terms:

- i) To issue 2,00,000 Equity Shares of Rs. 10 each at Rs. 12.50 to the Equity Shareholders of B Ltd.
- ii) To issue 15% preference shares of Rs.100 each to discharge preference shares of B Ltd. at par.
- iii) To convert debentures of B Ltd. into equivalent number of debentures of A Ltd. of Rs. 100 each.
- iv) To maintain investment allowance reserve for two years.
- v) The fair value of Plant and Machinery is Rs. 15,00,000.

Pass Journal Entries in the books of A Ltd. and prepare the Balance Sheet after the purchase. (20)

b) Anil furnished the following particulars of his income for the assessment year 2019-2020:

- i) Basic salary Rs. 8,00,000.
- ii) DA 50% of basic pay and includes in retirement benefits.
- iii) Bonus Rs. 4,00,000.
- iv) HRA 30% of salary. He pays Rs. 25,000 rent p.m. at Indore.
- v) Life Insurance Premium paid by his employer amounted to Rs. 20,000.
- vi) Employer's contribution to PF Rs. 1,55,000 and Anil also contributes equal amount.
- vii) He gets Rs. 550 per child as education fee allowance p.m. for his three children.
- viii) He is provided with a small car for office purpose for which the employer paid all the running costs.
- ix) He pays Rs. 200 as professional tax.

In addition to salary income, he also earns Rs. 4,50,000 as income from house property, Rs. 2,00,000 from capital gains. He invested Rs. 50,000 in bonds of National Highway Authority of India. He donated Rs. 3000 to Prime Minister's relief fund. He paid a premium of Rs. 15,000 towards medical insurance.

Compute his taxable income. (20)

c) What do you understand by "Outstanding Assets" and "Outstanding Liabilities", and what are the duties of an auditor in relation there to? (10)

3. a) During a month, 2,000 units were introduced into process-I. The normal loss was estimated at 5% on input. At the end of the month 1,400 units had been produced and transferred to next process, 460 units were uncompleted and 140 units had been scrapped. It was estimated that uncompleted units has reached a stage in production as follows: Material 75% completed; Labor 50% completed; and Overheads 50% completed.

The cost of 2,000 units introduced was Rs. 5,800. Direct materials introduced during the process amounted to Rs.1,440. Production overheads incurred were Rs. 1,670. Direct labor Rs. 3,340. Units scrapped realized Rs.1 each. The units scrapped have passed through the process, so were 100% completed as regards material, labor and overheads.

You are required to:

- i) Prepare a statement of equivalent production;
 - ii) Statement of cost;
 - iii) Statement of evaluation;
 - iv) Prepare the Process - I Account and Abnormal Loss Account. **(25)**
- b) B Limited entered into an agreement on 1st March, 2018 to buy computer spares from S Limited at prevailing market price for Rs. 1,200 lakhs on which S limited made a profit of 20% and received full advance payment. The transaction was concluded on 15th March. 2018. On the same day S Limited agrees to buy on 15th September 2013 the same goods from B Limited at 20% over cost. The 20% markup compensates B Limited compensates B Limited for its inventory holding costs till sale date. You are required to show (as per Accounting Standard-9) how both the buyer and seller account for the above transaction in the year 2017-18 explaining in brief the justification for your treatment and also draft the notes on account on disclosure if any required in the annual accounts year ended 31st March, 2018. **(15)**
- c) Explain the provisions relating to computation of annual value of a 'let out house property'. **(10)**

4. a) Allied Manufacturing company gives you the following information:

Particulars	Product -A (Rs.)	Product - B (Rs.)
Fixed overhead Rs. 10,000 per annum		
Direct materials per unit	20	25
Direct labour per unit	10	15
Variable overhead (100% of direct labour)		
Selling price per unit	60	100

(19)

(4)

You are required to present a statement showing the marginal cost of each product and recommend which of the following sales mixes should be adopted:

- i) 900 units of A and 600 units of B
 - ii) 1,800 units of A only
 - iii) 1,200 units of B only
 - iv) 1,200 units of A and 400 units of B
- (20)
- b) Peacock Company Ltd., has six segments for which the following information is available of the year 31st March, 2018:

(Rupees in crore)

Particulars	Segment-A	Segment-B	Segment-C	Segment-D	Segment-E	Segment-F
Capital Employed	1,500	1,200	3,000	2,400	4,500	6,000
Sales	3,000	3,000	6,000	3,600	1,800	1,200
Net Profit	150	300	150	720	450	1,200

You are required to measure the performance of different segments and draw conclusions regarding the performance of different segments. (20)

- c) Anil Limited has its share capital divided into equity shares of Rs. 10 each on 1st October, 2018, it granted 20,000 employees' stock options at Rs. 50 per share, when the market price was Rs. 120 per share. The options were to be exercised between 10th December, 2018 and 31st March, 2019. The employees exercised their options for 16,000 shares only and the remaining options lapsed. The company closes its books on 31st March every year. Show journal entries as would appear in the books of the company up to 31st March, 2019. (10)

SECTION-B

5. Explain the following in about 150 words each: (5×10=50)
- a) Aims of finance function. (10)
 - b) Funds flow statement Vs. Cash flow statement. (10)
 - c) Services offered by ICRA (10)
 - d) Primary market Vs. Secondary market (10)
 - e) Risk and Sources of Risk (10)

6. a) From the following particulars relating to ABC Ltd. Prepare a Balance Sheet as on 31st March, 2018 : (25)

Fixed Assets/Turnover Ratio	: 1 : 2
Debt Collection Period	: 2 months
Gross Profit	: 25%
Consumption of Raw Materials	: 40% of cost of goods sold
Stock of Raw Materials	: 4 months consumption
Finished Goods Stock	: 20% of turnover at cost
Fixed Assets to Current Assets	: 1:1
Current Ratio	: 2:1
Long-term Loan to Current Liabilities	: 1:3
Capital to Reserve	: 5:2
Value of Fixed Assets	: Rs. 10,50,000.

- b) Determine the optimal debt-equity mix for the company by calculation of overall cost of capital, from the following estimates of the debt and equity capital (after tax) have been made at various levels of debt-equity mix: (15)

Debt as a percentage of Total Capital Employed	Cost of Debt (%)	Cost of Equity (%)
0	6.0	13.0
10	6.0	13.0
20	6.0	13.5
30	6.5	14.0
40	7.0	15.0
50	7.5	17.0

- c) Explain the major components of Indian Financial System. (10)

(19)

(6)

7. a) X Limited is considering the purchase of a new machine, which will carry out some operations at present performed by labour. Two alternative models, A and B are available for the purpose. From the following information, prepare a profitability statement for submission to the management and calculate payback period: (20)

Particulars	Machine - A	Machine - B
Estimated life	5	6
Cost of machine (Rs.)	80,000	1,50,000
Estimated Additional Cost:		
Indirect material (p.a)	2,000	3,000
Maintenance (p.m)	500	750
Supervision (per quarter)	3,000	4,500
Estimated Savings:		
Estimated Savings in scrap (p.a)	8,000	12,000
Estimated savings in direct wages		
Worker not required	10	15
Wages per worker p.a.	7,200	7,200

Depreciation is calculated under straight-line method. Taxation may be taken at 50% of net profit (net savings).

- b) 'Venture capital financing is based on a certain crucial steps' - Discuss. (20)
- c) 'Insurance is governed by some basic principles' - Explain. (10)
8. a) Dream Well Company Limited belongs to a risk class for which the approximate capitalization rate is 10%. It currently has an outstanding 30,000 shares, which are selling in the market at Rs.80. The company is expecting a net income of Rs. 4,00,000 and it has a profitable investment (Project proposed that costs Rs. 6,00,000. The company is interested to declare a dividend of Rs. 4 per share at the end of financial year. Show that under MM hypothesis the payment of dividend does not affect the value of the firm. (20)
- b) 'The Securities and Exchange Board of India is the most powerful regulatory mechanism in India' - Support reasonably. (20)
- c) 'The growth of mutual funds in India is enormous in recent days'. Discuss the factors contributed for such growth. (10)

Total No. of Printed Pages-3

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

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SECTION-A

1. Answer the following questions in about **150** words each: **(5×10=50)**
- a) According to Chamberlin “excess capacity (restriction of output) and higher prices are the result of non-price competition coupled with free entry”. Explain. **(10)**
 - b) Bertrand’s model does not lead to the maximization of the industry (joint) profit due to the naive behavior of firms. Explain. **(10)**
 - c) How does Tobin’s approach to liquidity preference differ from Keynes’s liquidity preference function? **(10)**
 - d) Why does IS curve slope downward and LM curve slope upward? **(10)**
 - e) How does rational expectations theory show that there is no trade-off between rate of inflation and rate of unemployment? **(10)**
2.
 - a) Describe Kaldor’s distribution theory and analyze the impact of a change in propensity to save of capitalists (S_p) and propensity to save of workers (S_w) on distribution of income. **(20)**
 - b) What is product differentiation? Explain how the equilibrium tangency solution is reached with price competition and free entry under Chamberlin’s firm and group industry analysis? **(15)**
 - c) “The kink can explain why price and output will not change despite changes in costs”. Discuss. **(15)**
3.
 - a) Explain how far expansionary fiscal and monetary policies are effective in increasing the level of national income in each of the three ranges of LM Curve. In which range these two policies are most effective? **(20)**
 - b) State and explain Friedman’s quantity theory of demand for money. Is it close to Classical or Keynesian approach to the aggregate demand for money? Give reasons in support of your answer. **(15)**
 - c) Examine the compensation principle criterions of Kaldor, Hicks and Scitovsky. **(15)**
4.
 - a) What is meant by trade-off between the rate of inflation and unemployment? How is Friedman’s theory of natural rate of unemployment approach different from Phillips curve? **(20)**
 - b) What is crowding-out effect of debt financing of budget deficit? Examine Ricardian Equivalence view of debt financing of budget deficit. **(15)**
 - c) Explain in brief, Wagner’s law and Wiseman-Peacock hypothesis of growth in public expenditure. How do they explain rising public expenditure in the developing countries? **(15)**

SECTION-B

5. Answer the following questions in about **150** words each: **(5×10=50)**
- a) Critically examine the Ricardian comparative cost advantage theory. To what extent this theory was supported by empirical evidence? **(10)**
 - b) Do you agree with the view that “the inverted-U hypothesis of Kuznets much depends on the character of growth and policies followed by the governments of the countries in the growth process”. **(10)**
 - c) Discuss the Mundell-Fleming model under fixed exchange rates with capital mobility in achieving internal and external balance of an economy. **(10)**
 - d) What does speculative attack mean? How does speculative attack affect exchange rates? **(10)**
 - e) The Basic needs approach provides a best solution for the problem of coexistence of poverty with a high degree of equality’ than income approach Discuss. **(10)**
6.
 - a) How are terms of trade determined? Explain the factors that affect terms of trade. **(20)**
 - b) Describe effects of tariffs under partial equilibrium with help of a diagram. Compare them with the effects of quotas. **(15)**
 - c) Explain fully the effective rate of tariff and the optimum tariff. Show the importance of the two concepts in the theory of trade policy. **(15)**
7.
 - a) Show how the high degree of instability which is the characteristic of Harrod’s growth model is due directly to basic assumptions of his model. **(20)**
 - b) Critically examine Singer-Prebisch hypothesis of secular deterioration of terms of trade. **(15)**
 - c) What are ‘Singapore Issues’? What are the main features of Doha Declaration? **(15)**
8.
 - a) Discuss the causes and consequences of environmental degradation. **(20)**
 - b) Discuss the elasticity and income absorption approaches to devaluation as a measure of correcting balance of payment’s deficit of a country? **(15)**
 - c) “If the underdeveloped countries are to break the vicious circles of poverty. They have to undertake a critical minimum effort for sustained growth”. Discuss. **(15)**

Total No. of Printed Pages-8

Roll No. _____

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

<i>Time Allowed - Three Hours</i>	<i>Maximum Marks-250</i>
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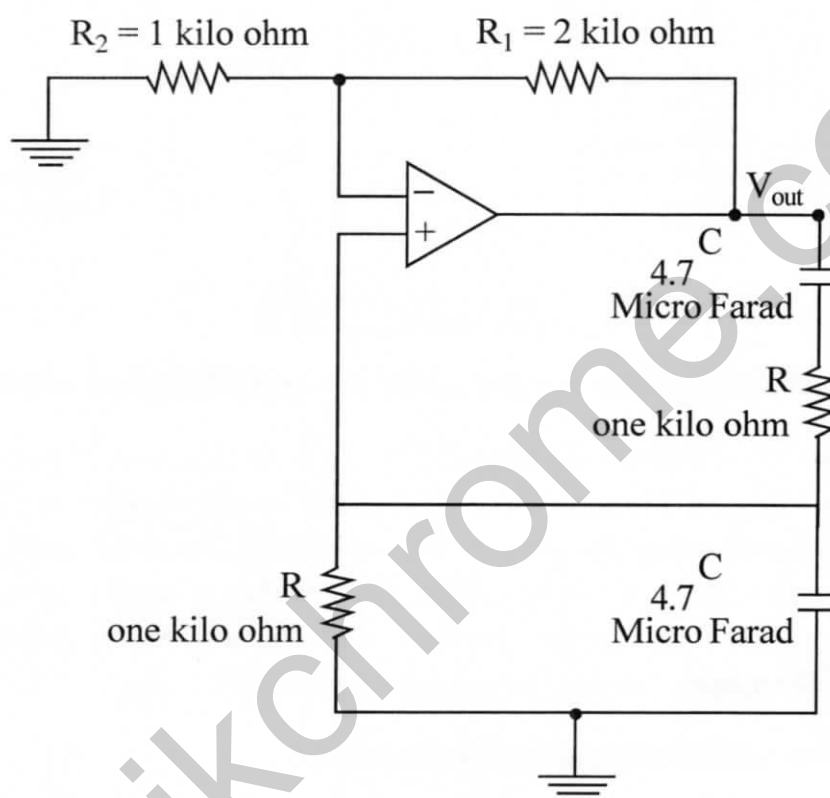
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SECTION - A

1. a) Input to the step-up chopper is 200 Volts. The output required is 600 Volts. If the conducting time of thyristor is 200 micro seconds, compute:
- Chopping Frequency (10)
 - If pulse width is halved for constant frequency of operation, find the new output voltage. (10)
- b) Determine the frequency of oscillation of the circuit given below for OPAMP, considering it to be ideal. (10)



- c) Determine the noise equivalent bandwidth of RC Low-Pass Filter (LPF) whose transfer function or frequency response is given by: $H(f) = \frac{1}{(1 + j2\pi fRC)}$ (10)
- d) The maximum efficiency of a 500 kVA, 3300/500 volt 50 Hertz, single-phase transformer is 97 percent and occurs at 75 percent full-load unity power factor. If the impedance is 10 percent, Calculate the regulation at full-load 0.8 power factor lagging. (10)
2. a) In a superheterodyne receiver having no RF amplifier, the loaded quality factor(Q) of the antenna coupling circuit (at the input of the mixer) is 90. If the intermediate frequency is 455 kilo Hertz, Calculate following:
- The image frequency (5)
 - The image frequency rejection ratio at 950 Kilo Hertz. (5)

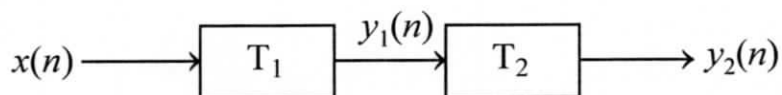
- b) A medium has $\epsilon_r = 4$ and $\mu_r = 9$. A wave having frequency $f = 0.3\text{MHz}$ propagates through this medium.

For $\sigma = 0$, what are the values of

i) Propagation constant (5)

ii) Intrinsic impedance of the medium. (5)

- c) Two systems are connected in cascade as shown below:

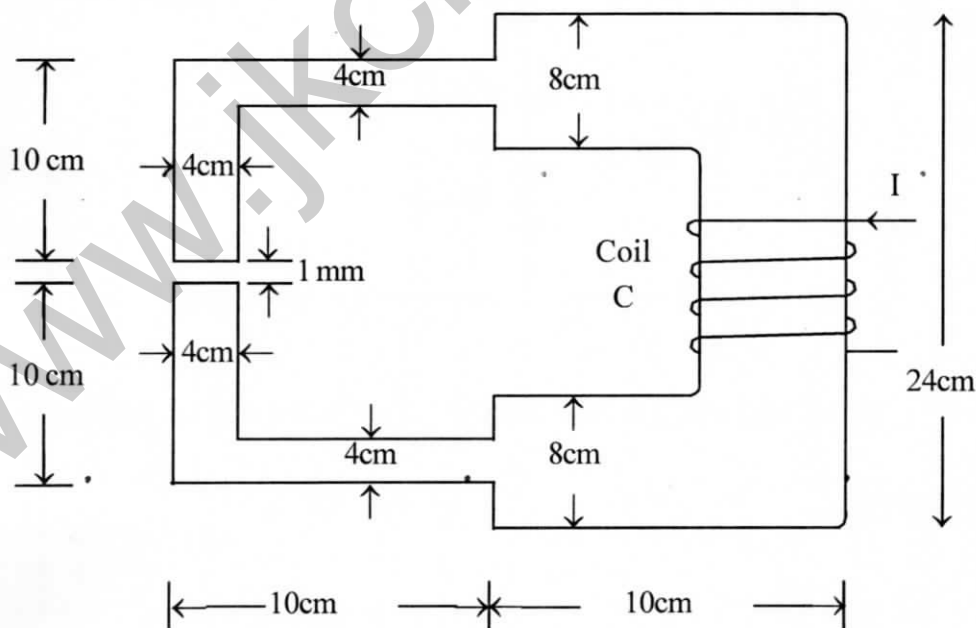


i) Show $T_c = T_1 T_2$ in $y_2(n) = T_c\{x(n)\}$. (5)

ii) Verify whether T_c is shift invariant or not if T_1 and T_2 are shift invariant. (5)

- d) Calculate the current to be passed in the coil 'c' having 500 turns so that a flux of one milli weber is produced in the air-gap of figure below.

Consider the core of square cross-section over the entire length and has permeability of 800. (20)

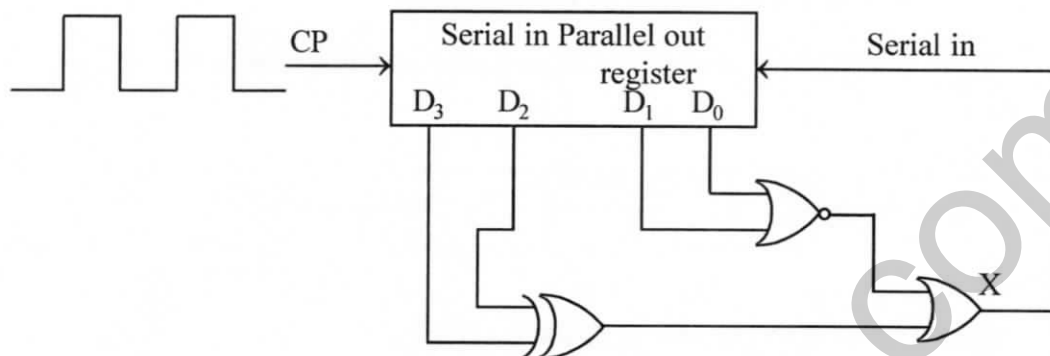


(23)

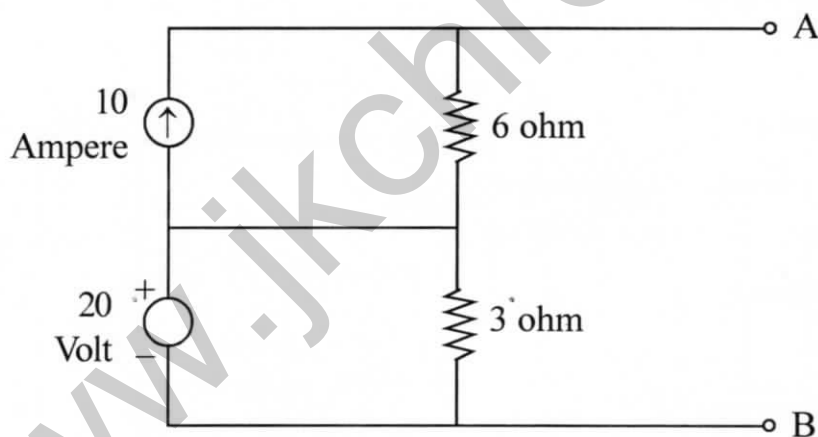
(3)

[Turn Over

3. a) Give the pulse train sequence which will be generated by the shift register circuit shown in figure below.
Assume initial state of the circuit as 1111. (10)



- b) Replace the network below by a single current source in parallel with a resistance. (10)



- c) Solve the following differential equations using Laplace transform

technique $\frac{d^2x}{dt^2} + xa = \cos(t)$;

$$x(0) = 0$$

$$\text{and } \left. \frac{dx}{dt} \right|_{t=0} = 1$$

(15)

(23)

(4)

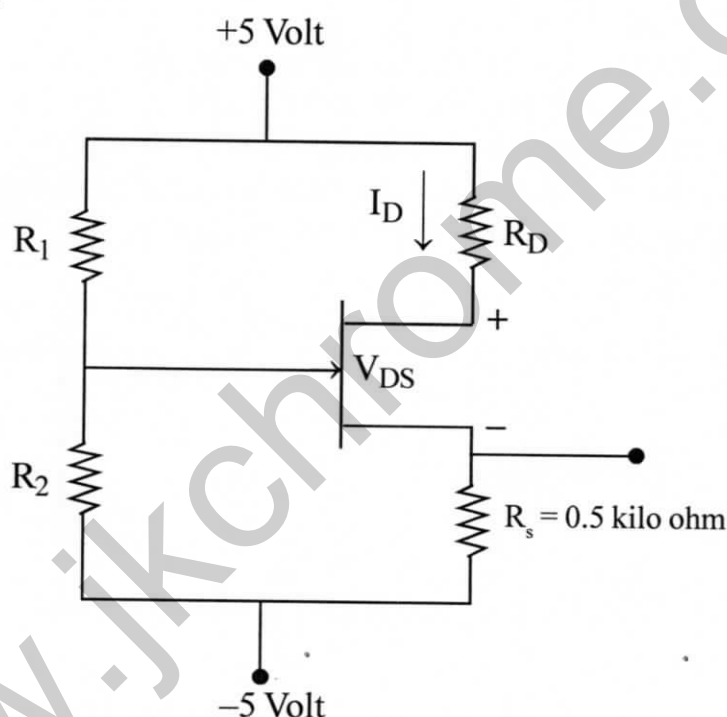
- d) The open circuit characteristic of a 3300 volt, star-connected 3-phase synchronous machine is as follows:

Field current	31.5	86	101	122	150	Ampere
emf	1500	3300	3600	3900	4100	Volt

On Open-Circuit an armature current of 219 ampere is obtained with a field current of 45 ampere. The resistance and leakage reactance per phase are 0.14 and 0.12 ohm, respectively.

Find the field current when the machine is running as a motor on 3300 Volt, taking 1000 kilo watt at a power factor of 0.8 leading. (15)

4. a) A voltage divider bias is provided to an n-channel JFET circuit as shown in figure below. Determine the values of R_1 , R_2 and R_D to establish $I_{DSS} = 10$ milli Ampere, $V_p = -3.5$ Volt, $R_1 + R_2 = 20$ Kilo Ohm, $I_D = 5$ milli Ampere and $V_{DS} = 5$ Volt (10)



- b) Two DC Series motors with different air-gaps, but otherwise identical, run at 700 and 750 rpm respectively, when taking 50 Ampere at 500 Volt. The total resistance of each motor is 0.36 ohm.

If the motors are mechanically coupled and connected in series to a 500 Volt supply and take a current of 50 Ampere. Calculate:

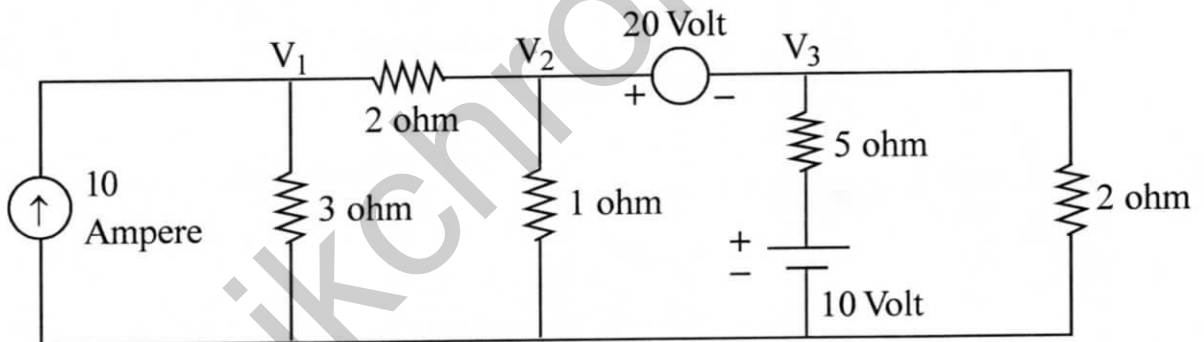
- The speed at which the set will run, and (10)
 - The voltage across each machine of the set. (10)
- c) i) A three-phase bridge inverter is used to run a three-phase induction motor rated at 440 Volt, 15 Ampere, 1440 rpm. The maximum to minimum speed ratio required is 10:1.

Find the minimum and maximum DC input voltage for the inverter. The inverter is operated in 180° conduction mode. (10)

- ii) If the voltage in (i) is to be obtained from a three-phase full-controlled bridge converter fed from 440 volt, 50 Hertz mains. Calculate the firing angles as needed. (10)

SECTION - B

5. a) An electric field wave is travelling in air and is incident normally on a boundary that is between air and a dielectric medium. Assume $\mu_r = 8$ and $\epsilon_r = 2$. Determine the following for the electric field wave
- Reflection coefficient (5)
 - Transmission coefficient (5)
- b) An induction motor has an efficiency of 0.9(90 percent), when the load is 50 HP. At this load, the stator copper loss and rotor copper loss each is equal to the iron loss. Also the mechanical losses are one-third of the losses on load. Calculate the Slip. (10)
- c) The antenna current of AM broadcast transmitter modulated to the depth of 40 percent by an audio sine wave is 11 Ampere. It increases to 12 Ampere, as a result of simultaneous modulation by another audio sine wave. What is the modulation index due to this second wave? (10)
- d) Determine the current in the 5 ohm resistor for the circuit shown below:(20)



6. a) The Probability Density Function(PDF) of a continuous random variable "X" in the range (-3,3) is defined as follows:

$$f_x(x) = \begin{cases} \frac{1}{16}(3+x)^2 & \text{for } -3 \leq x \leq -1 \\ \frac{1}{16}(2-6x)^2 & \text{for } -1 \leq x \leq 1 \\ \frac{1}{16}(3-x)^2 & \text{for } 1 \leq x \leq 3 \end{cases}$$

- Verify that the area under the curve is unity (10)
- Also prove that the mean is zero. (10)

(23)

(6)

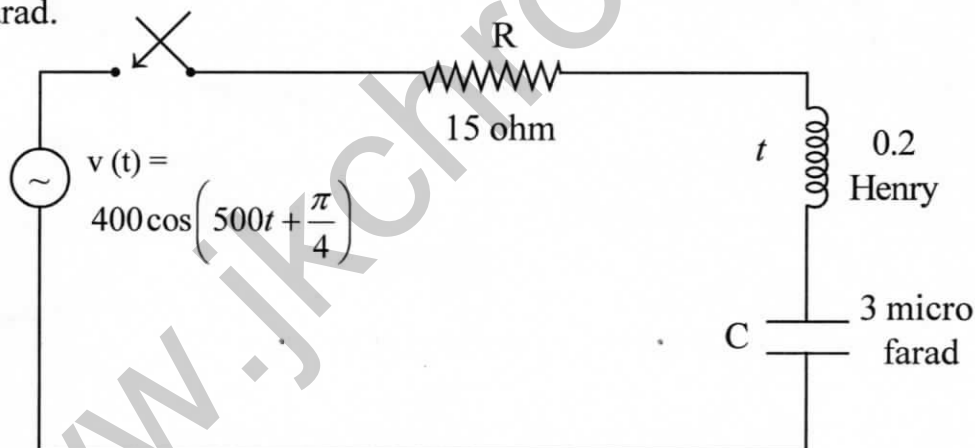
- b) A carrier signal is frequency modulated with a sinusoidal signal of 2 kilo Hertz resulting in a maximum frequency deviation of 5 Kilo Hertz.
- Find the bandwidth of the modulated signal (10)
 - The amplitude of the modulating signal is increased by a factor of 3, and its frequency is lowered to 1 Kilo Hertz. Determine the maximum frequency deviation of the new modulated signal (10)
- c) A direct current shunt machine generates 250 Volt on open circuit at 1000 rpm. Armature resistance including brushes resistance is 0.5ohm, field resistance is 250 ohm, input to machine running as a motor on no-load is 4 Ampere at 250 Volt.

Considering armature reaction weakens the field by 4 percent.

Calculate:

- The speed of the machine (5)
 - The efficiency of the machine (5)
7. a) For the circuit shown below, determine the complete solution for the current,

when the switch is closed at $t=0$. Applied voltage is $v(t) = 400 \cos\left(500t + \frac{\pi}{4}\right)$ resistance R is 15ohm, inductance L is 0.2 Henry, capacitance C is 3 micro farad. (20)



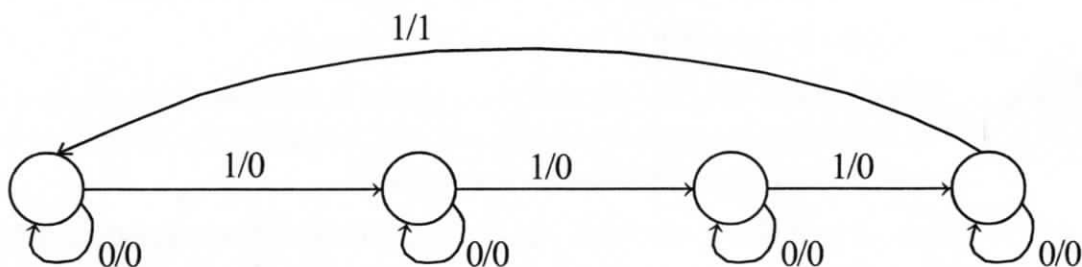
- b) An electric vector \vec{E} of an electromagnetic wave in free space is given by $E_x = E_z = 0$ and $E_y = Ae^{j[\omega t - (z/c)]}$. Find the H component in free space. (10)
- c) A 3-phase full converter operated from 3-phase star connected 208volt, 60 Hertz supply with $R_L = 10$ ohm.

It is required to obtain 50 percent of the maximum possible output voltage.

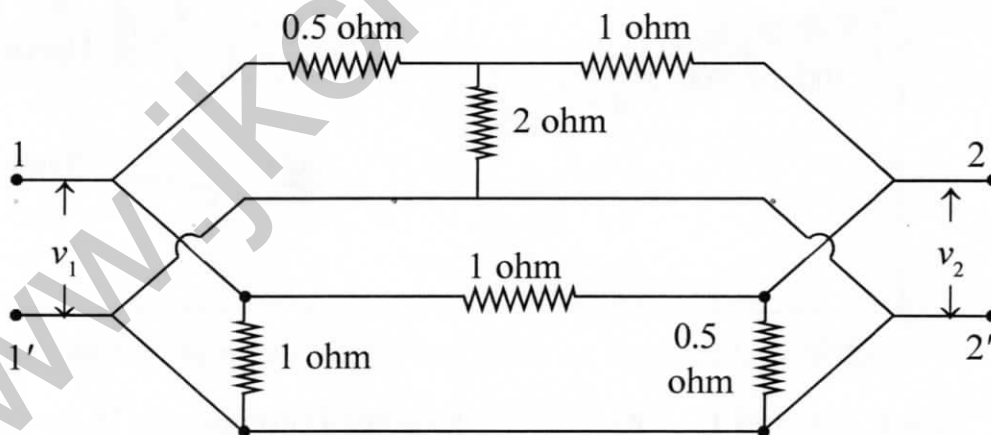
Calculate:

- Delay angle alpha (α) (5)
- RMS and Average currents (5)

- d) Derive the flip-flop circuit to represent the state diagram given below: (10)



8. a) The Electric field intensity associated with a plane wave travelling in a perfect dielectric medium ($\mu_r = 1$) is given by $E_x(z,t) = 14.14 \cos\left(2\pi * 10^7 t - \frac{\pi z}{10}\right)$ in volts per metre.
 Calculate the values of
 i) Velocity of propagation (05)
 ii) Intrinsic impedance (05)
- b) The two signals $x(t)$ and $y(t)$ are defined below:
 $x(t)=1; -2 \leq t \leq 2$
 $y(t)=t; -1 \leq t \leq 1$
 From above signals generate following signals and sketch them.
 i) $z(t)=x(t)-y(t)$ (5)
 ii) $x(3t)$ (5)
- c) Obtain Y-parameters of the two-port network shown below: (10)



- d) A 70 ohm lossless transmission line has a loss of 1.6 dB/metre. The velocity of the voltage wave on the line is $2 * 10^8$ metre/second. A section of the line is used to make a series resonant circuit at 2GHz. Find
 i) Input impedance of the line (10)
 ii) 3 dB band width of the resonant circuit. (10)

Total No. of Printed Pages-4

Roll No. _____

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

[25]

<i>Time Allowed - Three Hours</i>

<i>Maximum Marks-250</i>

INSTRUCTIONS

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SECTION-A

1. Write short notes on the following. Each question should be answered in about **150** words: **(5×10=50)**
 - a) Effects of Renaissance on English Literature.
 - b) Characteristics of Metaphysical poetry.
 - c) Important influences on the Romantic movement.
 - d) Realism and Naturalism in the Victorian age.
 - e) Factors responsible for rise of the novel in the 18th century.

2. Write notes on all of the following
 - a) The character of Satan as it emerges in Book-1 of *paradise lost*. **(15)**
 - b) The Tempest as a play about colonialism. **(20)**
 - c) Significance of the title in the poem "Cannonisation". **(15)**

3. Answer all of the following :
 - a) What is the predominant mood of the poem "*Westminster Bridge*"? **(15)**
 - b) Comment on the theme of Justice in *King Lear*. **(20)**
 - c) Write a note on the Christian theme of the poem "*Death be not Proud*". **(15)**

4. Write notes on the following:
 - a) Romantic elements in the poem *Tintern Abbey*. **(15)**
 - b) Victorian conflict in the poem *in Memorium*. **(20)**
 - c) Feminism in *Dolls House*. **(15)**

SECTION-B

5. Study the following poem and answer all the questions which follow. Each answer should be in around **150** words; **(5×10=50)**

A free bird leaps on the back
 Of the wind and floats downstream
 Till the current ends and dips his wing
 In the orange suns rays
 And dares to claim the sky.

(25)

(2)

But a BIRD that stalks down his narrow cage
Can seldom see through his bars of rage
His wings are clipped and his feet are tied
So he opens his throat to sing.

The caged bird sings with a fearful trill
Of things unknown but longed for still
And his tune is heard on the distant hill for
The caged bird sings of freedom.

The free bird thinks of another breeze
And the trade winds soft through
The sighing trees
And the fat worms waiting on a dawn-bright
Lawn and he names the sky his own.

But a caged BIRD stands on the grave of dreams
His shadow shouts on a nightmare scream
His wings are clipped and his feet are tied
So he opens his throat to sing.

The caged bird sings with
A fearful trill of things unknown
But longed for still and his
Tune is heard on the distant hill
For the caged bird sings of freedom.

5. a) Write a short note on the theme of the poem. (10)
- b) Point out the differences between the song on the caged bird and the free bird. (10)
- c) Why does the poet say, "The caged bird sings of freedom?" (10)
- d) What could be the possible significance of the caged bird and the free bird? (10)
- e) Comment on the kind of language used in the poem. (10)
6. Answer all of the following:
- a) Comment on the literary devices used in *Pride and Prejudice*. (15)
- b) Explicate Gulliver's travel as a children's book. (15)
- c) What is a social novel? Analyze *Hard Times* as a social novel. (20)
7. Write notes on all the following
- a) The theme of parental authority and individual choice in Tom Jones. (15)
- b) The theme of social criticism in *Tess of the d'Urbervilles*. (20)
- c) The theme of Education in *Hard Times*. (15)
8. Answer all of the following:
- a) Explore *Pride and Prejudice* as a feminist Novel. (15)
- b) Analyze *Gulliver's* travels as satire of Humanity. (20)
- c) Explore the influence of the past on the present identity in the novel *Mill on the Floss*. (15)



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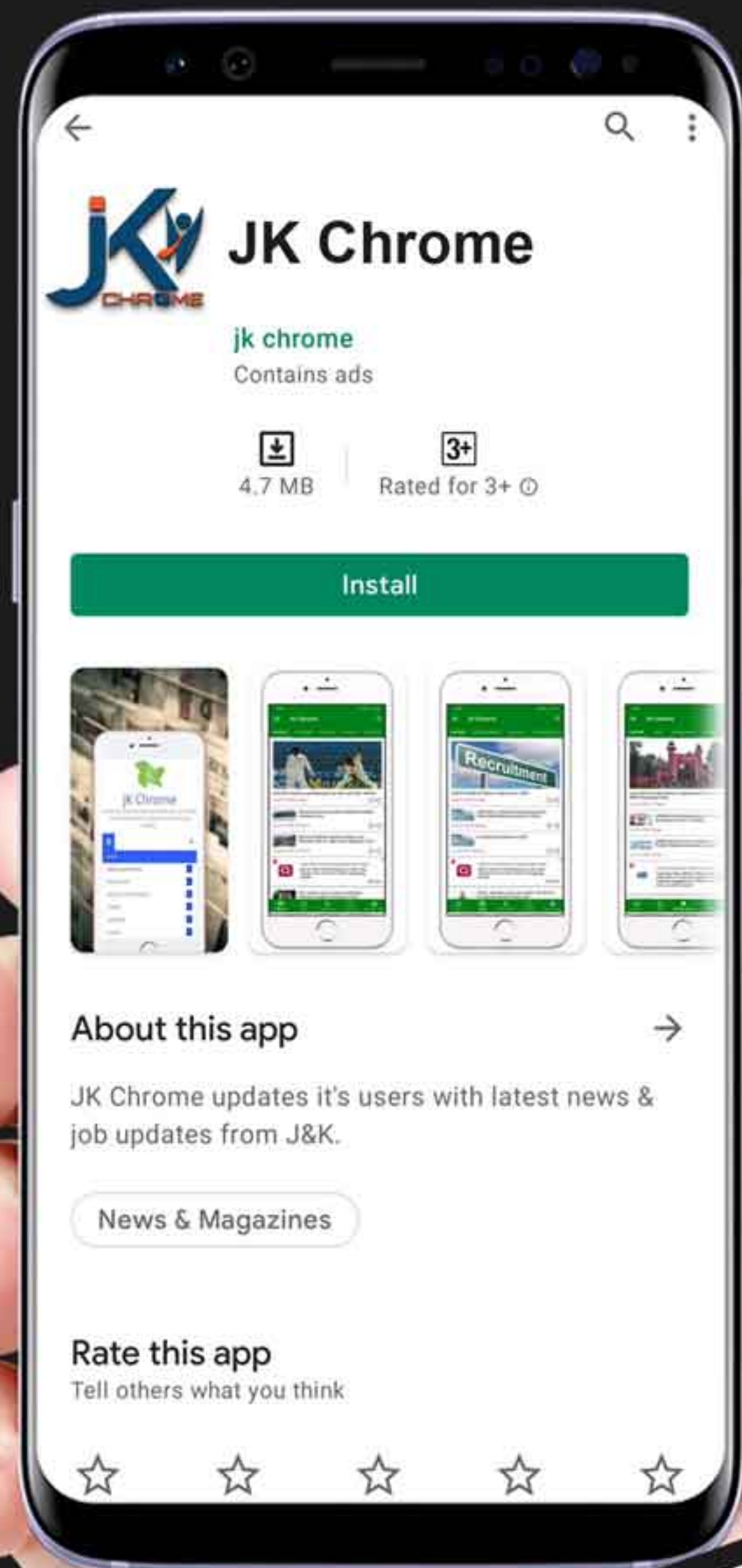
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CC(M)
GEOGRAPHY
(OPTIONAL)
PAPER-I
[27]

*Time Allowed - **Three Hours***

Maximum Marks-250

INSTRUCTIONS

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- vi) No blank page be left in between answer to various questions*

SECTION-A

1. Answer the following questions in about **150** words each: **(5×10=50)**
 - a) Evaluate the Rostov's model of growth with reference to the countries facing "**false start**" in modern world.
 - b) Economic degrowth a crisis or opportunity for social equity and ecological sustainability? Explain.
 - c) Modernization of society results in decline of religiosity. Comment.
 - d) Illustrate with suitable examples, man's perception and adjustment to ecological imbalances in the context of regional development.
 - e) Examine the factors that affect geomagnetism and how it helps in understanding the history of the earth.

2.
 - a) Highlight the geomorphic features essentially found in topographies under the first Cycle of Erosion. **(20)**
 - b) Discuss the consequences of Climate change on agriculture and food security, and on the Coastal Zones of the world. **(15)**
 - c) "Weathering is a complex phenomenon involving a number of processes and is influenced by various factors". Elaborate. **(15)**

3.
 - a) "Though 70% of Indian population is rural, urban planning is crucial to the development of India". Discuss. **(20)**
 - b) "Contemporary global climate change is an anthropogenic phenomenon". Discuss. **(15)**
 - c) Discuss the impact of positivism in paradigm shift in Geography. **(15)**

4.
 - a) What is 'Potential- Evapotranspiration'? Explain how it is used in assessing the water balance in an area. **(20)**
 - b) Impact of Cryosphere on global climate. **(15)**
 - c) Applied Geomorphology may be defined as geomorphology in the service of man. Elaborate **(15)**

SECTION-B

5. Answer the following questions in about **150** words each: **(5×10=50)**
- a) What are the basic postulates of behavioralism? Highlight its philosophical differences to Humanism?
 - b) Relevance of distance decay principle in Indian cities.
 - c) With suitable examples, bring out the impact of local winds on the climate of an area.
 - d) Give a brief account of the principal land biomes and their latitudinal distribution.
 - e) Relevance of Heartland theory in Contemporary world.
6. a) Critically examine the statement of Charles Darwin that 'Fringing reefs, Barrier reefs and Atolls are the successive stages of the development of coral reefs'. **(20)**
- b) Explain the formation of cyclonic storms "TITLI". Evaluate the significance of environmental education in disaster management. **(15)**
- c) Examine the dual impacts of Primate Cities. Supplement your answer with Indian examples. **(15)**
7. a) Explain the dynamics of soil formation and soil loss. Suggest some measures to mitigate the problem of soil degradation in hilly areas. **(20)**
- b) Elaborate the process of front formation. Draw out the main differences between Eddy and Polar theories. **(15)**
- c) Give an account of Pacific Ocean Currents. Highlight its influence on the monsoon mechanism of South Asia. **(15)**
8. a) "Huge populations of developing countries are not a curse. These may be and also are an asset, if situations are properly managed". Elaborate on this assertion. **(20)**
- b) Give an account of the structure of ecosystem and describe its functional aspects. **(15)**
- c) Compare the Subsidence and Glacial control theories on the formation of Coral reefs. **(15)**
-

Total No. of Printed Pages-3

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

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SECTION - A

1. Answer the following in about 150 words each:
 - a) Explain the sea-floor spreading and its impact. (10)
 - b) Discuss the applications of Geomorphology. (10)
 - c) What is an Index Fossil? Discuss the importance of Index fossil in stratigraphy. (10)
 - d) Discuss the water bearing characteristics of rocks. (10)
 - e) Explain the causes and effects of Earth quakes. (10)
2. a) Explain the Continental drift theory? What are the evidences will justify the theory. (20)
- b) Discuss the fundamental concepts of Geomorphology. (15)
- c) What is an aquifer? Explain the types of aquifers. (15)
3. a) Discuss the evolution of Archaeans with special reference to Dharwar Craton. (20)
- b) Explain in brief the ground water exploration methods. (15)
- c) Discuss the Physiographic divisions of India. (15)
4. a) What is a fault? Discuss the geometric classification of faults. (20)
- b) Discuss the geological parameters to be considered for the constructions of a Dam. (15)
- c) Application of GPS in Geology – Discuss the advantages. (15)

SECTION - B

5. Answer the following in about 150 words each:
 - a) Explain the origin of Trenches and Mid Oceanic ridges. (10)
 - b) Application of Remote sensing in Geology. (10)
 - c) What is a Joint? Explain the types of Joints. (10)
 - d) Write a brief note on the evolution of Himalayas. (10)
 - e) Discuss the vertical distribution of Groundwater. (10)

6. a) Write an essay on the Gondwana system and its economic significance. (20)
- b) Explain the engineering Properties of Rocks. (15)
- c) Write a brief note on Precambrian- Cambrian boundary. (15)
7. a) Discuss the types of Unconformities with neat sketches and their significance in stratigraphy. (20)
- b) Explain the geomorphology in relation to structures and lithology. (15)
- c) Discuss the Transmissivity and Storage Coefficient. (15)
8. a) Explain the methods of rain water harvesting. (20)
- b) Discuss the importance of GPS in Geology. (15)
- c) Explain the types of Drainage system with sketches. (15)

Total No. of Printed Pages-3

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

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SECTION-A

1. Mark the following places on the map supplied to you with a short note not exceeding 30 words on the places plotted by you: **(20×2.5=50)**

- i) Mohenjodaro
- ii) Burzahom
- iii) Inamgaon
- iv) Hampi
- v) Konark
- vi) Kot-diji
- vii) Arikamedu
- viii) Kaushambi
- ix) Talikota
- x) Nalanda
- xi) Amber
- xii) Mandu
- xiii) Kalibangan
- xiv) Fatehpur Sikri
- xv) Bijapur
- xvi) Aihole
- xvii) Sanchi
- xviii) Girnar
- xix) Ajanta
- xx) Tamralipti

2. a) To what extent archaeological materials are useful in understanding the progress of neolithic man in India? (25)
- b) Describe the social life of the people in the later Vedic period. Do you think it was different from the Rig-Vedic life? (25)
3. a) Analyse the nature of the Mauryan State and trace the features of its administrative system. (25)
- b) Give an account of the use of gold coins by common masses in the Gupta age. (25)
4. a) Assess the status of women in India from 4th century BC to 6th century AD. (25)
- b) Discuss the major stages in the evolution of architecture during the ancient period. (25)

SECTION-B

5. Write short notes in not more than **150** words in each of the following: (5×10=50)
 - a) Assess the value of *Rajtarangini* as a source of history.
 - b) Bhakti and sufism of Lal Ded emerged as a social force in Kashmir. Elucidate.
 - c) Estimate Jonaraja's account of the reign of Zain-ul Abidin.
 - d) Evaluate the Market control regulations of Alauddin Khalji as described by Ziauddin Barani.
 - e) The Portuguese monopolized their control over sea trade through the Cartaz system. Elucidate.
6. a) . Can we say that the Chola village assemblies were democratic in nature? Express your opinion with valied reasons. (25)
- b) Discuss the concept of Kingship as enunciated by Ghiyas-ud-din Balban and the modifications brought in by Alauddin Khalji. (25)
7. a) Emperor Akbar is considered exceptional for his religio-political ideals and policies. Critically analyse. (25)
- b) How was *Iqta* system of Delhi Sultanate different from the *Jagir* system of the Mughals? (25)
8. a) Estimate the impact of Sufi and Bhakti movements on vernacular languages and life and thought of common masses. (25)
- b) How would you like to characterize the eighteenth century in Indian History? (25)

Total No. of Printed Pages-4

Roll No. _____

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

Time Allowed - Three Hour

Maximum Marks-250

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SECTION - A

1. Answer the following questions in about 150 words each. (5×10=50)
 - a) Elucidate the 'original jurisdiction' of the Supreme Court of India.
 - b) What are the 'basic features' and their limits under the Constitution of India?
 - c) Discuss the powers of Parliament under Article 253 of the Constitution. Can it override the legislative powers as contained in the State List?
 - d) What is essential legislative function? Discuss 'delegated legislation' with the help of relevant case law.
 - e) Explain the rule against bias. Is this rule flexible enough to admit the circumstances of necessity?

2.
 - a) What is 'due process of law'? Examine this with reference to judicial interpretations that have widened horizons of Articles 14, 19 and 21 of the Indian Constitution. (20)
 - b) "The Indian Constitution is founded on the bedrock of the balance between Parts III and IV. To give absolute primacy to one over the other is to disturb the harmony of the constitution." Discuss this statement with the help of decided case law. (15)
 - c) Doctrine of separation of powers has not been recognized under the Indian Constitution in its absolute rigidity. Still the framers of the Constitution have meticulously defined the functions of various organs of the State. Do you agree with this balancing act? (15)

3.
 - a) Evaluate the principle of proportionality as a ground for judicial review of exercise of administrative discretion. (20)
 - b) What are the 'Parliamentary Privileges'? Discuss scope of these privileges with reference to the fundamental rights. (20)
 - c) What are the conditions under which a writ of 'certiorari' may be issued. (10)

4.
 - a) Critically evaluate the process, competence and limitations on the powers of the Parliament to amend the Constitution with reference to the decided case law. (20)
 - b) Examine the role, powers and functions of the Union Public Service Commission (UPSC). Has it served the original purpose envisaged by the framers of the Constitution. (20)
 - c) Write a short essay on the 'curative petition'? (10)

SECTION - B

5. Answer the following questions in about 150 words each. (5×10=50)
- a) Extradition is based upon the principle '*aut punier, aut dedere*'. Does it work in actual practice between sovereign states?
 - b) Is there a legal duty to recognize a newly formed state? Explain with reference to the theories of recognition.
 - c) What is the common heritage of mankind? Does it work under the Law of the Sea Convention?
 - d) Discuss the advisory opinion of the International Court of Justice (ICJ) in the *Legal Consequences of the Separation of the Chagos Archipelago from Mauritius*.
 - e) What is the fundamental change of circumstances under the law of treaties? Discuss with the help of concrete examples.
6. a) "International law is law as it works in actual practice between sovereign states". Explain with reference to the UK respecting sanctity of the Ecuadorean Embassy in London for the asylum granted to Julian Assange over seven long years. (20)
- b) Examine ICJ opinion on the *Legality of the Threat or Use of Nuclear Weapons*. Did the Court declare *non-liquet*? (15)
- c) "Not just rape out of control, but rape under orders". Discuss use of sexual violence against women as a weapon of war with reference to issues brought out by the awardees of the 2018 Nobel Peace Prize. (15)
7. a) "India taking up case of *Jadhav case* to the ICJ upholds majesty of International Law". How far India takes international law seriously as an instrument of policy? (15)
- b) What are the 'special procedures' of the Human Rights Council? Are they effective in the protection of human rights? (15)
- c) Examine the scope and functions of the mechanisms provided in the UN Charter for the peaceful settlement of international disputes with special reference to role of the Security Council. (20)

8. a) Examine the 'blueprint' for the prohibition of threat or use of force under the UN Charter. Do series of terror pin-pricks constitute a ground for the exercise of right of self-defense by a state through swift surgical strikes against terror launch pads? (20)
- b) Discuss role of the UN General Assembly protect and improve the global environment through the global conferencing technique. (15)
- c) Discuss reasons for recent controversies arising from the exercise of jurisdiction by International Criminal Court (ICC). Is the ICC facing a crisis of its survival? (15)
-

Total No. of Printed Pages-4

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

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- 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.*
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- vi) No blank page be left in between answer to various questions*

SECTION-A

1. Answer the following questions in about 150 words each: **(5×10=50)**
- a) i) Explain the salient features of the systems approach to management? **(5)**
ii) Point out the relative merits and demerits of 'tall' and 'flat' structure in organizations. **(5)**
 - b) i) Explain Likert's four styles of leadership. Which of these styles is best suited for modern day organizations? **(3)**
ii) Differentiate Locus of Control from Machiavellianism. **(3)**
iii) What do you mean by bounded rationality? What are the factors that lead to bounded rationality and satisfying decisions? **(4)**
 - c) Explain the process of conflict. What are the levels of conflicts in organizational life? **(10)**
 - d) "Tests often do not reflect an individual's true ability". What are your views on this statement? **(10)**
 - e) What are the characteristics of an ideal system of wage payments? What are the methods of wage payment? **(10)**
2. a) What is job design? Explain the significance, components and methods of Job Analysis. **(15)**
- b) Define an ethical dilemma. Explain four managerial interventions to ensure ethical conduct. Are values and ethics same? If not, state the differences between both. **(15)**
- c) What are the stages of communication? What are the barriers that check effective communication? How can these barriers be overcome? What are the types of communication? **(20)**
3. a) Explain the need for human resource Research and its process. **(10)**
- b) Define the term human resource records explain the different types of human resource records. **(20)**
- c) Define Industrial Relations. Explain the necessary conditions for the maintenance of good Industrial Relations. Explain the Dunlop model of Industrial relations. **(20)**

4. a) Why is planning regarded as a primary function of management? Distinguish between strategy, objectives, and goals. Explain the steps in the planning process. (20)
- b) What are values? How do they differ from attitudes? (15)
- c) Describe the Traits methods of Performance Appraisal. (15)

SECTION-B

5. Answer the following questions in about 150 words each:
- a) Explain the term Management accounting and state the objectives of Management accounting. How is Management Accounting different from Financial Accounting and Cost Accounting? (10)
- b) What is meant by zero based budgeting? What are the different steps involved in it and how is it useful to the business? (10)
- c) What are the common strategies practiced by organisations for building customer relationships? (10)
- d) What is target marketing? What are the different levels of target marketing?(10)
- e) Explain the methods of inventory valuation. (10)
6. a) A transport company is interested in measuring its cost of specific types of capital as well as overall capital cost. The finance department of the company indicates that the following costs would be associated with the sale of debentures, preference shares and equity shares. The corporate tax rate is 55%.

Debentures: The company can sell 15 year 10% debentures of the face value of Rs. 1000 for rupees 970. In addition and underwriting fee of 1.5% of the face value would be incurred in this process.

Preference shares: 12% preference shares having a face value of Rs. 100 can be sold at a premium of 10% An underwriting fee of rupees 2 per share is to be paid to the underwriters.

Equity shares: The company's equity shares are currently selling for Rs. 125 per share. The firm expects to pay Rs. 15 per share at the end of the coming year. Its dividend payments over the past 6 years per share are given below:

Year	Dividend (Rs.)
1	10.60
2	11.24
3	11.91
4	12.62
5	13.38
6	14.19

It is expected that the new equity shares can be sold at Rs. 123 per share. The company must also pay Rs. 3 per share as underwriting fee.

(35)

(3)

[Turn Over

Market and book values for each type of capital are as follows:

	Book Value Rs.	Market Value Rs.
Long term debt	18,00,000	19,30,000
Preference Shares	4,50,000	5,20,000
Equity Shares	60,00,000	100,00,000
Retained Earnings	15,00,000	
	<u>97,50,000</u>	<u>124,50,000</u>

- i) Calculate the specific cost of each source of financing. (15)
- ii) Determine the weighted average cost of capital using (1) book value weights and (2) market value weights. (5)
- b) Define market segmentation. Explain the basis for segmentation. (15)
- c) What are the accounting concepts and conventions? Explain them. (15)
7. a) What is a cash flow statement? What are its components? Differentiate between fund flow and cash flow statements. (15)
- b) Describe the Product Life Cycle, its characteristics and the marketing strategies adopted at each stage. (15)
- c) A company is contemplating three mutually exclusive projects A B and C. The projects are expected to each require Rs. 2,00,000, have an estimated life of 5 years, 4 years and 3 years respectively, and have no salvage value. The company's required rate of return is 10%. The anticipated cash flows after taxes (CFAT) for the 3 projects are as follows:

Year	CFAT (Rs.)		
	A	B	C
1	50,000	80,000	1,00,000
2	50,000	80,000	1,00,000
3	50,000	80,000	10,000
4	50,000	30,000	-----
5	1,90,000	-----	-----

- i) Rank each project applying the methods of Payback Period, Average Rate of Return, Net Present Value, Internal Rate of Return and Profitability Index.
- ii) Explain the reasons for conflict between NPV and IRR.
- iii) Recommend the project to be adopted and give reasons. (10+7+3)
8. a) Discuss the NI and NOI theories of capital structure. (15)
- b) What do you understand by Zero Based Budgeting? Is it different from Performance Budgeting and Traditional Budgeting? What are the types of Budgets? (15)
- c) Discuss the pricing strategies adopted by companies. Explain the 5 C's framework for pricing decisions. (20)

Total No. of Printed Pages-4

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

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SECTION-A

1. a) Find the orthogonal trajectories of the family of curve $3xy = x^3 - a^3$, where a being parameter of the family. (10)
- b) Show that the mapping $T:V_3(\mathbb{R}) \rightarrow V_2(\mathbb{R})$ defined as $T(a_1, a_2, a_3) = (3a_1 - 2a_2 + a_3, a_1 - 3a_2 - 2a_3)$ is a linear transformation from $V_3(\mathbb{R})$ into $V_2(\mathbb{R})$. (10).
- c) Draw the graph of $y = |x-1| + |x-2|$ in the interval $[0,3]$ and discuss the continuity and differentiability of the function in this interval. (10)
- d) If $\vec{r} = xi + yj + zk$, then prove that $\phi = 1/r$ is a solution of Laplace's equation. (10)
- e) Two spheres of radii r_1 and r_2 cut orthogonally, then prove that the radius of common circle is $\frac{r_1 r_2}{\sqrt{r_1^2 + r_2^2}}$ (10)
2. a) Trace the curve $x^3 + y^3 = 3axy$ (15)
- b) Find solution of the following Cauchy-Euler equation: (15)
- $$\left[(3x+2)^2 D^2 + 3(3x+2)D - 36 \right] y = 3x^2 + 4x + 1.$$
- c) Let T be the linear operator on \mathbb{R}^3 defined by (20)
- $$T(x_1, x_2, x_3) = (3x_1 + x_3, -2x_1 + x_2, -x_1 + 2x_2 + 4x_3)$$
- What is the matrix of T in the ordered basis $(\alpha_1, \alpha_2, \alpha_3)$ where $\alpha_1 = (1, 0, 1), \alpha_2 = (-1, 2, 1)$ and $\alpha_3 = (2, 1, 1)$?
3. a) Curve $y^2(a+x) = x^2(3a-x)$ revolved about the x-axis, find the volume of the solid generated by the loop. (15)

(37)

(2)

b) Find the eigen values of the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and verify Cayley- Hamilton theorem for the matrix A . Find inverse of the matrix A and also express $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ as a linear polynomial in A . (15)

c) Show that the shortest distance between the lines

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}; \frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5} \text{ is } \frac{1}{\sqrt{6}} \text{ and the equation of the line of shortest distance are } \frac{6x-10}{1} = \frac{3y-9}{-1} = \frac{6z-26}{1}. \quad (20)$$

4. a) For what values of n the equations $x + y + z = 1$, $x + 2y + 4z = n$, $x + 4y + 10z = n^2$ are consistent and solve them completely in each case. (15)

b) Show that the plane $8x - 6y - z = 5$ touches the paraboloid $3x^2 - 2y^2 = 6z$ and find the coordinates of the point of contact. (15)

c) Evaluate $\iint (x+y)^2 dx dy$ over the area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (20)

SECTION-B

5. a) Solve: $(x+y)^2 (dy/dx) = a^2$ (10)

b) Find constant a, b, c so that $\vec{F} = (x+2y+az)i + (bx-3y-z)j + (4x+cy+2z)k$ is irrotational. Also, show that \vec{F} can be expressed as the gradient of a scalar point function. (10)

c) Using the concept of inverse Laplace transform, prove that

$$L^{-1} \left\{ \tan^{-1} \frac{2}{s^2} \right\} = \frac{2}{x} \sin x \cdot \sinh x. \quad (10)$$

d) Find the point $P(x, y, z)$ on the plane $2x + y - z = 5$ that is closest to the origin. (10)

- e) A particle moving with simple harmonic motion in a straight line has velocities v_1 and v_2 at distance x_1 and x_2 respectively from the centre of its path. Find the period of its motion. (10)
6. a) Prove that every square matrix is uniquely expressible as the sum of a symmetric and a skew symmetric matrix. (15)
- b) Find the angle between the surfaces $z = x^2 + y^2$ and $z = \left(x - \frac{\sqrt{6}}{6}\right)^2 + \left(y - \frac{\sqrt{6}}{6}\right)^2$ at the point $P = \left(\frac{\sqrt{6}}{12}, \frac{\sqrt{6}}{12}, \frac{1}{12}\right)$. (15)
- c) Using Laplace transform solve the following initial value problem: (20)
- $$(D^2 + n^2)y = a \sin(nx + \alpha), \quad y(0) = y'(0) = 0.$$
7. a) Find the equation of the cone with vertex (α, β, γ) and touching the surface $ax^2 + by^2 + cz^2 = 1$. (15)
- b) Solve: $(D^2 - 1)y = \cosh x \cos x$ (15)
- c) Four rods are joined to form a parallelogram, the opposite points are joined by strings forming diagonals and the whole system is placed on a smooth table. Show that their tensions are in the same ratio as their lengths. (20)
8. a) A particle is thrown over a triangle from one end of a horizontal base and grazing the vertex falls on the other end of the base. If A and B be the base angles and α the angle of projection, then prove that $\tan \alpha = \tan A + \tan B$. (15)
- b) Apply the method of variation of parameters to solve the equation $(x+2)\frac{d^2y}{dx^2} - (2x+5)\frac{dy}{dx} + 2y = (x+1)e^x$. (15)
- c) Verify Green's theorem in the plane for $\int_C [(3x^2 - 8y^2)dx + (4y - 6xy)dy]$ Where C is the boundary of the region defined by $y = \sqrt{x}; y = x^2$. (20)

Total No. of Printed Pages-8

Roll No. _____

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

<i>Time Allowed - Three Hours</i>	<i>Maximum Marks-250</i>
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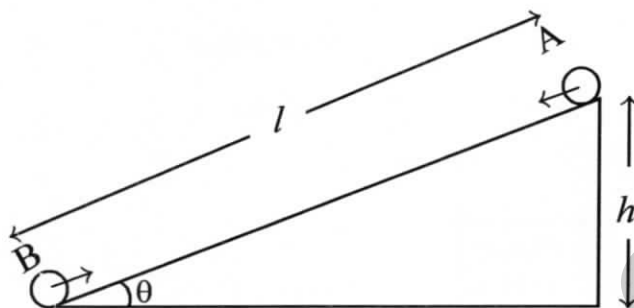
INSTRUCTIONS

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

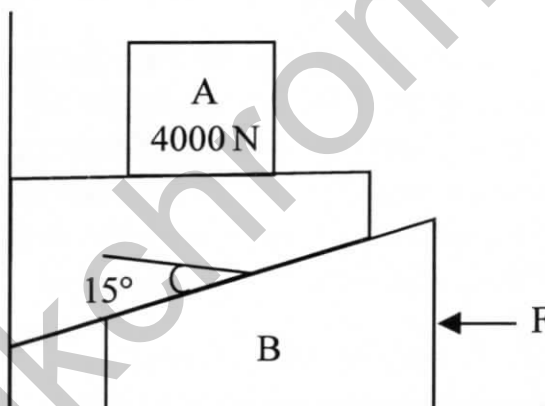
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- iv) Diagrams/Figures, wherever required shall be drawn in the space provided for answering the question itself.*
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SECTION-A

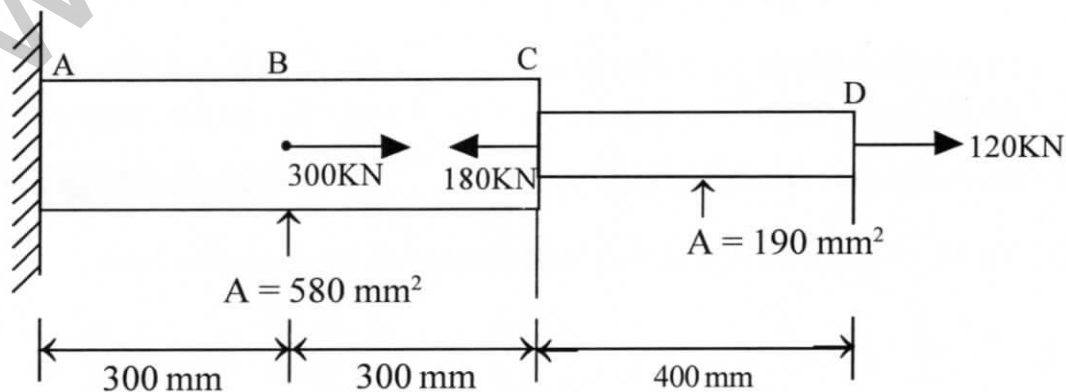
1. a) Body A is released from rest at the top of a smooth inclined plane and at the same instant body B is projected upward from the foot of the plane with such a velocity that they meet halfway up the plane. Determine: (10)
- The velocity of projection and
 - The velocity of each body when they meet.



- b) Determine the horizontal force F required for wedge B to raise block A of weight 4000N as shown in Fig. The coefficient of friction is 0.2 for all surfaces of contact. (10)



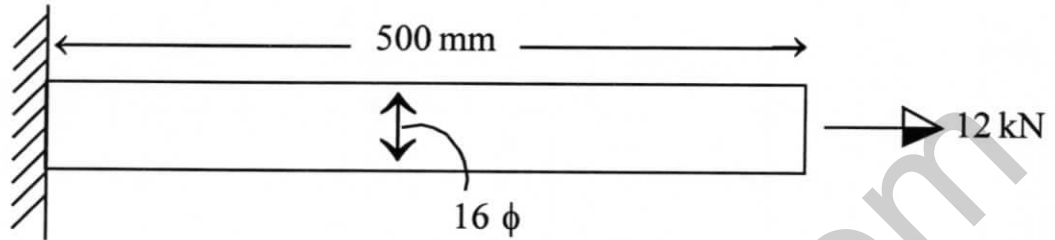
- c) Determine the deformation of the steel rod shown in Fig under the given loads. ($E=200\text{GPa}$) (10)



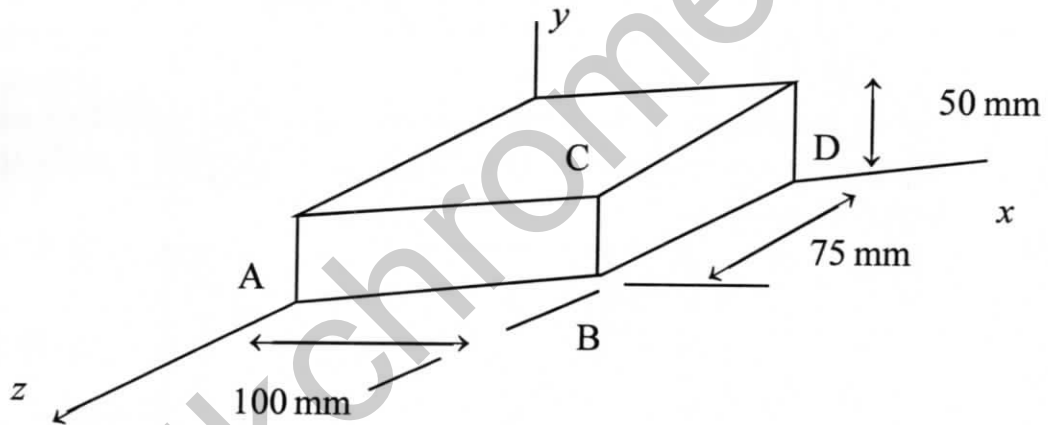
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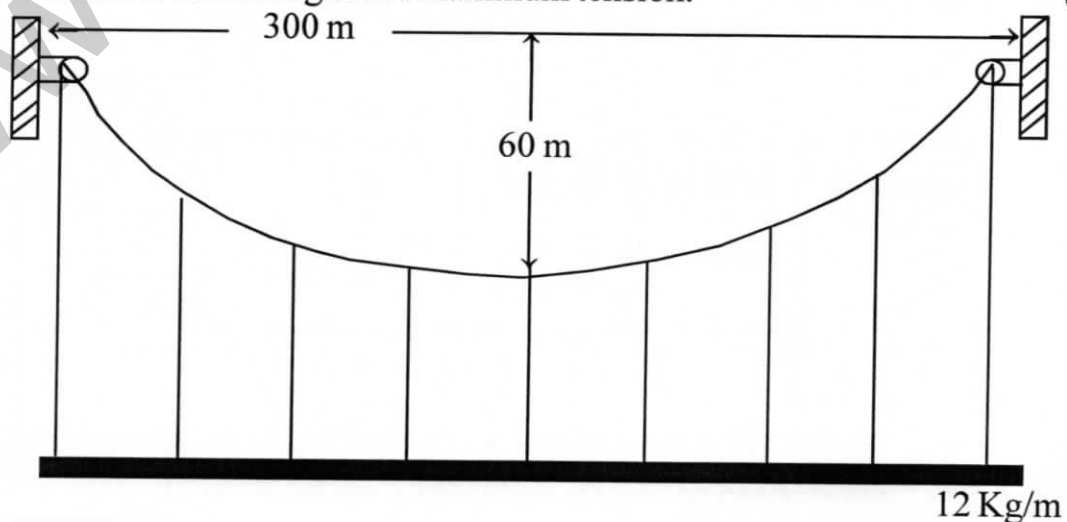
- d) i) The steel rod shown in Fig with 500mm long, 16mm diameter made of a homogenous isotropic material is observed to increase in length by $300 \mu\text{m}$ and to decrease in diameter by $2.4 \mu\text{m}$ when subjected to an axial 12kN load. Determine the modulus of elasticity and Poisson's ratio of the material. (5)



- ii) The Steel Block is subjected to a uniform pressure on all its faces. Knowing that the change in length of edge AB is $-30 \times 10^{-3} \text{ mm}$ determine
 I) The change in length of the other two edges and
 II) The pressure p applied to the faces of the block.
 Assume $E=200 \text{ GPa}$ and $\nu = 0.29$ (5)



- e) Calculate the atomic packing factor (APF) for the BCC unit cell, assuming the atoms to be hard spheres. (10)
2. a) A rope supports a mass of 12 Kg/m of horizontal length and is suspended between the two points on the same level 300m apart. If the sag is 60m; Find the tension at mid length and maximum tension. (20)

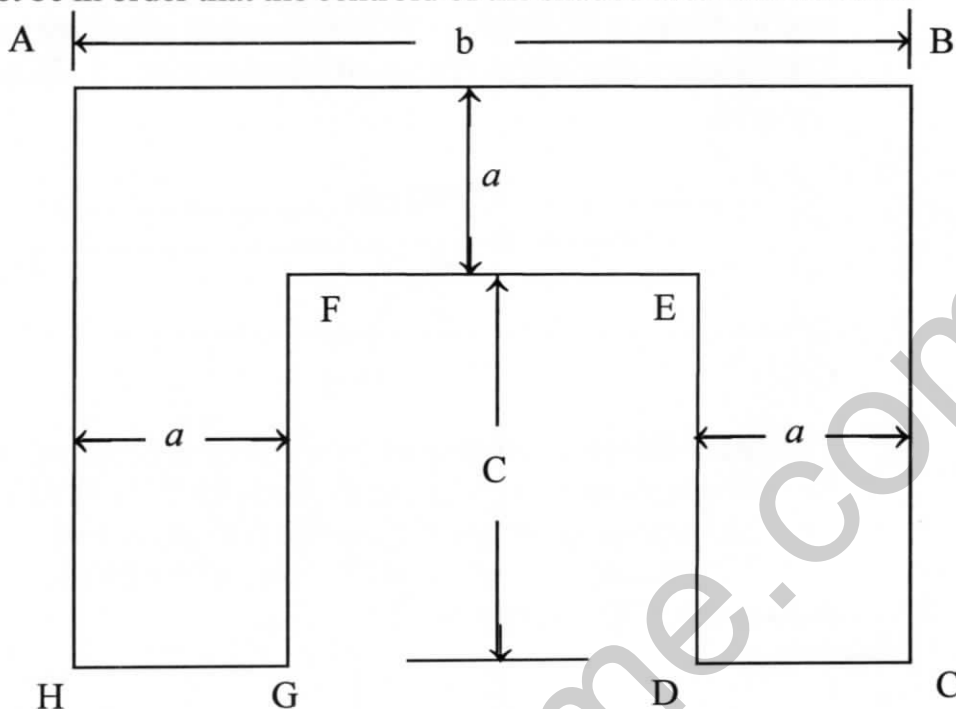


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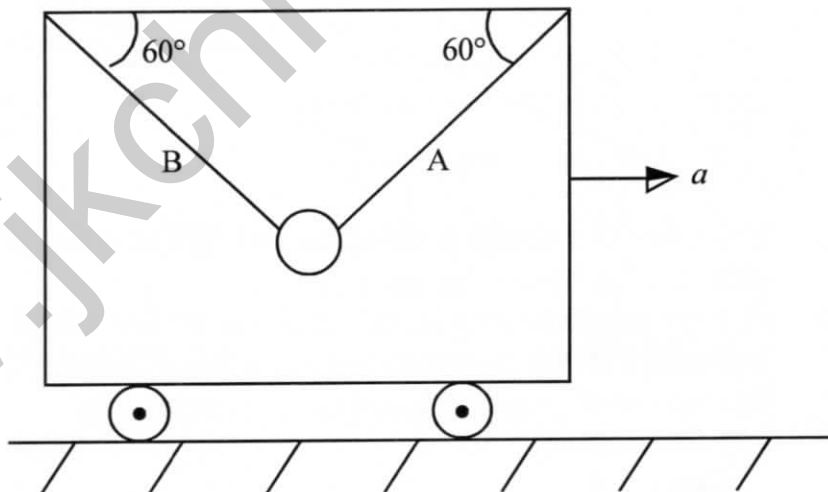
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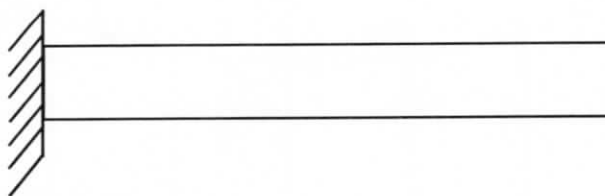
- b) If the dimensions a and b of the plane fig are fixed, find what the dimension c must be in order that the centroid of the shaded area will lie on EF (15)



- c) A ball is suspended from the accelerating frame by the two cords A and B . Determine the acceleration a of the frame which will cause the tension in A to be twice that in B . (15)

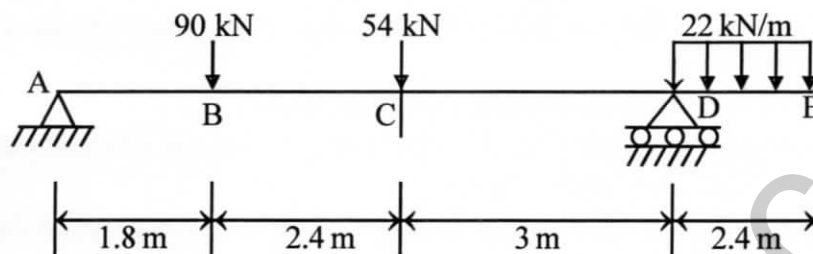


3. a) A hollow cylindrical steel shaft is 1.5m long and has inner and outer diameters respectively equal to 40 and 60mm

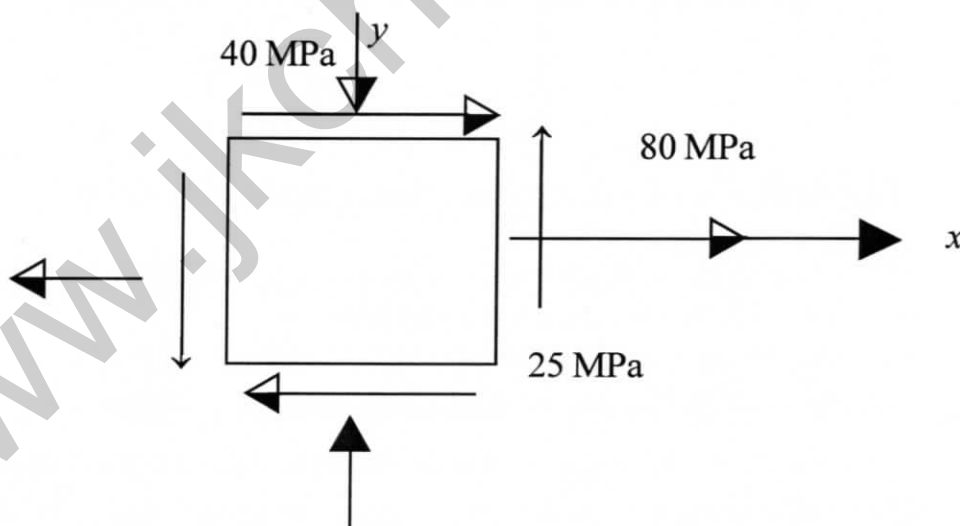


- i) What is the largest torque that can be applied to the shaft if the shearing stress is not to exceed 120MPa?

- ii) What is the corresponding minimum value of the shearing stress in the shaft?
- iii) What torque should be applied to the end of the shaft to produce a twist of 2° ? Use the value of $G=77\text{GPa}$ for the modulus of rigidity of steel.
- iv) What angle of twist will create a shearing stress of 70MPa on the inner surface of the hollow steel shaft. **(4×5=20)**
- b) Draw the shear and bending moment diagrams for the beam and loading shown in figure. **(15)**



- c) The state of plane stress shown occurs at a critical point of a steel machine component. As a result of several tensile tests, the tensile yield strength is $\sigma_y = 250\text{MPa}$ for the grade of steel used. Determine the factor of safety with respect to yield using **(15)**
- i) The maximum-shearing stress criterion.
- ii) The maximum-distortion-energy criterion.

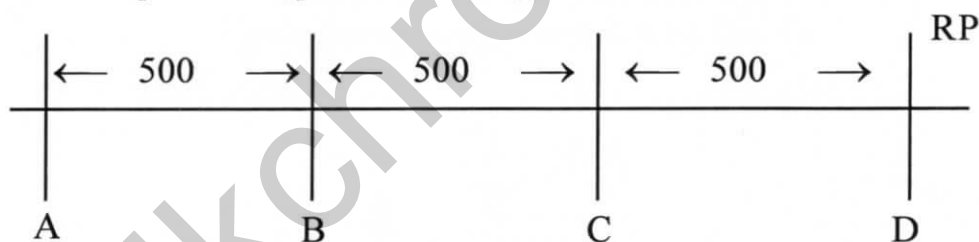


4. a) i) Draw Iron-Iron carbide phase diagram where by showing temperatures and various phases neatly.
- ii) A 0.40% C hypoeutectoid plain-carbon steel is slowly cooled from 940°C to a temperature just slightly above 723°C .
- Calculate the weight % austenite present in the steel
 - Calculate the weight % proeutectoid ferrite present in the steel. **(20)**

- b) Compare Precipitation hardening and the hardening of steel by quenching and tempering and with regard to
- The total heat-treatment procedure
 - The microstructures that develop
 - How the mechanical properties change during the several heat treatment stages. **(15)**
- c) A continuous and aligned glass fiber-reinforced composite consists of 40 vol% of glass fibers having a modulus of elasticity of 69GPa (10×10^6 psi) and 60 vol% of a polyester resin that, when hardened, displays a modulus of 3.4 GPa (0.5×10^6 psi)
- Compute the modulus of elasticity of this composite in the longitudinal direction.
 - If the cross-sectional area is 250mm^2 and a stress of 50MPa is applied in this longitudinal direction, Compute the magnitude of the load carried by each of the fiber and matrix phases.
 - Determine the strain that is sustained by each phase when the stress in part(ii) is applied. **(15)**

SECTION-B

5. a) Four masses A,B,C and D carried by a rotating shaft at radii 80mm,100mm,160mm and 120mm respectively are completely balanced masses B,C and D are 8kg, 4kg and 3kg respectively. Determine the mass A and the relative angular positions of the four masses if the planes are spaced 500mm a part. **(10)**



- b) i) Define the terms tolerance, limits and fit with reference to the dimensional measurement.
- ii) Define the different types of tolerance specification methods. Compare their specific applications with examples **(2×5=10)**
- c) In a machining operation that approximates orthogonal cutting. The cutting tool has a rake angle $= 10^\circ$. The chip thickness before the cut $t_0 = 0.50\text{mm}$ and the chip thickness after the cut $t_c = 1.125\text{mm}$. Calculate the shear angle and shear strain in the operation. Further, cutting force and thrust force are measured during an orthogonal cutting operation with values: $F_c = 1559\text{N}$ and $F_t = 1271\text{N}$. The width of the orthogonal cutting operation is $w = 3.0\text{mm}$. Determine the shear strength of the work material. **(10)**
- d) i) Compare Agile Manufacturing with mass production
- ii) Compare Agile Manufacturing with lean production. **(2×5=10)**
- e) i) What are the major categories of quality costs? Explain each of them and give examples
- ii) What is the difference between quality control and quality improvement. Discuss the role of management in each of these settings **(2×5=10)**

6. a) The following data relate to a shaft held in long bearings.

Length of shaft=1.2m

Diameter of shaft=14m

Mass of a rotor at midpoint=16kg

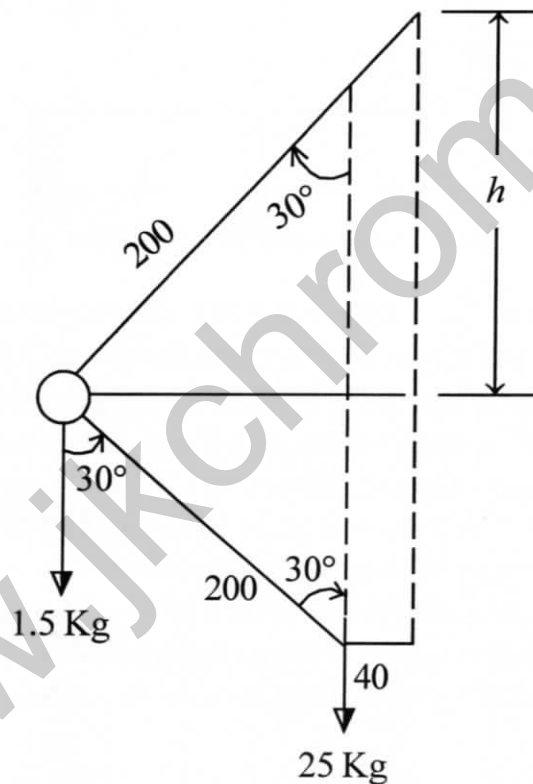
Eccentricity of centre of mass of rotor from centre of rotor=0.4mm

Modulus of elasticity of shaft material =200GN/m²

Permissible stress in shaft material=70×10⁶N/m²

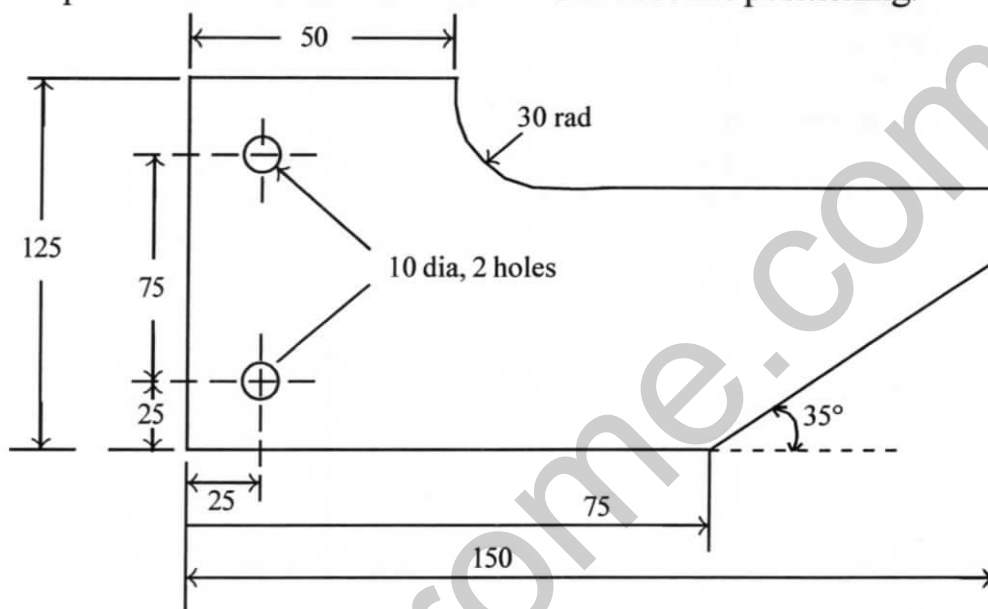
Determine the critical speed of the shaft and the range of speed over which it is unsafe to run the shaft. Assume the shaft to be massless. (20)

- b) Each arm of a porter governor is 200mm long and is hinged at a distance of 40mm from the axis of rotation. The mass of each ball is 1.5kg and the sleeve is 25 kg. When the links are at 30° to the vertical, the sleeve begins to rise at 260rpm. Assuming that the friction force is constant, find the maximum and minimum speeds of rotation when the inclination of the arms to the vertical is 45° (15)



- c) In a single-degree damped vibrating system, a suspended mass of 8kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine the
- Stiffness of the spring
 - Logarithmic decrement
 - Damping factor
 - Damping coefficient
- (15)

7. a) The Orthogonal cutting of steel is done with 10° rake tool with a depth of cut of 2mm and feed rate of 0.20 mm/rev. The cutting speed is 200m/min. The chip thickness ratio is 0.31. The vertical cutting force is 1200N and the horizontal cutting force is 650N. Calculate from the merchant's theory the various work done in metal cutting and shear stress. (20)
- b) The outline of the part in figure given below is to be profile milled, using a 20mm dia end mill with two teeth. The part is 10mm thick cutting speed=125 mm/min and feed=0.10mm/tool. Write the part program in the world address format with TAB separation and variable work order. Use absolute positioning. (15)



- c) Give a comparison of the unconventional processes in terms of process, material-removal rate and applications. Explain the principle of ECM with a neat sketch. (15)
8. a) The purchasing manager of a distillery company is considering. Three sources of supply for Oak barrels. The first supplier offers any quantity of barrels at Rs.150 each. The second suppliers offers barrels in lots of 150 or more at Rs.125 per barrel. The third supplier offers barrels in lots of 250 or more at Rs.100 each. The distillery uses 1500 barrels a year at a constant rate carrying costs are 40% and it costs the purchasing company Rs.400/- to place an order. Calculate the total annual cost for the orders placed to the probable suppliers and find out the supplier to whom the orders should be placed. (20)
- b) The information regarding jobs to be scheduled through one machine is given below.
- | Job : | A | B | C | D | E | F | G |
|------------------------|----|----|----|----|----|---|---|
| processing time(days): | 4 | 12 | 2 | 11 | 10 | 3 | 6 |
| Due date (days) : | 20 | 30 | 15 | 16 | 18 | 5 | 9 |
- i) What is the first come, first served (FCFS) schedule
 ii) What is the shortest processing time (SPT) Schedule
 iii) What is the slack time remaining (STR) Schedule.
 iv) What is the earliest due date (EDD) Schedule.
 v) What are the mean flow times for each of the Schedules above? (5×3=15)
- c) The control limits of an \bar{x} chart for gun shells with $n=5$ are 17.28 and 18.42. The specs are 17.1 ± 1.1 mm If a shell falls below 16.0, it must be scrapped and then the loss is very high. If it falls above 18.2 it may be further machined. Where do you suggest the target process mean to set? and why? (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

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SECTION - A

1. a) Briefly describe the pharmacotherapy for (3×5=15)
- i) HIV post-exposure prophylaxis
 - ii) MDR tuberculosis
 - iii) Malaria in third trimester of pregnancy
- b) 20-day old neonate presented with persistent jaundice, lethargy and poor feeding. His biochemical analysis showed a unconjugated hyperbilirubinemia and absence of bilirubin in urine. There was a family history of consanguinity, but the parents were asymptomatic. What can be the possible cause of this disorder and what tests will be done to confirm the same? How can this disorder be managed? (15+5)
- c) What are the chief sources of calcium in the diet ? How is calcium absorbed from the diet into the body? What is the function of intracellular calcium? (3+4+8)
2. a) what is DNA fingerprinting? Explain its underlying principle and two uses in medical science. (3+7)
- b) Describe knee joints under the following headings (3×5)
- i) Blood supply
 - ii) Nerve supply
 - iii) Ligaments
- c) Define Tidal volume, Inspiratory reserve volume, Total Lung capacity , Vital capacity. (15)
- d) Explain briefly about the physiology of ovulation. (10)
3. a) Differentiate the following: (3×10)
- i) Elastic, Hyaline and Fibrocartilage
 - ii) Osteocytes, Osteoblasts and Osteoclasts
 - iii) Gap junction, Tight junction and Desmosomes
- b) Discuss cerebellum under following orders:
- i) Types of cells found in cerebellum (5)
 - ii) Composition of cerebellum peduncles (10)
 - iii) Connections of spinocerebellum (5)

4. a) i) What is the composition of surfactant? (5+10+5)
- ii) Describe in detail the role it plays in Lung function in a normal Individual.
- iii) Write a Short note on Surfactant Dysfunction Disorders.
- b) i) Which are the two starting components in synthesis of Heme. Explain Heme Metabolism. (2+10)
- ii) Mention the various types of Porphyrias occurring due to the defect of respective enzymes. (8)
- c) How is the metabolism of Glycogen regulated in the muscle and in the Liver. (5+5)

SECTION - B

5. a) Discuss briefly the mechanism of action and uses of (3×5=15)
- i) Carbamazepine
- ii) Furosemide
- iii) Metformin
- b) i) What are the methods to diagnose HIV in the window period. (5)
- ii) Mention briefly about the Lab Diagnosis of HIV. (10)
- iii) Write down the various classes of drugs available, mechanism of action, with examples. (20)
6. a) i) What are the various methods to diagnose rabies infection. Explain the Lab diagnosis of Rabies. (10)
- ii) Write a note on the molecular structure of rotavirus and its implications on vaccine production. (10)
- iii) First aid for dog bite. (10)
- b) How is Vitamin D synthesized and activated? What are its primary sites of action. (10)
- c) Describe the Anatomy of Brachial plexus injury with a schematic diagram (10)

7. a) i) Explain the role of P53 in cell cycle control (10)
- ii) Explain with diagram the molecular mechanism of metastasis. (10)
- b) i) What are the features of reversible and irreversible cell death on gross, light microscopy and electron microscopy. (5+5+5)
- ii) Explain with example, Autosomal dominant, Autosomal recessive and X linked recessive inheritance. (5+5+5)
8. a) Write Short note on: (4×5=20)
- i) Run Amok
- ii) Cocaine Bugs
- iii) Lucid interval
- iv) Res ipsa loquitor
- b) Differentiate between poisonous and non-poisonous snakes. (10)
- c) Differentiate between:
- i) Th1 and Th2 response (5)
- ii) CMI and humoral immunity (10)
- iii) Type 1 and Type 4 hypersensitivity reaction (5)
-

Total No. of Printed Pages-2

Roll No. _____

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

Time Allowed - **Three Hours**

Maximum Marks-**250**

INSTRUCTIONS

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SECTION - A

1. a) What is the relationship between mind and body in Spinoza's philosophy? (10)
- b) Discuss Hegel's Master-Slave Dialectics. (10)
- c) Discuss the epistemological relevance of Locke's idea of *Tabula Rasa*. (10)
- d) Why does the question 'Does God Exist?' become meaningless in Logical Positivist perspective? (10)
- e) Discuss Strawson's idea of 'Persons' (10)
2. a) How does the idea of authenticity differ in Sartre's and Kierkegaard's thought? (20)
- b) What is the difference between Early & Later writings of Wittgenstein? (15)
- c) Why did Berkeley hold that everything exists in mind? Discuss his arguments. (15)
3. a) How does Hegel respond to Cartesian Dualism? (20)
- b) Discuss Kant's critique of proofs for the Existence of God. (15)
- c) Critically evaluate Descartes' dream conjecture. (15)
4. a) How does Husserl's 'Cartesian Meditations' take forward the Cartesian project? Discuss the relevance of the 'Transcendental Ego' in Husserl's thought. (20)
- b) What is Plato's 'Allegory of the Cave'? What is its epistemological significance? (15)
- c) If knowledge is conceived as Justified True Belief, then, critically evaluate perception, reason, and testimony as ways of justification and their fallibility. (15)

SECTION - B

5. a) How does the *Charvaka* philosophy reject inference and testimony? (10)
- b) Discuss the five good habits that constitute *niyama*. (10)
- c) Discuss *Moksha* according to the *Visistadvaita* school of Vedanta (10)
- d) Discuss the Problem of God in *Sankhya* philosophy. (10)
- e) Discuss how the *Mimamsika* metaphysics is pluralist and realist. (10)
6. a) Discuss the different levels of consciousness as proposed by Sri Aurobindo. (20)
- b) Discuss the three myths about Indian Philosophy as explained by Daya Krishna. (15)
- c) Discuss the critique of metaphysics as proposed by the *Charvaka* philosophy. (15)
7. a) How does Madhavacharya explain the relation between *Jiva*, *Jagat*, and *Brahm*? How is liberation possible in his view? (20)
- b) Discuss *Saptabhanginaya* as proposed by the *Jaina* Philosophy. (15)
- c) Briefly discuss *vada*, *jalpa*, *vitanda*, *hetvabhasa*, and *chala*. (15)
8. a) Discuss the idea of liberation of any four *Darshanas* of Indian Philosophy. (20)
- b) How would *Sunyavadins*, *Vijnanavadins*, and *Sarvashtivadins* respond to the question 'Is there any reality at all, mental or non-mental?' (15)
- c) Discuss the five principal theories of *Khyativada*. (15)

Total No. of Printed Pages-4

Roll No. _____

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

<i>Time Allowed - Three Hours</i>	<i>Maximum Marks-250</i>
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INSTRUCTIONS

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SECTION-A

1. a) A bullet is fired Horizontally in North direction with a velocity of 500 m/sec 30° N latitude. Calculate the horizontal component of Coriolis acceleration and the consequent deflection of the bullet as it hits a target 250 m away. (10)
- b) Obtain an expression for *time dilation* in regard to the time interval between two events measured from the two different inertial frames? (10)
- c) A 200 mm long tube containing 48 cm^3 of sugar solution produces an optical rotation of 11° when placed in a Sacchrimeter. If the specific rotation of sugar solution is 66° , calculate the quantity of sugar contained in the tube in the form of a solution. (10)
- d) Use Matrix method to obtain an expression for the focal length of a coaxial combination of two thin lenses having focal lengths f_1 and f_2 separated by distance d in a medium of refractive index μ . (10)
- e) A flat circular disc of mass 0.05 Kg and diameter 0.02m roll on its edge on a smooth horizontal surface with a velocity of 0.05 m/sec. Calculate its total kinetic energy? (10)
2. a) Consider a spherical shell of mass M and radius R. Estimate the Gravitational Potential and Field due to this Spherical Shell at a point (20)
 - i) Outside the shell ($r > R$) and
 - ii) Inside of the shell ($r < R$).
- b) Obtain an expression for path difference between the beam components from mirrors M_1 and M_2 while rotating the arms of instrument through 90° in Michelson - Morley experiment? What is the significance of the *null result*? (20)
- c) A Venturimeter has a pipe diameter of 0.2 m and a throat diameter 0.15m. The levels of water column in the two limbs differ by 0.1m. Calculate the amount of water discharged through the pipe in one hour. (10)
3. a) A damped oscillator is subjected to a damping force proportional to its velocity, Set up the differential equation of the oscillation. Discuss the under-damped, over-damped and critical damped motions of the oscillator. (20)
- b) What are Fresnel half period zones? Show that the resultant amplitude at a point due to whole wave-front is equal to half of the amplitude due to first half period zone only. (20)

- c) A thin equi-convex lens of focal length 4m and refractive index 1.50 rests on and in contact with an optically flat glass surface, and using light of 5460 \AA . Newton's rings are viewed normally by reflection. What is the diameter of 5th bright ring? (10)
4. a) Why Einstein proposed Stimulated emission process? Obtain the relations between *Einstein Coefficients*? (20)
- b) Explain the terms *Streamline motion and rate of flow of fluid*? Obtain *Poiseuille's* equation for a viscous fluid flowing through a narrow tube of radius r and length l ? (20)
- c) In the spectrum of diffraction grating used for Normal incidence, Green line ($\lambda = 5400 \text{ \AA}$) in some order coincide with the next higher order of Violet line ($\lambda = 4050 \text{ \AA}$). If the angle of diffraction is 30° , Find the grating element and number of lines/cm. (10)

SECTION-B

5. a) A positive charge of $1 \mu\text{C}$ is placed at the point defined by the vector $r_1 = 3j$. A negative charge of the same magnitude is placed at the point defined by $r_2 = -3j$. Calculate the potential at a point defined by the position vector $r = 8i + 3j$. (10)
- b) State and explain Lenz's law? Does it contradict the law of conservation of energy? (10)
- c) What is Poynting Vector? Derive an expression of Poynting vector? (10)
- d) A conductor is allowed to have current through it as 10 amp for 1 sec at 27°C .
- Find the change in Entropy of conductor.
 - Find the change in Entropy of universe. (10)
- e) Using Maxwell - Boltzmann distribution law prove that there cannot be any negative absolute temperature. (10)
6. a) i) Explain the reason for formation of Domain structure in Ferromagnetism and how the Hysteresis curve is explained on the basis of Domain theory. (10)
- What is the *Energy Product* in hysteresis curve? (5)
 - The area of hysteresis loop drawn between B and H is 100 cm^2 . Each unit of space along the vertical axis represent 0.01 W/m^2 and that each space along the horizontal axis represents 40 A/m . Determine hysteresis loss per cycle? (5)

- b) Give detailed theory of L-C-R series circuit carrying alternating current and explain resonance condition. (20)
- c) A long solenoid having 1000 turns per cm carries an alternating current of peak value 1 amp. A search coil having a cross-sectional area of 10^{-4} m^2 and 20 turns is kept in the solenoid so that its plane is perpendicular to axis of solenoid, the search coil registered peak voltage $2.5 \times 10^{-2} \text{ V}$. Find frequency of current in the solenoid? (10)
7. a) Explain distribution of energy and *ultraviolet catastrophe* in a *blackbody spectrum*? Obtain the *plank's law of radiation* in terms of wavelength? (20)
- b) Explain the Four thermodynamic relations of Maxwell, Using the same, obtain Clausius-Clapeyron equation $\frac{dp}{dT} = \frac{L}{T(V_2 - V_1)}$ (20)
- c) Determine the field at the point located at the centre P of the semi-circular section of the hairpin bend shown in the figure. (10)



8. a) Deduce the expressions for Bose-Einstein and Fermi Dirac distribution functions? (20)
- b) Explain *Volume correction*, *Pressure correction* and constants *a* & *b* in Van der Wall equation? (15)
- c) Two reversible heat engines A and B are arranged in series, A rejecting heat directly to B. Engine A receives 200kJ at a temperature of 421°C from a hot source, while engine B is in communication with a cold sink at a temperature of 4.4°C .

If the work output of A is twice that of B find

- i) The intermediate temperature between A and B, (05)
- ii) The efficiency of each engine, and (05)
- iii) The heat rejected to the cold sink. (05)

Total No. of Printed Pages-3

Roll No. _____

CC(M)

(POLITICAL SCIENCE) AND INTERNATIONAL RELATIONS**(OPTIONAL)****PAPER - I****[47]****Time Allowed - Three Hours****Maximum Marks-250****INSTRUCTIONS**

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SECTION - A

1. Comment on the following in about 150 words each: (5×10=50)
- a) 'The study of arthasastra leads to appreciation of autonomy of political life'.
Comment. (10)
 - b) Characterise Aurobindo's "Integral Philosophy". (10)
 - c) Sketch the nature of M.N.Roy's 'heteronomous radicalism'. (10)
 - d) Assess Ambedkar as a holistic thinker. (10)
 - e) Identify the sources of legitimacy in a representative democracy (10)
2. a) Gandhi observed that "Hinduism is search after truth through non violent means". Elaborate. (20)
- b) Discuss the four virtues of good community as stated by Plato. (15)
- c) Deliberate upon J.S. Mill's 'anathema of democracy'. (15)
3. a) "The idea of relative autonomy of the state was anticipated by a distinction which Marx made between the dominant class and governing class". Examine. (20)
- b) Analyse the elements of the text in political theory. (15)
- c) Elaborate upon communitarian critique of Rawl's theory of justice. (15)
4. a) Examine John Locke as founder of modern liberalism. (20)
- b) State 'constructs men and women differently'. Analyse. (15)
- c) What is rights based liberalism? (15)

SECTION- B

5. Comment on the following in about 150 words each: (5×10=50)
- a) Account for the presence of increasing number of wealthy people in legislative houses in India in recent times. (10)
 - b) List out the fundamental duties as enshrined in Indian constitution. (10)
 - c) Identify strengths of non cooperation movement as political strategy of freedom struggle. (10)
 - d) Sketch the nature of human rights movements in India. (10)
 - e) Describe the special powers of Governor in scheduled areas. (10)

6. a) 'Federal governance in India is hostage to party politics'. Comment. (20)
- b) 'Presidents of India have become more assertive since 1989'. Examine. (15)
- c) 'Judiciary is the ultimate custodian of constitutional values'. Substantiate. (15)
7. a) Account for the sustenance and success of regional political parties. (20)
- b) Describe the composition and functions of national commission of Minorities. (15)
- c) 'Women's movements are enriching Indian democracy'. (15)
8. a) 'Progressive individualisation of party system is eroding democratic content in Indian politics'. Examine. (20)
- b) What is 'demand polity' and 'command polity' in India? (15)
- c) Deliberate upon dalit perspective of Indian national movement. (15)

Total No. of Printed Pages-3

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

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SECTION-A

- 1. Answer the following questions in about 150 words each (5×10=50)**
- a) Do you think the psychology has relevance to other social sciences? Explain. **(10)**
 - b) Discuss how the Allport's definition of personality is comprehensive. Also describe the concept of functional autonomy. **(10)**
 - c) Differentiate between participant and non-participant observation. Explain the advantages and disadvantages of observation method. **(10)**
 - d) What are the Gestalt principles of perceptual organization? Illustrate with examples. **(10)**
 - e) Discuss with examples the barriers to communication and the ways of overcoming them. **(10)**
- 2.**
- a) How does Erikson's theory of psychosocial development differ from Freud's theory of psychosexual development **(20)**
 - b) EQ matters more than IQ. Comment on the statement Describe Goleman's theory of emotional intelligence. **(15)**
 - c) According to Heider, 'Imbalance' state leads to attitude change. What is imbalance? Explain with examples the Heider's theory of balance. **(15)**
- 3.**
- a) According to Torrance, it is possible to teach children to think creatively. Comment on the statement. Describe the stages of creativity. **(20)**
 - b) How the principles of operant conditioning can be used to improve academic performance of school students? Discuss and give examples. **(15)**
 - c) Discuss critically the Erikson's concept of identity crisis with reference to his life span development stage of identity versus role confusion. **(15)**
- 4.**
- a) Confounding variables distort the results of an experiment. Discuss how we can control the influence of confounding variables. Give examples. **(20)**
 - b) Explain how Canon-Bard theory is different from James-Lange theory of emotion. Give examples. **(15)**
 - c) Why we fail to remember the material learnt earlier? Discuss from the point of view of Herman Ebbinghaus. **(15)**

SECTION-B

Answer the following questions in about 150 words each. (5×10=50)

5. a) Why psychology is considered as a science? Discuss. Also describe the contribution of Wundt to experimental psychology. (10)
- b) Discuss the process and obstacles to problem solving. Cite examples. (10)
- c) Critically examine the problems in the assessment of motivation. (10)
- d) Discuss how the psychological laboratories can be computerized in Indian universities and colleges. (10)
- e) Do you think that you can achieve your goal by using the techniques of psycho cybernetics? Discuss critically. (10)
6. a) What are the internal and external factors that influence the attention of individuals? Discuss and cite examples. (20)
- b) Compare psychoanalytic perspective and behaviouristic perspective on personality. (15)
- c) Distinguish between Skinner's and Chomsky's theory of language development. (15)
7. a) Critically examine memory models which focus on rehearsal and deeper processing of information. (20)
- b) Distinguish between one group design and two group design. Describe the basic principles of experimental design. (15)
- c) Evaluate critically the intelligence theories of Spearman and Cattell. Differentiate between aptitude and attitude. (15)
8. a) Social learning theory is often described as a bridge between behaviouristic and cognitive approach. Discuss. (20)
- b) Differentiate between probability and non-probability sampling techniques. Explain the limitations of quota sampling. (15)
- c) What are the errors of attribution? Differentiate between dispositional attribution and situational attribution. Give examples. (15)

Total No. of Printed Pages-4

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

INSTRUCTIONS

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SECTION - A

1. Answer the following questions in about 150 words each: **(5×10=50)**
 - a) ‘Public administration as a discipline is still in the process of seeking its identity’- examine the current status of discipline in the light of above statement. **(10)**
 - b) “The Study of Administration” was the result of Woodrow Wilson’s search to find answers to the political abuses of spoil system in administration- comment on Wilson’s arguments on separation of public administration from politics.**(10)**
 - c) ‘Taylorism dehumanises industry and make workers automatons and sacrifices individual freedom and their intelligence’ – Critically examine FW Taylor’s theory of Scientific Management in the light of above statement. **(10)**
 - d) Examine the issues and challenges in the implementation of Citizen’s Charter to enhance accountability in public services. **(10)**
 - e) ‘One nation, one tax policy of India has not actually taken-off’ –Comment.**(10)**
2.
 - a) Examine the need and jurisdiction of Administrative Tribunals in adjudicating service matters of public servants. **(20)**
 - b) Explain the main features of the Pension Fund Regulatory and Development Authority (PFRDA) and examine its role in protecting the interests of subscribers. **(15)**
 - c) What is public policy? Examine the relevance of ‘incremental model’ to the study of public policy. **(15)**
3.
 - a) Examine the context of Sustainable Development Goals and issues and challenges in realizing them. **(20)**
 - b) Examine the relevance of Comparative Public Administration approach to the study of public administration in the context of globalization. **(15)**
 - c) ‘There is a perception that standards in public life are on the decline’. Explain the reasons for it and suggest measures to promote the culture of integrity in public service in India. **(15)**
4.
 - a) Analyze the causes for decline of public sector enterprises and their consequences on Indian economy. Suggest measures to restructure public sector undertakings. **(20)**

- b) 'Promoting entrepreneurship among the rural women is still unfinished agenda' Critically examine the role of Self-help Groups in promoting entrepreneurship of women. (15)
- c) Right to Information Act 2005 mandates timely response to citizen requests for government information, but not private sector. Do you think that there is a need for extending it to the private institutions performing public functions? Substantiate your argument? (15)

SECTION - B

5. Answer the following questions in about 150 words each: (5×10=50)
- a) What are the instruments that Reserve Bank of India adopts for implementing the Monetary Policy? (10)
- b) What is Public Choice theory and how it is posing challenge to traditional administrative theory? (10)
- c) 'Abram H. Maslow's legacy in the domain of administration has remained insignificant'. Present your arguments on this statement. (10)
- d) 'Yehezkel Dror's normative model of policy making tend to be more academic in perspective than operational utility' - Comment. (10)
- e) New Public Administration is 'less institution oriented and 'more client impact oriented' - Elaborate. (10)
6. a) 'Authority is the character of communication (order) in a formal organisation by virtue of which it is accepted by a member of the organisation' - Explain Chester Barnard's theory of authority in the light of the above statement. (20)
- b) What is Performance Budgeting and explain its utility in rationalizing budgetary process? (15)
- c) Explain the concepts of 'Position Classification' and its relevance in modern organisations. (15)
7. a) Public- Private Partnerships (PPPs) provide an alternative source of finance, but it is more expensive than concessional loans from multilateral and bilateral institutions. Examine the implications of PPP mode on infrastructure development. (20)

- b) 'New Public Service approach to the study of public administration is an improvement over traditional approach' - Explain. (15)
- c) 'Governance is a more encompassing phenomenon than government' – Elaborate. (15)
8. a) 'Civil Society Organizations contribute to political processes but cannot replace political parties'. Examine the statement in Indian context. (20)
- b) 'The Second Administrative Reforms Commission suggested a case for a separate budget allocation to Panchayats in the State Budget for strengthening rural local bodies' – Discuss. (15)
- c) 'The management style of a Manager is shaped by his/her perception about human beings in an organisation' examine the statement in the light of Douglas McGregor's approach to understanding of organisations. (15)
-

Total No. of Printed Pages-3

Roll No. _____

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

Time Allowed - Three Hours

Maximum Marks-250

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.*
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- v) No continuation sheets shall be provided to any candidate under any circumstances.*
- vi) No blank page be left in between answer to various questions.*

SECTION-A

1. Answer the following questions in about 150 words each: **(5×10=50)**
 - a) Explain the major issues with positivism. **(10)**
 - b) Discuss the concepts of value neutrality and value relevance. **(10)**
 - c) Examine under what conditions a Null Hypothesis is either accepted or rejected. **(10)**
 - d) Describe how Merton's Reference Group theory can be applied to the process of sanskritization. **(10)**
 - e) Bring out the major differences between modern societies and traditional societies. **(10)**
2.
 - a) Explain the emergence of Sociology from a sociological perspective. **(20)**
 - b) Discuss the features of ethnomethodology as a non-positivist methodology. **(20)**
 - c) Describe two tests for establishing the reliability of a scale. **(10)**
3.
 - a) Explain the problems in applying scientific method in Social Sciences. **(20)**
 - b) Discuss the major types of qualitative methods in Sociology. **(20)**
 - c) Analyse the different types of alienation in contemporary India. **(10)**
4.
 - a) Explain the relation between Social, Cultural and Personality systems in Talcott Parson's theory. **(20)**
 - b) Discuss the problems of using secondary data in India. **(20)**
 - c) Discuss how a participant observer may become a non-observing participant. **(10)**

SECTION-B

5. Answer the following questions in about 150 words each: **(5×10=50)**
 - a) Analyze the difference between the theories of Marx and Weber on Class. **(20)**
 - b) Examine the barriers to technological change in Traditional Societies. **(20)**
 - c) Explain the challenges in attaining objectivity in Sociology. **(10)**

6. a) Examine the importance of social facts in Durkheim's methodology. (20)
- b) Analyze the role of social movements in bringing about social change (20)
- c) Explain how sociology is different from commonsense (10)
7. a) Explain how power elite subverts democracy (20)
- b) Examine the relation between patriarchy and gender inequality (20)
- c) Discuss the components of Human Development Index (10)
8. a) Analyze different ways of measuring poverty (10)
- b) Bring out the relationship between poverty, education and social mobility(10)
- c) Analyze the factors influencing religious fundamentalism (10)
- d) Bring out the changes in sexual division of labour in modern society (10)
- e) Explain the barriers to the growth of civil societies in India. (10)
-

Roll No. _____

Total No. of Printed Pages-3

CC(M)
URDU
(OPTIONAL)
PAPER - I
(LITERATURE)
[55]

<i>Maximum Marks-250</i>	<i>Time Allowed - 3 Hours</i>
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سوالات سے متعلق خاص ہدایات

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

اس پرچے میں آٹھ سوالات ہیں جو دو حصوں (سیکشن) پر مشتمل ہیں۔

امیدوار کو کل پانچ سوالوں کے جواب دینے ہیں۔

سوال نمبر 1 اور 5 لازمی ہیں۔ باقی سوالات میں سے صرف تین سوالوں کے جواب دینے ہیں لیکن ہر سیکشن سے کم از کم

ایک سوال کا انتخاب ضروری ہے۔

ہر سوال یا سوال کے حصے کے نمبر اس کے سامنے درج کر دیے گئے ہیں۔

جوابات اردو میں ہی مطلوب ہیں۔

سوالات کے جوابات کے لیے الفاظ کی جو تعداد مقرر کی گئی ہے اس کی پابندی لازمی ہے۔

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۔

[55]

(1)

[Turn over

SECTION - A

(5×10=50)

1. درج ذیل سوالوں کے جوابات ایک سو پچاس (150) الفاظ میں لکھیے:

- a- ہند آریائی زبانوں کے عہد وسطیٰ کا تعارف کرائیے۔
 b- ادبی سنسکرت کی ترقی کس دور میں ہوئی؟ اختصار سے گفتگو کیجیے۔
 c- اردو ایک ہند آریائی زبان ہے۔ اس کے امتیازات واضح کیجیے۔
 d- ان اسباب پر روشنی ڈالیے جن کے سبب اردو شمال کے مقابلے دکن میں پہلے پہلی پھولی۔
 e- 'اردو نواحِ دہلی کی بولیوں سے پیدا ہوئی' واضح کیجیے۔

2. مندرجہ ذیل سوالوں کے جوابات تین سو (300) الفاظ میں لکھیے:

- a- اردو زبان کی پیدائش کے مختلف نظریات میں سے آپ کسے درست سمجھتے ہیں؟ واضح کیجیے۔ (20)
 b- کھڑی بولی اور اردو کے لسانیاتی رشتے کی وضاحت کیجیے۔ (15)
 c- ویدک سنسکرت سے اپنی واقفیت ظاہر کیجیے۔ (15)

3. درج ذیل سوالوں کے جوابات تین سو (300) الفاظ میں لکھیے:

- a- دکنی اردو کے لسانی امتیازات واضح کیجیے۔ (20)
 b- اردو اور ہریانوی زبانوں کے باہمی تعلق پر روشنی ڈالیے۔ (15)
 c- اپ بھرنشوں سے اپنی واقفیت ظاہر کیجیے۔ (15)

4. درج ذیل سوالوں کے جوابات تین سو (300) الفاظ میں لکھیے:

- a- ہندستان کی قدم ترین زبان کون سی ہے؟ بحث کیجیے۔ (20)
 b- عادل شاہی عہد حکومت میں اردو کی ترقی کا ایک تعارف پیش کیجیے۔ (15)
 c- اردو زبان کی تہذیبی اور ثقافتی بنیادوں پر روشنی ڈالیے۔ (15)

SECTION - B

(5×10=50)

5. مندرجہ ذیل سوالوں کے جوابات ایک سو پچاس (150) الفاظ میں لکھیے:

-a صنف قصیدہ کے اجزائے ترکیبی پر اختصار کے ساتھ گفتگو کیجیے۔

-b اٹھارویں صدی کی اردو غزل سے اپنی واقفیت ظاہر کیجیے۔

-c اردو قصائد کے زوال کے اسباب پر روشنی ڈالیے۔

-d اردو مختصر افسانے کی تاریخ کا ایک خاکہ پیش کیجیے۔

-e تنقید سانس کی طرح ضروری ہے۔ بحث کیجیے۔

6. درج ذیل سوالوں کے جوابات تین سو (300) الفاظ میں لکھیے:

(20) -a 'اردو ادب پر سرسید کا اثر' عنوان پر ایک مضمون لکھیے۔

(15) -b اردو غزل کی مقبولیت کے اسباب پر روشنی ڈالیے۔

(15) -c کلیم الدین احمد کا بہ حیثیت نقاد مقام متعین کیجیے۔

7. مندرجہ ذیل سوالوں کے جوابات تین سو (300) الفاظ میں لکھیے:

(20) -a شبلی کی تنقید نگاری پر روشنی ڈالیے۔

(15) -b انجمن پنجاب کی ادبی خدمات پر روشنی ڈالیے۔

(15) -c تنقید کی ادب میں ضرورت

8. درج ذیل سوالوں کے جوابات تین سو (300) الفاظ میں لکھیے:

(20) -a لکھنؤ میں شعر و ادب کا ارتقا۔

(15) -b اردو میں جدیدیت کا رجحان۔

(15) -c آل احمد سرور کی تنقید نگاری۔

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Total No. of Printed Pages-3

Roll No. \_\_\_\_\_

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

*Time Allowed - Three Hours*

*Maximum Marks-250*

**INSTRUCTIONS**

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### SECTION-A

1. a) Discuss the various types of nutrition in Protozoa. (10)
- b) What is parental care? And how is it exhibited in Amphibia. (10)
- c) Describe the mode of Locomotion in Echinodermata. (10)
- d) Elaborate the general features of egg laying mammals, write giving suitable examples. (10)
- e) What is polymorphism ? Explain with reference to class Cnidaria. (10)
2. a) Give an account of migration in birds, mention the problems faced during the course of migration and what triggers migration. (20)
- b) What is the social hierarchies in primates. (15)
- c) Elaborate the structure and life cycle of *Wuchereria bancrofti* add a note on its pathogenicity and control. (15)
3. a) What are the different types of canal systems in porifera, mention its function and significance . (20)
- b) What are the skull types in reptilia, also mention its evolutionary significance.(15)
- c) Define torsion and explain torsion and detorsion in Gastropods. (15)
4. a) Define a coelome and write the general features and examples of a acoelomate a pseudocoelomate and a coelomate. (20)
- b) Write the general characters and affinities of Herdmania and explain why Herdmania is known as a sea squirt. (15)
- c) Give the structure of the pancreatic gland and write about the hormones secreted and its action. (15)

### SECTION-B

5. a) Elaborate a population characteristics and population dynamics. (10)
- b) What are the different types of pollution and what is the impact of pollution on the biosphere . (10)
- c) How can apiculture be encouraged for self employment (10)
- d) What is AIDS ? Write the structure and mode of infection of the pathogen, how can AIDS be prevented ? (10)

- e) What is chi square test ? Give a detailed account of the computation of chi square tests of independence, homogeneity and goodness of fit using biological data. (10)
6. a) What is ELISA (Enzyme linked immunosorbent assay). Write about its principles and procedure. Add a note on its applications. (20)
- b) What is the systemic position of the sugarcane pest *pyrilla perpusilla* ? Write about its life cycle and pathogenicity. (15)
- c) Explain the concept of gene counselling and what are the benefits of gene therapy. (15)
7. a) What are biological rhythms ? And elaborate homing instinct.. (20)
- b) Write the principles of fluorescence microscopy and its applications in zoology. (15)
- c) Discuss about the mite *Tabanus*, its life cycle, pathogenicity and symptoms. (15)
8. a) Explain what are pheromones and its role in crypsis predator detection and predator tactics. (20)
- b) What is correlation, explain its various types and methods of calculating correlation analysis. (15)
- c) How does remote sensing help in sustainable development. (15)
-



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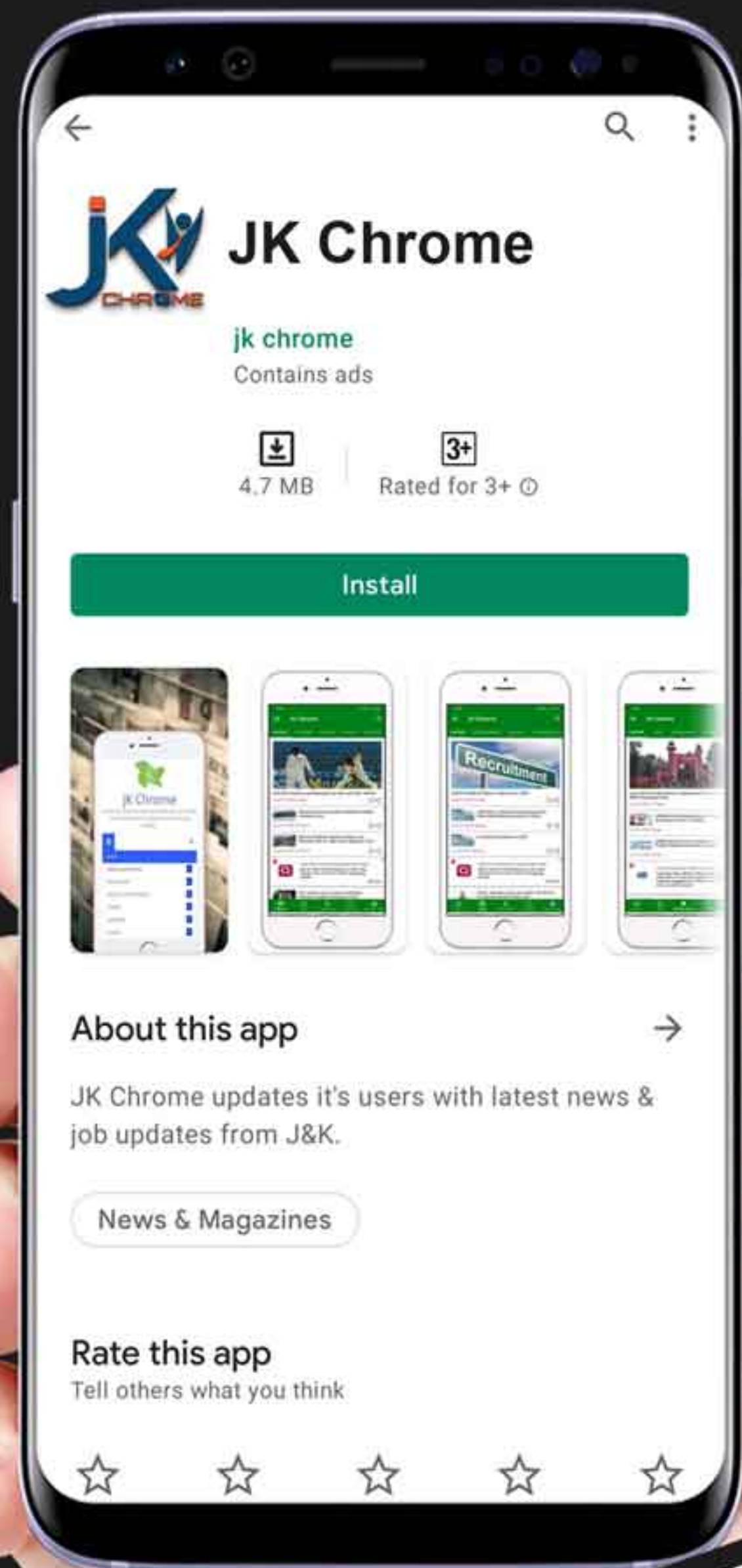
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