No. 8239

ENGLISH

(Qualifying Paper)

Marks : 300

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **all** questions

1. Write an essay in about *500* words on any *one* of the following topics : 150

(a) Social media in the 21st century is both a boon and a bane

(b) Drug addiction—a rising menace in our society

(c) The role of technology in modern classrooms and its effects on teaching and learning

(d) Gender inequality in family business

(e) Childhood memories

2. Read the following passage carefully and answer the questions given below :

Can India make it to a leadership position in the new millennium or will it retain the 'fast-train-going-slow' image of the last 50 odd years?

Most people believe that the potential for our country to succeed is huge. They are also disappointed at the inability to convert the natural advantages we possess into tangible benefits. The recent success of our infotech industry globally has reinforced the belief that when we put our mind to it, we can and do succeed. Now, the expectation is that this success will be replicated in other areas.

There is no doubt that India's future will be driven by the intellectual capital of its people. Even though many of the billion Indian people are and will continue for the foreseeable future to live in a third-world setting, there are many Indians

with the skills, ability and aspiration to prosper and flourish in a first-world environment. It is, therefore, likely that India will, at the same time, belong to both the first and third worlds.

That first-world environment will be powered increasingly by knowledge workers and brainware. India clearly has the numbers. It needs to invest in training and skill-building and also encourage entrepreneurship and risk-taking.

I have no magic recipe to convert India's people power into a competitive advantage on global basis. Also, I am nowhere near qualified to address macro issues like universal education and school curricula. Therefore, I have to shrink the issue into a familiar framework of 'growing our people'.

It is imperative that Indian businesses pay more than lip service to the empowerment of their employees. We have to break the 'do-as-you-are-told' mentality which inhibits creativity and promotes the culture of servitude long after our 'foreign masters' are gone. Together with empowerment, there has to be a culture of personal accountability so that everyone realizes the necessity of valuing commitment.

In all areas of activity, seniority and hierarchies (if any) must be based purely on merit. Seniority, like respect, must be earned and not 'termed', i.e., based on the length of service.

Future organizations will be based on communities and interaction between individuals and teams both within and outside the organization. The work environment, both with respect to physical space as well as culture, must be barrierless/boundaryless, allowing the impromptu and regular interaction across work groups/teams.

Organizations must accept that empowerment and personal accountability should go hand in hand with a degree of tolerance for mistakes and failures. Mistakes and failures are good learning opportunities for our people and should be regarded as such, unless repeated. Tolerance would also provide a safety net for those prepared to take risks, a quality rarely seen among Indian executives today but crucial to succeed in the new economy.

Organizations must be as transparent as possible with their employees. Both good and bad news must be shared. Often organizations and their leadership wrongly believe that the employees aren't interested in certain information or, more arrogantly, decide that information is best withheld as it is beyond the comprehension of their employees.

Knowledge sharing must be pushed at all levels through a carrot-and-stick approach. Those who continuously hoard knowledge must be weeded out. Everyone must come to work thinking that he will learn and add to his skills.

Performance management must be institutionalized to give everyone a clear understanding of organizational goals, team goals, the individual's role or goals within a team, rewards which follow from meeting goals, and career opportunities in the organization.

Encourage a sense of commitment to the community among your employees. Apart from making them feel good about themselves, it also affords opportunities for them to work as teams in a non-work environment.

Above all, make work fun. If people, however talented, show up at work because it is a job, then they are unlikely to realize their full potential.

The above is not an exhaustive list for each organization to get the best out of its people. But if each organization addresses some of these issues then people will grow individually and collectively. This is bound to have a beneficial effect on harnessing and driving their intellectual capital.

(a) Choose the correct answer from the options given below : 5×5=25

(i) The author attributes success of India in infotech industry to

(1) do-as-you-are-told mentality

(2) lazy and intolerant attitude of Indians

(3) realizing the latent intellectual capital

(4) None of the above

(ii) Which of the following is the best way for organizations to be transparent?

(1) Share both good and bad news at all levels

(2) Share only that information which employees can understand

(3) Share only good news and withhold bad news

(4) None of the above

(iii) What does the word 'impromptu' communicate in the passage?

(1) The communication should be unprovoked

(2) Employees' interaction should be spontaneous and natural

(3) Employees should interact only when necessary

(4) None of the above

(iv) To realize the full potential of the talent, what is the recommendation in the passage?

(1) Love your job even if you hate to work

(2) Make the work interesting as if it is fun

(3) Make clear distinction between work and job

(4) None of the above

(v) Which of the following provides good learning opportunities?

(1) High level of tolerance for mistakes

(2) Overlooking the mistakes of the employees

(3) Making efforts not to commit the same mistake again

(4) None of the above

(b) Answer the following questions briefly : 5×5=25

(i) How should Indian businesses empower their employees?

(ii) According to the author, what are the factors that inhibit creativity?

(iii) According to the passage, what measures must be adopted to make employees value commitment?

(iv) Why should performance management be institutionalized?

(v) What is the expectation of the author from the Indians?

3. Write a précis of the following passage in about one-third of its length and provide a suitable title : 45+5=50

It is very easy to acquire bad habits such as eating too many sweets, or drinking too much fluid of any kind, or smoking. The more we do a thing, the more we tend to like doing it; and if we do not continue to do it, we feel unhappy. This is called the force of habit, and the force of habit should be fought against.

Things which may be very good when only done from time to time, tend to become very harmful when done too much or too often. This applies even to

such good things as work or rest. Some people form a bad habit of working too much, and others of idling too much. The wise man always remembers that this is true about himself, and checks any bad habit.

One of the most widely spread of bad habits is the use of tobacco. Tobacco is now smoked or chewed by men, often by women, and even by children, almost all over the world. It was brought into Europe from America by Sir Walter Raleigh, and has thence spread everywhere.

Alcohol is taken in almost all cool and cold climates, and to a less extent in hot ones. Alcohol is not necessary in any way to anybody. The regular use of alcohol affects the liver, it weakens the mental powers, and lessens the general energy of the body.

4. Rewrite the following sentences after making the necessary corrections : 1×10=10

(a) The boy is swimming on the pool.

(b) A good man and useful citizen have passed away.

(c) I have been working from morning.

(d) The forest abounds by wild animals.

(e) A nursemaid is wanted for a baby about twenty years old.

(f) I spent the three last days of my holiday in a chair with a swollen leg.

(g) The earth moved round the sun.

(h) He exercises complete authority with his followers.

(i) I asked him where is he going.

(j) The boy who I trusted proved worthy of my confidence.

5. Rewrite the following sentences inserting suitable articles where necessary : 1×5=5

(a) What beautiful scene this is !

(b) For Brutus is honourable man.

(c) We started late in afternoon.

(d) I have not seen him since he was child.

(e) Measles is contagious disease.

6. Fill in the blanks with appropriate prepositions : 1×5=5

(a) His friends prevailed _____ him to withdraw his resignation.

(b) The avaricious man is greedy _____ gain.

(c) He is too miserly to part _____ his money.

(d) The Atlantic separates Europe _____ America.

(e) Long indulgence _____ vice impaired his once robust constitution.

7. Rewrite the following sentences according to the instructions given after each, and making the changes that may be necessary, without changing the meaning of the sentence : 2×5=10

(a) It is probable he will never come back.

(Begin : In ....)

(b) He said to me, "Where do you live?"

(Begin : He asked me ...)

(c) I was surprised at his behaviour.

(Begin : His ...)

(d) He is the best student in the class.

(Use 'better' instead of 'best')

(e) He won't show me his papers, he won't tell me how he is.

(Use neither ... nor)

8. Give the synonyms of the following words : 1×5=5

(a) Brutal

(b) Insipid

(c) Conceal

(d) Careless

(e) Honest

9. Give the antonyms of the following words : 1×5=5

(a) Permanent

(b) Mortal

(c) Generous

(d) Miserable

(e) Virtue

10. Use the following idioms in sentences of your own so as to bring out their meanings : 2×5=10

(a) wild goose chase

(b) through thick and thin

(c) an apple of discord

(d) a dark horse

(e) take the bull by the horns

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No. 9275

ESSAY

Paper—I

(Compulsory)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Notes : (1) Please read the instructions carefully before attempting the questions. Word limit, as specified, should be adhered to.

(2) Write two essays, choosing **one (1)** from each of the following Sections A and B in about 1000–1200 words each.

SECTION—A

Write on *any* **one** of the following topics within *1000–1200* words : 125

1. Artificial intelligence—Its advantages and disadvantages

2. Startups, entrepreneurships and their role in employment generation in the State

3. The impact of social media on the politics of the State

4. The National Education Policy, 2020 and its effects on the education sector of the State

SECTION—B

Write on *any* **one** of the following within *1000–1200* words : 125

5. Should the youth in the State consider politics as a career? Give reasons to support your answer.

6. Explain and give your comments on "Luck is when preparation meets opportunity".

7. Explain and give your comments on "Talent is nothing without dedication and discipline".

8. Explain and give your comments on "With great power comes great responsibility".

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No. 10180

GENERAL STUDIES—I

Paper–II

(Compulsory)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer any *six* of the following questions : 15×6=90

(a) Were the occurrences of the Revolt of 1857 inevitable? Mention the reasons in support of your answer.

(b) Explain the formation, types and characteristics of metamorphic rock.

(c) A country's freedom struggle has its own identity. How would you apply this statement in the context of the Indian Freedom Struggle?

(d) The natural resources of the country can prove to be both boon and bane. Discuss this statement with relevant examples.

(e) Mention the various methods adopted in the world to deal with prevailing energy crisis.

(f) Critically examine the consequences of globalization on Indian society.

(g) Mention the contribution of North-East India to Indian culture.

(h) Give a detailed account of fluvial landforms.

(i) Explain the changing trends of caste system in India.

(j) Write short notes on any *three* of the following (in not more than *50* words each) : 5×3=15

(i) Seismic wave

(ii) Chemical weathering

(iii) Secularism in India

(iv) Pa Togan Sangma

(v) Rowlatt Act

(vi) Partition of Bengal

2. Answer any *eight* of the following questions : 20×8=160

(a) The treaty of Versailles contains the seed of another World War. Discuss the significance of this statement.

(b) How did the clash of two ideologies—capitalism and communism affect international relation in the 20th century?

(c) Bring out the significance of 'Decolonization' in post World War II period.

(d) Write an essay on the distribution and types of Ocean currents in the world.

(e) Discuss the causes and consequences of groundwater resources depletion in India.

(f) What are the problems associated with urbanization in India? Suggest measures to address the problems.

(g) Attempt a critical evaluation of the Women Reservation Act passed by the Indian Parliament in 2023.

(h) Cite the various reasons that are hindering the overall economic development of North-East India.

(i) How far was Germany responsible for the First World War (1914–1918)? Analyze critically.

(j) Write short notes on any *four* of the following (in not more than *50* words each) : 5×4=20

(i) Permanent Settlement of 1793

(ii) Demographic dividend

(iii) Bhagat Singh

(iv) Raja Rammohan Roy

(v) Autonomous District Council

(vi) Indigo Rebellion

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No. 11280

GENERAL STUDIES—II

Paper–III

(Compulsory)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Note : (1) There are 20 questions in total. Answer any **six** questions from Q. Nos. **1** to **10** and any **eight** from Q. Nos. **11** to **20**.

(2) Answers to Q. Nos. **1** to **10** should be in *150* words each whereas answers to Q. Nos. **11** to **20** should be in *200* words each.

Answer any *six* of the following questions : 15×6=90

1. Discuss the historical and philosophical background of the Indian Constitution.

2. Discuss the legislative functions of the Indian Parliament.

3. Critically examine the Fundamental Rights enumerated in the Constitution of India. Evaluate their significances.

4. Critically assess the Women Reservation Act, 2023.

5. Explain the working of the Central Administrative Tribunal as an Independent Judicial Authority.

6. Examine the role of the Attorney-General as the chief legal advisor and lawyer of the Government of India.

7. Explain the various approaches used by political parties in India to mobilize voters during elections.

8. Examine the features of the CAA. How will this Act have an impact on the existing population of the country?

9. Critically examine the role of the Supreme Court of India in checking the arbitrary power of the Parliament in amending the Constitution.

10. Discuss the major challenges that the government is facing when implementing e-governance initiative in India.

Answer any *eight* of the following questions : 20×8=160

11. Discuss the causes of the growth of regional parties in India. How have they influenced the formation of government at the Central level?

12. Critically examine the Right to Freedom as enshrined in the Constitution.

13. Examine the discretionary power of the Governor of a State in India. How does the use of these discretionary power impact State politics?

14. Define Pressure Groups. Discuss the role in the electoral politics of the country.

15. Write short notes on any *four* of the following (not more than *50* words each) : 5×4=20

(a) Article 356

(b) Judicial activism

(c) Sarva Shiksha Abhiyan (SSA)

(d) Swachh Bharat Abhiyan

(e) Smart cities

(f) Doctrine of colourable legislation

16. Evaluate the role of Self-Help Groups in achieving twin objectives along with empowering women in rural India.

17. Examine the provision in the Constitution of India relating to the appointment, functions and powers of the Election Commission of India. What are the challenges that the Election Commission is facing today and what measures can be taken to ensure transparency in its operation?

18. Describe various confidence building measures, military as well as non-military, between India and Pakistan.

19. Critically examine the working of the National Commission on Scheduled Tribes. Has the Commission been able to address the issues faced by Scheduled Tribe in India?

20. Write short notes on any *four* of the following (not more than *50* words each) : 5×4=20

(a) Right to Constitutional Remedies

(b) ASEAN

(c) Gujral Doctrine

(d) NEP 2020

(e) Electoral Bonds

(f) The Election Commission of India

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No. 12146

GENERAL STUDIES—III

Paper—IV

(Compulsory)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Note : (1) There are *20* questions in total. Answer *any* **six** questions from Question Nos. **1–10** and *any* **eight** from Question Nos. **11–20**.

(2) Answers to Question Nos. **1–10** should be in *150* words each whereas answers to Question Nos. **11–20** should be in *200* words each.

Answer any *six* of the following questions : 15×6=90

1. "The nature of economic growth in India is often described as jobless growth." In the light of the above statement, give appropriate arguments to express your views.

2. Assess the prospect of food processing industry with suitable examples from India.

3. What factors influence the location of industries in India today?

4. Critically examine the Indian Agricultural Acts of 2020.

5. "Air pollution and water shortages are among the problems faced by urban centres across the globe." Examine this statement.

6. Discuss the differences between Capital Budget and Revenue Budget. Highlight the components of both these types.

7. The frequency of severe heat waves has increased in the Indian subcontinent. Critically discuss the effective mitigation strategies for heat wave management in Indian cities.

8. Discuss the factors giving rise to recurring internal security threat in North-East India.

9. How can global climate change affect food security in India?

10. Elaborate the major challenges faced by the Public Distribution System (PDS) in ensuring its effectiveness and transparency in India.

Answer any *eight* of the following questions : 20×8=160

11. Review the progress of land reforms in India in the post-Independence period and account for the slow progress.

12. "Financial inclusion is an essential tool in pursuit of social justice."

    In view of the above statement, examine the role of digital technology in enhancing financial inclusion in India.

13. "The development of agriculture and industry depends solely on its infrastructure." Analyze this statement with reference to the various initiatives undertaken by the Government in recent years.

14. Give an account on the growth of Information Technology and Biotechnology Sectors and their impact on GDP and employment in India.

15. Write short notes in not more than *50* words each on any *four* of the following : 5×4=20

    (a) National Agricultural Insurance Scheme (NAIS)

    (b) Pradhan Mantri Fasal Bima Yojana (PMFBY)

    (c) Pink Revolution

    (d) Renewable Energy

    (e) Power crisis in India

    (f) Foreign Direct Investment (FDI) in the services sector

16. Discuss some of the main issues of environmental pollution today. Choose one local and one global problem and explain its impact in some detail.

17. Explain in detail the challenges faced by the North-Eastern Region with respect to infrastructural development.

18. Evaluate the role of biodiversity parks in the conservation of wildlife.

19. "Digital India requires strong cyber security." Comment on this statement highlighting the challenges faced by cyber security. How can these challenges be overcome?

20. Write short notes in not more than *50* words each on any *four* of the following : 5×4=20

(a) Artificial Intelligence

(b) Samudrayaan Mission

(c) Nanotechnology in the health sector

(d) Cryptocurrency

(e) Orphan Crops

(f) Uniform Civil Code

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No. 13254

GENERAL STUDIES—IV

Paper—V

(Compulsory)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Note : (1) There are *12* questions in total. Answer *any* **five** questions from Question Nos. **1–7** and **all** from Question Nos. **8–12**.

(2) Answer to all questions numbered **1–12** should be in *250* words each.

SECTION—A

Answer any *five* of the following questions : 25×5=125

1. Define the term 'public servant'. What can be the expected role of a public servant?

2. Explain the role of integrity in leadership. Provide examples of leaders who have demonstrated high integrity.

3. Explain the difference between ethics and law. Provide appropriate examples to illustrate your answer.

4. Are values and ethics relative or absolute? Elucidate and comment with examples.

5. Discuss Mahatma Gandhi's concept of social sins. According to you, how can a public servant be an agent of change to remove these social sins which plague our nation and society?

6. They say that present education system is only producing 'Qualified Monsters'. In light of the recent events of scams and the increase in the level of corruption, can we say that the statement is justified?

7. A non-profit organization you volunteer for is facing a dilemma. They received a substantial donation from a corporation known for its controversial practices, including environmental harm and unfair labor practices. The fund could significantly enhance the organization's ability to achieve its mission. However, accepting the donation could be seen as endorsing the corporation's behavior. How would you advise the organization to proceed?

SECTION—B

Read the passages and answer the questions that follow : 25×5=125

8. A landslide occurred in the middle of the night on 20th July, 2023 in a remote mountain hamlet, approximately 60 km from Uttarkashi. The landslide was caused by torrential rains and has resulted in large-scale destruction of property and life. You as District Magistrate of that area, have rushed to the spot with a team of doctors, NGOs, media and police along with numerous support staffs to oversee the rescue operations. A man came running to you with a request for urgent medical help for his pregnant wife who is in labour and is losing blood. You directed the medical team to examine his wife. They return and convey to you that this woman needs blood transfusion immediately. Upon enquiry, you come to know that a few blood collecting bags and blood group test kits are available in the ambulance accompanying your team. Few people of your team have already volunteered to donate blood. Being a physician who has graduated from AIIMS, you know that the blood for transfusion needs to be procured only through a recognized blood bank. Your team members are divided on this issue; some favour transfusion, while some others oppose it. The doctors in the team are ready to facilitate the delivery provided they are not penalized for transfusion. Now, you are in a dilemma. Your professional training emphasizes on prioritizing service to humanity and saving lives of individuals.

   (a) What are the ethical issues involving in this case?

   (b) Evaluate the options available to you being the District Magistrate of the area.

9. In a fast-growing pharmaceutical industry in India, Medico Pharmaceuticals, a major player, faces a significant ethical dilemma. Medico Pharmaceuticals has developed a new drug that promises to be highly effective in treating a common but severe illness. However, the clinical trial revealed mixed results, with some side effects reported among a small percentage of patients. The regulatory authorities have approved the drug with warning label. But there is pressure from the management to launch the drug aggressively to maximize profit and recover the high research and development costs. Medico Pharmaceuticals plans a large-scale marketing campaign targeting doctors, hospitals and directly to consumers through advertisement. The marketing material highlights the effectiveness of the drug but down play the potential side effects. The company's marketing strategy includes incentives for doctors to prescribe the new drug, which raises ethical concerns about the influence on medical decisions.

(a) How should Medico Pharmaceuticals balance the need for profitability with the ethical obligation to ensure patient safety and truthful marketing?

(b) How can the company ensure transparency in its marketing while still achieving its business objectives?

(c) What step can Medico Pharmaceuticals take to address potential side effects and safeguard patient health?

10. You have just been appointed as Additional Director General of Central Public Works Department. The chief architect of your division, who is to retire in six months, is passionately working on a very important project, the successful completion of which would earn him a lasting reputation for the rest of his life. A new lady architect, Seema trained at Manchester School of Architecture, UK, joined as senior architect in your division. During the briefing about the project, Seema made some suggestions which will not only add value to the project, but will also reduce completion time. This has made the chief architect insecure and he is constantly worried that all the credits will go to her. Subsequently he adopted passive and aggressive behavior to her and has become disrespectful to her. Seema felt it embarassing as the chief architect left no chance of humiliating her. He would very often correct her in front of other colleagues and raised his voice while speaking to her. This continuous harassment has resulted her in losing confidence and self esteem. She felt perpetually tensed, anxious and stressed. She appeared to be in awe of him

since he has had a long tenure in the office and has vast experience in the area of her work. You are aware of her outstanding academic credentials and career record in her previous organizations. However, you fear that this harassment may result in compromising her much needed contribution in this important project and may adversely impact her emotional well-being. You have also come to know from her peers that she is contemplating tendering her resignation.

(a) What are the ethical issues involved in the above case?

(b) What are the options available to you in order to complete the project as well as to retain Seema in the organization?

(c) What would be your response to Seema's predicament? What measures would you institute to prevent such occurrences from happening in your organization?

11. Honesty and uprightness are the hallmark of a civil servant. Civil servants possessing these qualities are considered as the backbone of any strong organization. In the line of duty, they take various decisions, at times they become bonafide mistakes. As long as such decisions are not taken intentionally and do not benefit personally, the officer cannot be said to be guilty. Though such decision may, at times, lead to unforeseen adverse consequences in the long-term. In the recent past, a few instances have surfaced where civil servants have been implicated for bonafide mistakes. They often been prosecuted and even imprisoned. The instances have greatly rattled the moral fiber of the civil servants.

(a) How does this trend affect the functioning of the civil services?

(b) What measures can be taken to ensure that the honest civil servants are not implicated for the bonafide mistakes on their part? Justify your answer.

12. At 9:00 p.m. on Saturday evening, Rashika, a Joint Secretary, was still engrossed in her work in her office. Her husband, Vikram, is an executive in an MNC and frequently out of town in connection with his work. Their two children aged 5 and 3 are looked after by their domestic helper. At 9:30 p.m. her superior, Mr. Suresh calls her and asked her to prepare a detailed note on an important matter to be discussed in the meeting in the ministry. She realized that she have to work on Sunday to finish the additional task given by

her superior. She reflects on how she had looked forward to this posting and had worked long hours for months to achieve it. She had kept the welfare of the people uppermost in discharging her duties. She feels that she has not done enough justice to her family and has not fulfilled her duties in discharging essential social obligations. Even as recently as last month she had to leave her sick child in the nanny's care as she had to work in the office. Now, she feels that she must draw a line, beyond which her personal life should take precedence over her professional responsibilities. She thinks that there should be reasonable limits to the work ethics such as punctuality, hard work, dedication to duty and selfless service.

(a) Discuss the ethical issues involved in this case.

(b) Briefly describe at least four laws that have been enacted by the government with respect to providing a healthy, safe and equitable working environment for women.

(c) Imagine you are in similar situation, what suggestions would you make to mitigate such working conditions?

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No. 14034

PUBLIC ADMINISTRATION—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question No. **1** (Section—A) which is compulsory and **four** of the remaining questions, selecting at least **two** from each Section

SECTION—A

1. Answer any *two* of the following questions in not more than *250* words each : 25×2=50

(a) "Woodrow Wilson's vision of Public Administration is the most suited for the present times." In the light of this statement, discuss the principles of Public Administration as given by Wilson.

(b) What is delegated legislation? How is delegated legislation helpful in increasing efficiency in administration?

(c) "Public choice approach has emerged as a response to the traditional normative approach that focuses on the ideal behavior of government officials and policy makers." Critically assess.

(d) Describe the role of the Central Administrative Tribunal in India.

2. What are the major components of new public management? Examine in detail. 50

3. The citizen's charter is the ideal instrument of organizational transparency and accountability but has its own limitations. Examine. 50

4. How does good governance differ from government? Analyze the important factors for promoting good governance in India. 50

SECTION—B

5. Answer any *two* of the following questions in not more than *250* words each : 25×2=50

   (a) Examine how auditing is undertaken in an organization. Why is it important for the success of the organization?

   (b) "Riggs' Prismatic Sala model needs more intervention." Examine this statement.

   (c) Discuss the current status of Comparative Public Administration.

   (d) Why is policy evaluation necessary? Analyze the problems in policy evaluation.

6. "Human resource development is the most important component of any organization." In this regard, examine the importance of human resource development. 50

7. Critically analyze the enforcement of conduct rules for civil servants in India and substantiate with reasons, "prevention of misconduct requires institutionalization of ethical values at political and administrative level". 50

8. Do you agree with the view that Information Technology bridges the gap between the citizens and the government? Give your views. 50

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No. 15059

PUBLIC ADMINISTRATION—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question No. **1** (Section—A) which is compulsory and **four** of the remaining questions, selecting at least **two** from each Section

SECTION—A

1. Answer any *two* of the following in not more than *250* words each : 25×2=50

(a) "Kautilya's *Arthashastra* is an extensive systematic treatise on Public Administration." Comment.

(b) Examine the changing role and functions of the Sub-Divisional Officer.

(c) Autonomy and accountability in the Public Sector cannot walk together. Examine.

(d) "By virtue of his unique position as head of the official machinery and advisor to the Council of Ministers, the Chief Secretary has an extremely important role to play in the State Administration." Examine.

2. Critically examine the functions of the National Human Rights Commission of India. 50

3. Democratic decentralization through Panchayati Raj Institutions in India has been implemented successfully. Critically analyze. 50

4. Examine the role of the Chief Minister in the era of Coalition Government. 50

SECTION—B

5. Answer any *two* of the following in not more than *250* words each : 25×2=50

(a) "The doctrine of civil service neutrality is no longer relevant in India." Give your views.

(b) Critically evaluate the role of the Public Accounts Committee in control over finances.

(c) Discuss the provisions for independence of the Comptroller and Auditor-General of India.

(d) Dantwala Committee in 1978 had observed that even in the case of States which have set up something like the District Planning Machinery the composition of the staff reflects that there has been no serious attempt to induct technical skill planning. Analyze this statement and discuss the recommendations of the Dantwala Committee.

6. What are Civil Society Organizations? How can they play a role in eradicating corruption from the State of Meghalaya? 50

7. Discuss the causes of child labour in India and suggest measures to strengthen child welfare organizations. 50

8. Examine the impact of globalization on Indian administration. 50

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No. 16089

SOCIOLOGY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt **five** questions. Question No. **1** is compulsory

1. Trace the factors responsible for the emergence of Sociology. Explain the relationship of Sociology with other social sciences. 25+25=50

2. Define scientific method and describe its basic characteristics. Explain the major theoretical strands of research methodology. 25+25=50

3. Distinguish between qualitative and quantitative techniques of data collection. Examine them in the light of reliability and validity. 25+25=50

4. Why is historical materialism not economic determinism according to Marx? Discuss Karl Marx concept of alienation. 30+20=50

5. "Marriage is a union between a man and a woman." Using this statement, explain the forms of marriage and the changing structure of this institution. Do you think marriage is an institution in crisis? 20+20+10=50

6. Distinguish between power and authority. What is the rational-legal authority? 25+25=50

7. Define religion and sketch the origins of religious beliefs in human society. Distinguish among magic, religion and science. 25+25=50

8. Discuss the significant features of structural-functional theory of social change. How effective is technology as a factor of social change? 25+25=50

★ ★ ★

No. 17089

SOCIOLOGY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt **five** questions. Question No. **1** is compulsory

1. Explain the intellectual antecedents of sociological thought in India. Do you think tradition and modernity coexist in Indian society? Discuss. 25+25=50

2. Outline the basic features of the caste system. How did Gandhi's and Ambedkar's views on the caste system differ? Discuss. 20+30=50

3. Discuss the historical perspective of the land tenure system in India. Write on the emergence of middle class in India. 25+25=50

4. Examine the working of democratic political system in a traditional society. Trace the role of political parties and pressure groups in this context. 25+25=50

5. Analyze the perspectives of isolation, assimilation and integration in understanding the trajectories of tribal development in India. 50

6. Discuss the current crisis of development, displacement, environmental problems and sustainability. 50

7. Does religion play a cohesive role in India? Discuss critically. 50

8. What are the major challenges faced by women in Indian society? Critically examine the impact of existing programmes on the upliftment of women's status in India. 25+25=50

★ ★ ★

18041

No.

POLITICAL SCIENCE AND INTERNATIONAL RELATIONS—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions including Question No. **1** which is compulsory, selecting at least **one** question from each Section

SECTION—A

1. Comment on any *two* of the following : 25×2=50

(a) Marxist perspective on the nature and functions of the State

(b) Sri Aurobindo's idea of Nationalism

(c) Globalization and the problems of illegal immigration

(d) Contributions of Dr. B. R. Ambedkar to the Dalit Movement in India

2. Examine the evolution of the ideology of liberalism. Bring out the differences between classical and modern liberalism. 50

3. Discuss the idea of political obligation. Explain under what conditions the citizen can revolt against the State authority. 50

4. How do Plato's views on justice, education and communism of family and property all contribute to the creation of an ideal State? 50

SECTION—B

5. Discuss Gandhi's idea of Satyagraha as an instrument of political struggle. 50

6. Examine the concept of judicial activism. Examine its impact on the Indian polity. 50

7. Examine the changing nature of the party system in India. 50

8. Discuss the policy of liberalization and its impact on the Indian economy. 50

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No. 19050

POLITICAL SCIENCE AND INTERNATIONAL RELATIONS—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions including Question No. **1** which is compulsory, selecting at least **one** question from each Section

SECTION—A

1. Comment on any *two* of the following in about *250* words each : 25×2=50

(a) Impact of the collapse of the Soviet Union on international politics

(b) Key features of the Universal Declaration of Human Rights

(c) Technology as an element of national power

(d) Is India's nuclear doctrine a viable one?

2. Critically examine the working of the International Court of Justice in resolving international disputes. 50

3. Critically examine the role of the World Health Organization in handling global health emergencies with specific reference to the Coronavirus in 2019–2020. 50

4. Discuss the meaning of the term 'Balance of Power'. Is Balance of Power still relevant in contemporary international politics? Give your views. 50

SECTION—B

5. What are the major determinants of India's foreign policy? Indicate the changes in India's foreign policy since 1990s. 50

6. Evaluate India's stand in the United Nations on the Ukraine-Russia conflict. 50

7. Analyze India's role in the UN peacekeeping operations. 50

8. Discuss the origin, organizational structure, objectives and functions of the International Monetary Fund. 50

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No. 20009

KHASI—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and **four** from the remaining questions, selecting at least **one** from each Group

1. Katkum ka poim 'Ki Sngi U Hynñiew Trep' kumno u myllung Soso Tham u kren bad pynphalang halor ka jingsdang jong ka Niam lm bad ka jingpyndep ïa ka Niam Ïap. Thir sani bin-pa-bin bad batai bniah ryngkat bad ki nuksa ban kyrshan ïa ka jubab. Ai de ki jingkynthoh. 20+20+10=50

GROUP—A

(Khasi Poetry)

2. Buddien ïa ka jinglong jingman ha ka Jylla Synshar Paitbah kumba la pruiddur da u nongthoh. Kdew shai bad batai bniah kumno kane ka jylla ka siatpharshi ïa ka jinglong ki riewsynshar ha ka juk ka bamynta. Ai ïa ka jingkynthoh. 10+15+15+10=50

3. Kaei ka elegy bad don katno jait ka elegy? Batai bniah. Bishar bad buhdor ïa ka poim 'I Thakemon' kum ka elegy? Hato kane ka poim ka don ïa snap elegy bapaka? Ai ïa ka jingbatai ryngkat bad ki nuksa. 15+20+15=50

4. Kaei ka dawbah kaba pynmih ïa ka jingkhihwin hapdeng ka jingïadei u Rynñiaw bad ka Sohlyngngem? Batai bniah. Hato kane ka saiñpyrkhat ka ïoh jaka ne em katkum ka kolshor u Khasi. Sei ïa ki nia kiba biang ban pynksan ne pynrem ïa ka jubab jong phi. 25+25=50

5. Kaei ka Phawar? Batai bniah ïa ki bynta kiba don ha 'Ka Phawar Shadwait'. Kumno ki phawar ki pynphalang ïa ka irmat jong ka Jaitbynriew? Kyrshan da ki nia ryngkat bad ka jingkynthoh. 10+20+20=50

GROUP—B

(Khasi Drama)

6. Sei ïa ki nia ban kyrshan haduh katno u S. J. Duncan u la lah ban pynbit pynbiang ïa ka kylla-ktien ha ka sawangka *U Androkolis Bad U Sing*. Kdew kyrpang ruh ïa ki sap biria-rai ba une u nongthoh u la lah ban bsiap ha kane ka sawangka. 25+25=50

7. "... ka rngiew ka long kawei kaei kaei kaba U Nongbuh Nongthaw U la shon shab lypa ha ka jyrmat jong uwei pa uwei u briew." Kaei ka rngiew? Bishar bad batai bniah kumno u nongthoh u pyntyllun ïa ki jingjia lyngba ka rngiew ha ka sawangka *Ka Rangli*. Hato ka rngiew ka dang ïoh jaka ne em haduh kine ki sngi bamynta. Ai ïa ka jingkynthoh jong phi. 10+20+20=50

8. "Ïa ka kynthei te, ki khun keiñ,
Ym don kynthei ka bym kwah thum,
Ym don kynthei ka bym kwah bah,
Ym don kynthei ka bym kwah ri,
Ïa mat kylliang. Ka dukhi dei kata
Kaba wad jingsngewbha khlem da kha."

Bishar bniah bad pynshongdor da ki nia kiba snah katkum kitei ki kyntien ba la kdew. Hato ka jingkren jong ka Mahadei ka dei ne em ka dawbah jong ka jingkwah khun. Batai bniah ryngkat ki jingkynthoh ban kyrshan ne pynrem halor kitei ki jingong. 25+25=50

GROUP—K

(Khasi Fiction)

9. Thew bad buhdor ïa u H. W. Sten kum u nongthaw thymmai ïa ka nobel *Ka Samla Nongkyndong*. Pynskhem ïa ka jubab katkum ki mat puson kiba ïadei halor ka jingthaw thymmai da kaba kdew kyrpang katkum ki aiñ jong ka litereshor. 15+15+20=50

10. Batai bniah ïa ki jingmut ba ar-syrtap jong kine ki pharshi harum : 10×5=50

(a) U Thapmyntoi

(b) Khristan

(k) U Nongpynpaw

(d) Ka Jingsuk

(e) U Bunktien

★ ★ ★

No. 21010

KHASI—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and **four** from the remaining questions, selecting at least **one** from each Group

1. Kiei ki Konsonan? Kumno ki dkhot met ki shna dur ïa ki sawa Konsonan? Batai bniah ha ryngkat ki nuksa ïa ki jaka ne ki bynta ha ka met u briew kiba pynwandur ïa ki sawa (place of articulation) bad ka rukom pynmih ïa ki sawa da kaba khang ne plie ïa ki dkhot met (manner of articulation). 5+5+20+20=50

GROUP—A

(Khasi Culture)

2. Katkum u Jeebon Roy ha ka kot *Ka Niam jong ki Khasi* ka bynta jong u ksiang ka ïoh ka jaka kaba kongsan ha ka poikha-poiman u Khasi. Batai bniah kumno phi shem ïa ka poikha-poiman u Khasi ha kane ka juk bamynta. Ai ïa ka jingkynthoh jong phi da ka sabut ba snah. 30+20=50

3. Katkum u H. Lyngdoh kumno u batai halor ka jingmih jong ka jait Lyngdoh? Don katno jait ki Lyngdoh ha ri Khasi bad Synteng? Batai bniah ïa ki kam ba ki pyndep la ka long ha ka Raid ne ka Hima. 15+15+20=50

4. U Khasi u long u Jaitbynriew uba bat ïa ka jubanlak. Kdew shai ïa ka bishar u Khasi kaba long da ka 'jingpynsmai' bad 'ka bishar ngam um'. Hato kane ka jingbishar ka dang don jingïasnoh eiei bad ka Jaitbynriew. Ai ïa ka jingkynthoh. 15+15+20=50

GROUP—B

(Khasi Literary Criticism)

5. Ka khana ka long u budlum jong ka nobel bad ka plot pat ka long u klongsnam jong ka nobel. Batai bniah katkum u H. W. Sten ïa kine ar da kaba wanrah ïa ka jingïapher hapdeng jong ki. 25+25=50

6. Kiei ki kamram bad ki kyndon jingtip ba u kritik u dei ban don? Batai bniah. 25+25=50

7. Batai bniah ïa ki jingmut ba ar-syrtap jong kine ki pharshi harum : 10×5=50

(a) Ka Khriang

(b) Ka Skit Lympiar

(k) Ka Symphiang

(d) Ka bor jong ka Poetry

(e) Ka thymmei jong ka Poetry

GROUP—K

(Khasi Linguistics)

8. Buddien ïa ka jingroi jingsan ki Parom (fiction) naduh ka snem 1960 haduh ka snem 1980. Batai bniah ba ki nongthoh ki wanrah ïa ki phang ha kane ka juk. 20+30=50

9. "Ka snem 1960 ka ïeng kum u mawmarok uba pynïakhlad ïa ka juk sah shrah bad ka juk seisoh." Kaei kaba pynlong ïa u R. S. Lyngdoh ban buh ïa kitei ki kyntien? Batai bniah. 20+30=50

GROUP—D

(Khasi Language Study)

10. Don katno ki jait ki Klos katkum u H. W. Sten? Batai shai bad bniah ïa kawei-pa-kawei ka shynrong Klos. 10+40=50

11. Ai ïa ka jingbatai ba bniah halor ka Verb katkum ki nongthoh bapher bapher. Don katno jait ki Verb bad batai bniah ïa kawei-pa-kawei halor kine ki jait Verb katkum u H. Marweiñ. 10+10+30=50

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No. 22020

GEOGRAPHY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

The candidates have to answer Question No. **1** and *any* **four** from the rest, selecting at least **one** from each Section

SECTION—A

(Physical Geography)

1. On an outline map of Asia provided to you, mark the location of any *ten* of the following and also write their respective characteristics/significance in your answer-book (word limit *30/40* words each) : (2+3)×10=50

(a) Pamir Knot

(b) Arakan Yoma

(c) Plateau of Mongolia

(d) Hwang Ho River

(e) Mt. Fujiyama

(f) Mariana Trench

(g) Lake Baikal

(h) Kabul

(i) Euphrates River

(j) Khyber and Bolan Pass

(k) The Dead Sea

(l) Philippine Islands

(m) Anatolia Plateau

(n) Mansarovar Lake

2. What do you understand by 'plate tectonics'? Into how many plates has the earth's crust been divided? Name them. What is the difference between plate boundary and plate margin? Mention the types of plate margins. What are their significance? 10+10+15+15=50

3. Discuss the factors influencing the horizontal and vertical distribution of temperature on the earth's surface. Under what circumstances does inversion of temperature take place? Discuss. Explain, with the help of a diagram, the heat balance of the earth.

10+10+15+15=50

4. Write brief notes on any *five* of the following within *200/250* words each : 10×5=50

(a) Causes of biodiversity depletion

(b) Soil profile

(c) Concept of isostasy

(d) Frontogenesis and frontolysis

(e) Salinity in enclosed sea

(f) Ocean currents

(g) Effects of climate change on environment

(h) Types of ocean deposits

(i) Zoogeographical regions

(j) Cycle of erosion

SECTION—B

(Human Geography)

5. Discuss the nature of paradigm shift in geography since the Second World War. Explain some major theoretical and methodological developments in Geography due to quantitative revolution. 20+30=50

6. Discuss the causes and consequences of international human migration. How can the rate of migration be estimated? Critically explain the neo-classical economic theory of labour migration. 15+15+5+15=50

7. What is the role of transport cost in industrial location? What the premises of the least transport cost school? Critically explain the least transport cost theory of industrial location as proposed by Alfred Weber. 10+10+20+10=50

8. Write short notes on any *five* of the following : 10×5=50

(a) Environmentalism

(b) Indicators of human development

(c) Concept of the limits to growth

(d) Rural-urban fringe

(e) Growth pole theory

(f) Planning for sustainable development

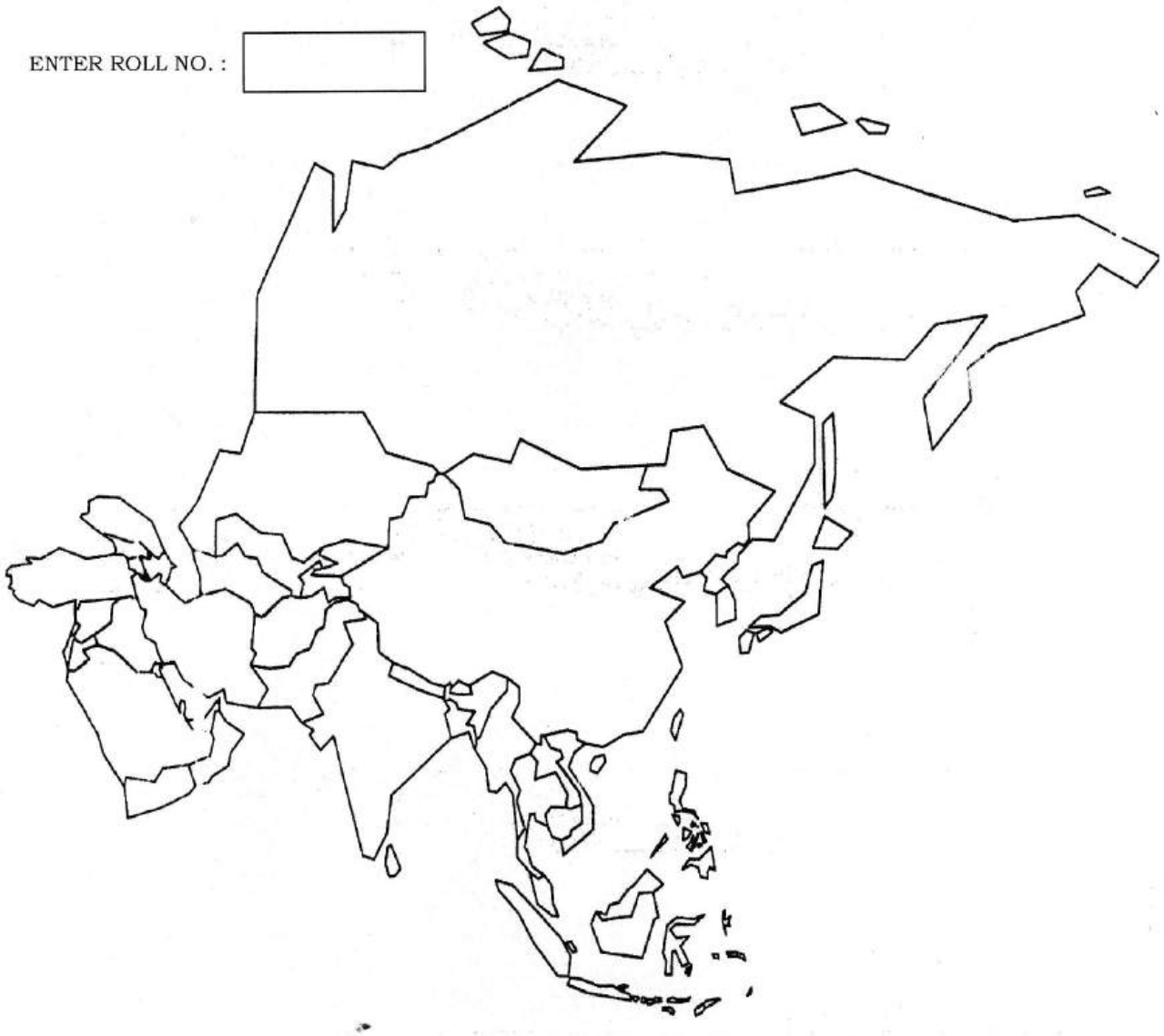
(g) Von Thunen's model of agricultural location

(h) Problems of urbanization

* * *

OUTLINE MAP OF ASIA

ENTER ROLL NO. :



/22

No. 23052

GEOGRAPHY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

The candidates have to answer Question No. **1** and *any* **four** from the rest, selecting at least **one** from each Section

SECTION—A

(Physical and General)

1. On an outline map of India provided to you, mark the location of any *ten* of the following and also write about their respective significance in your answer-book within *40/50* words each : (2+3)×10=50

(a) Aravalli Hills

(b) Hirakud Dam

(c) Nilgiri Hills

(d) Palghat Gap

(e) Malwa Plateau

(f) Tungabhadra River

(g) Maikal Range

(h) Mt. Kanchenjunga

(i) Chilika Lake

(j) Barak Valley

(k) Puducherry

(l) Patkai Range

(m) Rann of Kutch

2. Critically assess the groundwater potential of India in different regions of the country. What are the major causes of groundwater depletion in India? Suggest suitable measures to be undertaken to arrest water stress, improve water quality and security. 20+15+15=50

3. Why is dryland farming considered important to India's agriculture? Discuss the types of farming in India, their characteristics and the challenges faced by them. 15+10+15+10=50

4. Write short notes on any *five* of the following : 10×5=50

(a) Impact of western disturbances on India's weather and agriculture

(b) Energy crisis in India

(c) Ecological implications of the Green Revolution

(d) Concept of land capability

(e) Industrial complexes of India

(f) Locational factors associated with cotton textile industry in India

(g) Eco-tourism potential of India

(h) Role of railways in regional integration in India

(i) Role of ports in foreign trade of India

SECTION—B

(Human and Geo-environmental Issues)

5. Describe the role of language and religion in the formation of cultural regions in India. Bring out the consequences of racial and ethnic diversities citing examples from India. 25+25=50

6. Classify Indian cities on the basis of their functions. Enumerate the State-wise pattern of urban growth in India. What are the problems of urbanization in India?

20+15+15=50

7. Write a note on the history of planning and origin of Five-Year Plans in India. Discuss the goals and achievements of Five-Year Plans. What are the disadvantages of stopping Five-Year Plans in India? 20+20+10=50

8. Write short notes on any *five* of the following : 10×5=50

(a) Problems of intra-region migration in India

(b) Problems of slum in India

(c) Morphology of rural settlements in India

(d) Geopolitics of Indian Ocean

(e) Disputes of sharing water resources of India

(f) Causes and consequences of landslides in Eastern Himalayas

(g) Principles of EIA

(h) Advantages of linking of Indian rivers

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Outline Map Of India

ENTER ROLL NO. :

/23

No. 24015

LAW—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should answer Question Nos. **1** and **5** which are compulsory, and **three** of the remaining questions, selecting at least **one** from each Section

SECTION—A

1. Discuss the provisions in the Constitution of India forbidding retrospective effect of criminal legislation and double punishments for the same offence. 50

2. "Article 22 of the Constitution makes provisions for protection against arrest and detention in certain cases." Explain fully the scope and the limitation of this protection. 50

3. "No person shall be deprived of his property saved by the authority of law." Comment. 50

4. Discuss Article 15 of the Indian Constitution, mentioning the various provisions of the Constitution on certain grounds. 50

SECTION—B

5. Answer any *two* of the following (each answer should not exceed *200* words) : 25×2=50

(a) Whom does International Law apply to? What are the sources of International Law?

(b) Discuss the fundamental principles of International Humanitarian Law.

(c) Discuss the legal status of extradition from Indian and International Law perspective.

6. "The formation of International Law is entirely dependent on the actions of States." Discuss critically with special reference to Article 38 of the Statute of the International Court of Justice, giving decided case laws as well. 50

7. Insisting upon the existence of *mens rea* to punish persons for violation of public welfare, legislations may frustrate the purpose of these Acts and the object for which they have been enacted. Comment on the light of decided cases in India. 50

8. *(a)* What is the role of defence attorney in Criminal Law? 20

(b) What is the distinction among types of crimes, felony, misdemeanour, infractions? 30

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No. 25015

LAW—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and **two** from each Section

SECTION—A

1. Answer/Write on any *five* of the following within *250* words each : 10×5=50

(a) Discuss the importance of *mens rea* and *actus reus* to attract criminal liability.

(b) Elucidate the concept of 'Joint tortfeasors'.

(c) Explain the concept and requirement of Quasi-contract.

(d) Discuss the role of Right to Information towards bringing administrative transparency.

(e) Plea bargaining

(f) Dissolution of partnership by the Court

(g) Essentials and effect of a valid ratification by Principal

(h) Enumerate the kinds of punishment under Indian Penal Code.

2. *(a)* Explain the defence of 'mistake' as a general exception of Indian Penal Code.

(b) "Minority can be claimed as a shield but not as a sword." Explain the statement and mention the situations when a minor is liable under the Contract Law. 25+25=50

3. *(a)* How far is the rule of absolute liability a reform over the rule of strict liability? Explain.

(b) Examine the recent trends relating to application, use and misuse of Public Interest Litigation (PIL) in India. 25+25=50

4. *(a)* Explain the concept of right of private defence as an exception to criminal liability. Discuss the general principles forming the basis of right of private defence in the light of existing legal provisions and judicial decisions.

(b) Explain the distinction between offer and invitation to offer for a valid contract. Substantiate the answer with the help of decided cases. 25+25=50

SECTION—B

5. *(a)* Critically discuss as to how far the provisions of the Prevention of Corruption Act, 1988 have been able to safeguard the democracy in India.

(b) "The abetment of the illegal omission of an act may amount to an offence although the abettor may not himself be bound to do that act."

Explain and illustrate the above statement. 25+25=50

6. *(a)* Explain with the help of leading case laws, the modes of protection evolved by courts to protect weaker party against the possibility of exploitation inherent in a standard form contract.

(b) Discuss the nature and scope of the Law of Torts in India, as an important regulator in the adjustment of losses, eventuate allocation of their cost and providing the only source for alternating the plight of the injured. Substantiate your answer with leading case laws. 25+25=50

7. *(a)* Discuss the scope of the legally enforceable liability of the drawer of a cheque, under Sections 138 and 139 of the Negotiable Instruments Act, 1881.

(b) "Sustainable development has been accepted as a balancing concept between ecology and development." Discuss the role played by National Green Tribunal in recognizing and applying this principle under the laws relating to environmental protection in India. Substantiate the answer with case laws. 25+25=50

8. *(a)* Discuss the concept and importance of vicarious liability vis-à-vis State liability under the Law of Torts with the help of decided case laws.

(b) Critically discuss the role played by media trial in reference to its limit and attempts to influence the judicial process in Courts. 25+25=50

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No. 26030

AGRICULTURE—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates must attempt **five** questions taking at least **two** from each Section

SECTION—A

1. Answer any *two* of the following questions in not more than *250* words each : 25×2=50

(a) Describe the various climatic factors affecting crop growth.

(b) Explain in detail the different cropping systems practised in agriculture and their role in increasing crop production.

(c) Describe in detail the concept of integrated nutrient management practice with example.

2. *(a)* Elaborate in detail the various properties of soil. 25

(b) Explain in detail the methods of soil reclamation. 25

3. *(a)* What are the problems in rainfed agriculture system? Describe the various technologies to mitigate the agriculture production problems under rainfed system. 25

(b) Explain in detail drip and sprinkler irrigation. Enlist their advantages and disadvantages in comparison to conventional system of irrigation. 25

4. Write short notes on any *four* of the following : 12½×4=50

(a) Role of agricultural price policy and crop insurance in improving the livelihood of small and marginal farmers citing suitable example

(b) Role of NGO and Self-help group in the development of rural population

(c) Farm mechanization and its role in agriculture

(d) KVK and its role in technology dissemination

(e) Environmental pollution and its associated hazard to crop plants

SECTION—B

5. Answer any *two* of the following questions in not more than *250* words each : 25×2=50

(a) What is greenhouse effect? Explain its role in global warming and measures to mitigate it.

(b) Explain the advances in ecosystem analysis with special emphasis on remote sensing and GIS.

(c) Define soil erosion. What are the measures for prevention of soil erosion and runoff in hill ecosystem?

6. Answer any *two* of the following questions : 25×2=50

(a) Describe in detail the good agricultural practices for production of rice.

(b) Name the essential plant nutrients and describe in detail their functions in growth and development of plants.

(c) What is dryland agriculture? Highlight the various challenges of agriculture in dryland and their mitigations.

7. Explain the following in brief : 10×5=50

(a) Lab to land programme

(b) Difference between multiple cropping and intercropping with examples

(c) Integrated weed management in agriculture

(d) Modern classification of Indian soil

(e) Ideal quality of irrigation water

8. Answer any *two* of the following questions : 25×2=50

(a) Describe in detail the processes and factors of soil formation.

(b) Explain in detail the cropping pattern followed in different agroclimatic zones of India.

(c) Elaborate in detail the impact of high yielding and short duration varieties in crop diversification.

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No. 27017

AGRICULTURE—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates must attempt **five** questions taking at least **two** from each Section

SECTION—A

1. Answer any *two* of the following questions in not more than *250* words each : 25×2=50

(a) What is mutation breeding? Explain the implication of mutation in breeding programme for crop improvement with appropriate example.

(b) Discuss the various modes of reproduction. Explain in brief the methods of breeding for improvement of self- and cross-pollinated crops.

(c) Write a brief note on the various enzymes and phytopigment. Discuss in detail their function in growth and development of plant.

2. *(a)* Discuss in detail the principal method of preservation of vegetable products. 25

(b) What do you understand by IPR? Discuss its importance in protection of agriculture innovation. 25

3. *(a)* Give the package of practice of any potential ornamental crop of Meghalaya. 25

(b) What do you understand by biological control of pests and diseases? Discuss in detail. 25

4. Write short notes on any *four* of the following : 12½×4=50

(a) Polyploidy

(b) Protein-energy malnutrition

(c) Carbohydrate mechanism

(d) Hybrid vigour

(e) Difference between diffusion and osmosis

SECTION—B

5. Answer any *two* of the following questions in not more than *250* words each : 25×2=50

(a) Define centre of origin. Write a brief note on the origin and evolution of crop plants. Enlist any five fruits and vegetables, each that have centre of origin in North-Eastern region.

(b) What is microbial toxin? Discuss in detail some important storage pests of cereals and their management practice.

(c) Differentiate between interspecific and intergeneric hybridization with suitable examples.

6. Answer any *two* of the following questions : 25×2=50

(a) Discuss in detail the causal organism, symptoms and management practices of important disease of any fruit crop commercially grown in Meghalaya.

(b) Give a brief note on food-based dietary approaches to eliminate hunger.

(c) What do you understand by seed certification? Discuss in brief the technologies for seed production and processing.

7. Explain the following in brief : 10×5=50

(a) Sex-limited characters

(b) Modern concept of photosynthesis

(c) National dietary guidelines

(d) Chromosomal aberration

(e) Imbibition

8. Answer any *two* of the following questions : 25×2=50

(a) Discuss in brief the concept of integrated disease management citing suitable examples.

(b) What are plant growth regulators? Discuss the mechanism of action of some important PGR.

(c) Give the package of practice of any potential fruit crop of Meghalaya.

★ ★ ★

No. 28008

ECONOMICS—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and *any* **four** from the rest

1. Write notes on the following : 10×5=50

(a) Alternate theories of distribution

(b) High-powered money

(c) Discount house

(d) International Monetary Fund (IMF)

(e) Sustainable development

2. Compare and contrast the Marshallian and Walrasian approach to price determination. 25+25=50

3. Describe Say's law of market and explain the process of achieving full employment. Explain how the level of income and employment is determined according to Keynes. 20+30=50

4. Explain the liquidity preference theory of interest. What are its limitations? 40+10=50

5. Discuss the goals and instruments of monetary management in a closed and an open economy. 25+25=50

6. Explain the different types of budget deficits. Discuss the various effects of public expenditure. 15+35=50

7. *(a)* Discuss the concepts of comparative advantage in international trade. Explain the role of terms of trade in generating surplus or deficits. 15+10=25

   (b) Explain the concept 'Trade as an engine of growth'. 15

   (c) Discuss the major differences between an import quota and a tariff. 10

★ ★ ★

No. 29008

ECONOMICS—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and *any* **four** from the rest.

1. Write notes on the following (any *five*) : 10×5=50

(a) Randade's critique of Laissez-Faire

(b) Contributions of Gadgil and Rao in the estimation of national income in India

(c) Regional disparities in agricultural growth

(d) Measurements of poverty

(e) Agriculture and the World Trade Organization (WTO)

(f) Intellectual Property Rights (IPR)

(g) 73rd and 74th Constitutional Amendments

2. Describe the Indian economy during the colonial period with special references to agriculture and trade relations with other countries. 50

3. Explain the idea of the Green Revolution. Discuss the effect of technological changes in terms of agricultural prices and the terms of trade. 10+(20+20)=50

4. Discuss the role of public and private sectors in the process of growth in Indian industries. 50

5. Briefly explain the sectoral composition of national income. Discuss the changes that took place in the sectoral composition income in India. 20+30=50

6. Briefly elaborate the latest EXIM policy in the post-liberalization era. 50

7. Explain the various causes of inflation. What policy measures can be adopted to control inflation? Discuss the effect of inflation under open economy. 20+15+15=50

8. Under the new economic policy, what role does Foreign Direct Investment (FDI) and multinationals play in the growth and development of Indian economy? 50

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No. 30020

COMMERCE AND ACCOUNTANCY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question Nos. **1** and **5** which are compulsory and **three** from the remaining questions, selecting at least **one** from each Part

PART—A

(Accounting, Taxation and Auditing)

1. *(a)* State the sources of buyback of shares. 10

(b) The following is the Balance Sheet of *XY* Ltd. as at 31st March, 2023 :

Particulars		*Note. No.*	*Amount* ₹
I. Equity and Liabilities :			
1. Shareholders' Funds :			
(a) Share Capital :			
100000 Equity Shares of ₹ 10 each			10,00,000
(b) Reserve and Surplus :			
General Reserve	4,50,000		
Profit & Loss A/c	2,00,000		
Staff Welfare Fund	80,000		7,30,000
2. Non-Current Liabilities :			
Long-term Borrowings—10% Debentures			6,00,000
3. Current Liabilities :			
(a) Trade Payables—Creditors			3,70,000
(b) Short-term Provision—Proposed Dividend			1,50,000
Total			28,50,000

Particulars		Note. No.	Amount ₹
II. Assets :			
1. Non-Current Assets :			
Fixed Assets			
(a) Tangible Assets :			
Equipments (at cost)	18,00,000		
Less : Depreciation	3,00,000		15,00,000
(b) Intangible Assets :			
Goodwill			2,00,000
2. Current Assets :			
(a) Inventories	7,00,000		
(b) Trade Receivables—Debtors	3,00,000		
(c) Cash and Cash Equivalents :			
Cash at Bank	1,50,000		11,50,000
	Total		28,50,000

You are required to calculate the value of each equity share on assets basis based on the following information : 40

(i) A fair after-tax return on capital employed for this type of business is 18%

(ii) Equipment to be revalued at ₹ 16,00,000

(iii) Inventories are considered to have a net realizable value of ₹ 6,60,000

(iv) Goodwill in this type of business is normally valued at 3 years purchase of super profits

(v) Included in the debtors is a balance of ₹ 20,000 which is considered irrecoverable

(vi) Profits for the last three years (before interest and taxes) are

Year	*Profit* ₹
2020–21	11,00,000
2021–22	10,20,000
2022–23	10,80,000

(vii) Company's profits are taxed at 40%

Or

(a) What are the functions of Cost Accounting? 10

(b) A product passes through three distinct processes—*A*, *B* and *C*. The details of expenses incurred on the three processes during the year 2023 were as under :

Process	*A*	*B*	*C*
Units issued/introduced (in unit)	10000	—	—
Cost per unit (in ₹)	100	—	—
Materials (in ₹)	10,000	15,000	5,000
Labour (in ₹)	30,000	80,000	65,000
Direct expenses (in ₹)	6,000	18,150	27,200
Selling price per unit of output (in ₹)	120	165	250

Management expenses during the year were ₹ 80,000 and selling expenses were ₹ 50,000. These were not allocable to the processes.

The actual output of the three processes was

A—9300 units; *B*—5400 units and *C*—2100 units

Two-thirds of the output of Process—*A* and one-half of the output of Process—*B* were passed onto the next process and balance was sold. The entire output of Process—*C* was sold

The normal loss of the three processes, calculated as percentage of input, was as follows :

Process—*A* 5%, Process—*B* 15% and Process—*C* 20%

The normal loss units of Process—*A* were sold at ₹ 2 per unit, those of Process—*B* at ₹ 5 per unit and of Process—*C* at ₹ 10 per unit

Prepare Process A/cs, Abnormal Loss and Abnormal Gain A/c, and also a statement of profit and loss. 40

2. From the following information, calculate the taxable income of Mr. *A* (age 56 years), an employee of a private company for the Assessment Year, 2024–25 : 50

	₹
Basic Salary	35,000 p.m.
Dearness Allowances	12,000 p.m.
Entertainment Allowances	1,500 p.m.
City Compensatory Allowances	1,000 p.m.

Mr. *A* and his employer both contributes ₹ 50,000 p.a. to a recognized provident fund. Interest on provident fund @ 15% is ₹ 30,000. He is provided with a rent-free furnished accommodation at Shillong for which the company pay rent of ₹ 6,000 p.m. During the year, he has earned ₹ 8,200 as bank interest from Savings A/c and ₹ 10,000 as interest from Fixed Deposit, and further ₹ 6,000 from interest from Post Office Savings A/c. Dividend received by him during the year from an Indian company amounted to ₹ 25,600.

During the year, he paid Life Insurance Premium on his own life ₹ 25,000 (policy value ₹ 1,50,000). He also paid Medical Insurance Premium ₹ 20,000 p.a. for covering self and spouse's health. He donated ₹ 16,000 to National Defence Fund and paid ₹ 2,500 as professional tax for the year.

(Assume that dearness allowance does not form part of salary for computation of any retirement benefits and Mr. *A* has exercised the option to shift out of the default tax regime under Section 115BAC.)

3. *(a)* What are the special features to be considered while conducting an audit of an educational institution? 25

(b) "No dividend shall be payable, except out of profit."

Discuss the above statement. 25

4. Write short notes on any *two* of the following with examples : 25×2=50

(a) Residential status of an individual as per the IT Act, 1961

(b) Break-even Analysis

(c) Accounting for Depreciation

(d) Vouching

PART—B

(Business Finance and Financial Institutions)

5. *(a)* Write a note on profit maximization versus wealth maximization. 10

(b) What are the factors determining a firm's working capital requirements? 10

(c) Explain briefly the main determinants of dividend policy of a firm. 10

(d) Machine—*A* costs ₹ 10,00,000 payable immediately and Machine—*B* costs ₹ 12,00,000, half payable immediately and half payable in one year's time. The cash receipts expected from the two machines are as follows :

Year (at end)	*Machine—A* ₹	*Machine—B* ₹
1	2,00,000	—
2	6,00,000	6,00,000
3	4,00,000	6,00,000
4	3,00,000	8,00,000
5	2,00,000	—

The company's cost of capital is 7%. You are asked to calculate the NPV of each machine. Suggest which machine should be selected. 20

The present value of ₹ 1 at 7% discounting rate are as follows :

Year	1	2	3	4	5
PV Factor @ 7% p.a.	0·935	0·873	0·816	0·763	0·713

Or

(a) What are the assumptions based on which the Modigliani and Miller theory was developed? 10

(b) Who are the important players in the Indian Money Market? 10

(c) If the RBI reduces the CRR, what will happen to the credit creation? 10

(d) Calculate the Degree of Operating Leverage (DOL), Degree of Financial Leverage (DFL) and Degree of Combined Leverage (DCL) for the following firms and interpret the results : 20

Firms	*A*	*B*	*C*
1. Output (units)	60000	15000	100000
2. Fixed cost (₹)	7,000	14,000	1,500
3. Variable cost per unit (₹)	0·20	1·50	0·02
4. Interest on borrowed funds (₹)	4,000	8,000	—
5. Selling price per unit (₹)	0·60	5·00	0·10

6. The capital structure and specific cost of capital (after tax) of a company is given below :

Source	*Book value* (₹)	*After-tax cost* (%)
Equity Share Capital (shares of ₹ 10 each)	2,00,000	18%
Retained Earnings	1,00,000	18%
Long-term Loan	2,00,000	6%
Total	5,00,000	

The present market value of equity is ₹ 90 per share and the corporate tax rate is 25%.

Calculate the Weighted Average Cost of Capital (WACC) using—

(a) book value weights;

(b) market value weights. 50

7. The Cost Sheet of a company provides the following information :

	Amount per unit ₹
Elements of Cost :	
Raw Materials	40
Direct Labour	15
Overheads	30
Profit	15
Selling Price	100

The following particulars are available :

Raw materials are in stock on an average for 1 month. Work-in-progress is on an average for half a month. Finished goods are in stock for an average of 1 month. Credit allowed by supplier is 1 month and credit allowed to customers is 2 months. Lag in payments of wages is half month and lag in payments of overheads is 1 month. It is also informed that the $\frac{1}{4}$th of the total sales is against cash. Cash balance of the company is expected to be ₹ 25,000.

Prepare a statement showing working capital requirement for a level of activity of 104000 units of production during a year. 50

8. Write short notes on any *two* of the following : 25×2=50

(a) Changes in the structure of Indian financial institutions in the post-reform period (i.e., post 1991)

(b) Monetary policy techniques of the Reserve Bank of India

(c) Causes of industrial sickness

(d) Instruments of the Indian money market

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No. 31010

COMMERCE AND ACCOUNTANCY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question No. **1** which is compulsory and **four** of the remaining questions, selecting at least **two** from each Part

PART—A

1. *(a)* Define organization. Explain the different forms of organizational structure. 5+20=25

(b) What functions do informal groups perform from the members point of view? 25

Or

(a) Discuss the contribution of Henri Fayol to management. 25

(b) How can employee training and development program be used to improve organizational performance? 25

2. Discuss the various functions which constitute the process of management. 50

3. *(a)* "Good leadership is an integral part of effective direction." Discuss. 25

(b) Explain the elements of good planning. 25

4. What are the forces that cause organizational change? Discuss how an organization would manage the change process. 20+30=50

PART—B

5. Explain the different types of industrial disputes in India. Explain how disputes between employees and management should be resolved. 25+25=50

6. *(a)* What is the role of trade unions in the modern workplace? 20

(b) How can Human Resource (HR) Department work most effectively with unions to ensure the best possible outcome for all parties involved? 30

7. *(a)* Discuss the factors that contributed to the growth of Trade Union Movement in India. 25

(b) Describe the significance of International Labour Organization (ILO) in the context of Industrial Relations. 25

8. *(a)* Discuss, in brief, the benefits of worker's participation in management. 25

(b) What are the main causes of high labour turnover in Indian service sector? Suggest remedies, if any. 25

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No. 32013

GEOLOGY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** and Question No. **5** which are compulsory and *any* **three** from the rest, selecting at least **one** from each Section.

SECTION—A

1. Answer any *five* of the following : 10×5=50

(a) What are the evidences which indicate that sea-floor spread?

(b) Give a classification of meteorites and state the basis on which classification has been made.

(c) Explain geomorphic cycle.

(d) What is polar orbiting satellite and for what purpose are they launched?

(e) Write briefly on the importance of strain markers found in rocks.

(f) Write about stress ellipsoid.

(g) What is petrofabric analysis and what is its importance?

(h) Write about stereographic projection in structural geology.

2. *(a)* Explain the theory of plate tectonics. Draw a suitable diagram of plate subduction to indicate the position of back arc basin, fore arc basin, island arc. What is the difference between lithosphere and crust? 15+6+4=25

(b) Describe briefly on the interior of the earth with the help of seismic evidences. 25

3. *(a)* What are the three segments of global positioning system? Write briefly about NAVSTAR and GLONASS. 13+12=25

(b) Explain how geomorphological studies can help in *(i)* mineral exploration and *(ii)* environmental studies. 15+10=25

4. *(a)* Write on the genetic classification of faults. Explain the role of the principal stress in generation of faults. 20+5=25

(b) Define lineation. Add a note on the different types of lineation. How are lineations useful in structural analysis? 5+15+5=25

SECTION—B

5. Write explanatory notes on/Answer any *five* of the following : 10×5=50

(a) Darcy's law of hydraulic conductivity

(b) Importance of alkali-aggregate reaction test

(c) Write briefly on the stratigraphy of Shillong Group of rocks.

(d) Modes of preservation of fossils

(e) Use of microfossils in petroleum exploration

(f) Pleistocene glaciations in Indian subcontinent and their evidences

(g) Major thrust belts of the Himalayas

(h) Cause of saline water intrusions in aquifers

6. *(a)* Discuss the evolutionary trend of Cephalopoda with reference to their sutures and geological age. 25

(b) Enumerate the evolutionary trend of Equidae. 25

7. Write on/Answer any *two* of the following : 25×2=50

(a) K-T boundary and its geological significance

(b) Discuss the distribution of Precambrian rocks in the Indian subcontinent.

(c) Evolution of the Himalayas

8. Answer/Write an explanatory note on any *two* of the following : 25×2=50

(a) Write on the various methods of rain water harvesting.

(b) Geological investigation to be carried out for bridge site selection in a hilly terrain

(c) Define factor of safety. Describe the geological factors that cause landslides. Add a note on the preventive measures of landslide.

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No. 33013

GEOLOGY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** and Question No. **5** which are compulsory and **three** from the rest, selecting at least **one** from each Section.

SECTION—A

1. Answer/Write on any *five* of the following : 10×5=50

(a) Give the outline of the international system of crystallographic notations.

(b) Twinning and its types with neat sketches

(c) Bowen's reaction principle and its application

(d) Discuss the petrogenesis of charnockite, being considered as 'charnockite series'.

(e) Isomorphism, pseudomorphism and polymorphism

(f) Distribution of sedimentary basins of India

(g) Explain how sediment's study helps to determine its provenance.

(h) Components of limestone

2. Write short notes on any *two* of the following : 25×2=50

(a) Classification of crystals into six systems

(b) Optical properties of the amphibole group

(c) Common minerals of igneous and metamorphic rocks

3. *(a)* Describe the crystallization behaviour of diopside-anorthite system with the help of phase rule. Also add a note on its petrogenetic significance. 20+5=25

(b) Answer/Write short notes on any *two* of the following : 12½×2=25

(i) How is magma generated? Explain the process of magmatic differentiation.

(ii) Metamorphic facies of metapelites in regional metamorphism

(iii) Petrogenesis of granite

4. Write explanatory notes on any *two* of the following : 25×2=50

(a) Dott's classification of sandstones

(b) Marine environment of deposition

(c) Heavy minerals and provenance studies

SECTION—B

5. Write on any *five* of the following : 10×5=50

(a) Coal deposits of Meghalaya

(b) Conservation of mineral resources

(c) Reconnaissance survey

(d) Types of geochemical survey

(e) Composition of planets

(f) Radioactive waste disposal

(g) Types of chemical bonds

6. Answer any *two* of the following : 25×2=50

(a) Describe any two processes of formation of mineral deposits.

(b) Write about physical and chemical constituents of coal.

(c) Write about National Mineral Policy.

7. Write explanatory notes on any *two* of the following : 25×2=50

(a) Geophysical methods of prospecting

(b) Techniques of sampling

(c) Mineral beneficiation and ore dressing

8. Write short notes on any *two* of the following : 25×2=50

(a) Cosmic abundance of elements

(b) Structure and composition of the earth

(c) Environmental laws of India

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70

No. 34010

CHEMISTRY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer *any* **five** questions

1. *(a)* Write down the Schrödinger wave equation for an electron propagating in three dimensions in space and explain the terms involved. Explain the significance of ψ and ψ^2. 5+5=10

(b) Explain the term dual character of matter and radiation and derive the de Broglie's equation. 5

(c) Draw the molecular orbital diagram of O_2 and O_2^+. Calculate the bond order and discuss their magnetic properties. 5+5=10

(d) What type of hybridization is expected for I_3^- and ClF_3? Explain the geometry of these molecules using VSEPR theory. 10

(e) Derive the Bragg's equation for X-ray diffraction of a crystal. 8

(f) What are point defects? Explain the different types of point defects present in a crystal. 7

2. *(a)* What type of defects in crystals imparts both paramagnetic effect and colour of the solid? How are such defects caused? Explain with a suitable example. 10

(b) Draw Born-Haber cycle for the formation of NaCl, mentioning various terms involved. How does Born-Haber cycle explain the solubility of ionic compounds? 10

(c) If heavier gas molecules move more slowly than light gas molecules, why is the average kinetic energy independent of gases? 6

(d) Give the proper reasons to justify whether the following systems will obey Maxwell's law or not : 3×2=6

(i) Pressure is trebled in an ideal gas obeying Maxwell's law initially

(ii) A gas, obeying Maxwell's law initially, is placed in the gravity field of the earth

(e) "The viscosity of a gas increases with increase in temperature." Explain. 5

(f) "Volatile liquids must have lower surface tension and viscosity." Explain. 5

(g) At 293 °C, 10 cc of water gave 29 drops and 10 cc of ether gave 87 drops in the same stalagmometer. The density of ether is 0·7 gm/cc and γ of water is 72 dynes/cm. Calculate the surface tension of ether. 8

3. *(a)* State the first law of thermodynamics and derive its mathematical equation. How does the equation become in case of *(i)* a closed system and *(ii)* an adiabatic process? 10

(b) State Nernst heat theorem. How does it lead to the enunciation of the third law of thermodynamics? 10

(c) Calculate the entropy change when 1 mole of ethanol is evaporated at 351 K. The molar heat of vaporization of ethanol is 39·84 kJ mol^{-1}. 5

(d) Draw the phase diagram of a binary system showing a eutectic point and describe the important points, lines and areas in the system. 10

(e) Phenol and water are partially miscible liquids. By mixing these two liquids, we get two phases at equilibrium. Find the number of degrees of freedom of the system. 5

(f) The normal boiling point of methanol is 64·7 °C. Calculate the boiling point of methanol at an elevation of 4000 m above sea level where the pressure is 478 mmHg. The heat of vaporization of methanol is 35·3 kJ mol^{-1}. 10

4. (a) Derive Nernst equation for measuring EMF of a cell. 10

(b) Calculate the EMF of a zinc-silver cell at 30 °C when activity of Zn^{2+} ions is 0·5 and the activity of Ag^{+} ions is 10. Standard reduction potentials at 30 °C are—

(i) Ag^{+}, Ag electrode $= +0 \cdot 799$ volt;

(ii) Zn^{2+}, Zn electrode $= -0 \cdot 760$ volt. 5

(c) What is electrochemical series? What are its applications? 10

(d) Can a solution of 1 M $CuSO_4$ be stored in a vessel made of nickel metal? Given that, $E^{\circ}_{Ni,\ Ni^{2+}} = +0 \cdot 25$ volt and $E^{\circ}_{Cu,\ Cu^{2+}} = -0 \cdot 34$ volt. 5

(e) Write short notes on the following : 10

(i) Concentration cells

(ii) Overpotential

(f) Discuss, in detail, the collision theory of bimolecular reactions. What are the limitations of this theory? 10

5. (a) With the help of a Jablonski diagram, discuss all the possible decay routes of an electronically excited molecule. 10

(b) What is meant by steady-state approximation? How does this approximation help in deriving the kinetics of the following photochemical reaction?

$$H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$$

Explain why the quantum yield of this reaction is extremely high. 10

(c) The blue solution of $CuSO_4$ slowly gets discharged when a zinc rod is dipped into it. Explain this observation from the following electrode potentials :

E° of Cu^{2+}/Cu and Zn^{2+}/Zn are $+0 \cdot 34$ V and $-0 \cdot 76$ V respectively

Also write the relevant equation. 5

(d) Derive Langmuir adsorption isotherm. How does this isotherm help in elucidation of kinetics of a gaseous reaction on solid surface? 10

(e) Discuss the BET theory of multilayer adsorption. 10

(f) Differentiate between physisorption and chemisorption. 5

6. (a) What does PSII do in photosynthesis? Why is it called PSII? What is the difference between PSI and PSII photosynthesis? 10

(b) Discuss the structure of myoglobin and haemoglobin. Discuss, in detail, the roles played by these bioinorganic compounds in biological systems. 15

(c) What is nitrogen fixation? Discuss briefly biological nitrogen fixation. 10

(d) How do the *d*-orbital energy levels split when a transition metal ion is placed in an octahedral crystal field of the ligands? 10

(e) What is meant by spectrochemical series? 5

7. *(a)* On the basis of CFT, explain the following giving appropriate reasons for your answers : 10

(i) $[CoF_6]^{3-}$ ion is paramagnetic while $[Co(CN)_6]^{3-}$ ion is diamagnetic.

(ii) $[Fe(CN)_6]^{4-}$ ion is diamagnetic while $[Fe(CN)_6]^{3-}$ ion is paramagnetic, although both the ions have strong ligands.

(b) Draw the geometrical isomers of the following : 6

(i) $[Pt(NH_3)_2Cl(NO_2)]$

(ii) $[Co(NH_3)_4(NO_2)_2]^+$

(c) What do you mean by labile and inert complexes? Explain. 8

(d) How does the presence of a ring structure affect the stability of complexes? 6

(e) Explain why $[Ni(CN)_4]^{2-}$ is thermodynamically stable but kinetically labile. 5

(f) What are metal carbonyls? Give one method of preparation each for $Cr(CO)_6$ and $Ni(CO)_4$. 10

(g) What is binuclear carbonyl? Give an example and also draw the structure. 5

8. *(a)* Complete the following reactions and draw the structure of the major products formed : 5+5=10

(i) $3B_2H_6 + 6NH_3 \xrightarrow{200\,^\circ C}$ ____ + ____

(ii) $S_2Cl_2 + 16NH_3 \longrightarrow$ ____ + ____ + ____

(b) What is lanthanide contraction? What are its consequences? Explain the separation of lanthanides by ion-exchange method. 10

(c) Sketch the synthesis of $[Fe(\eta^5\text{-}C_5H_5)(\eta^5\text{-}C_5H_4COOH)]$ complex starting from $[Fe(\eta^5\text{-}C_5H_5)_2]$. 5

(d) What are *trans*-uranium elements? Why are they so called? Give the method of preparation of neptunium and comment on the stability of the element. 10

(e) Give one method of preparation of $N_3P_3Cl_6$. How does it react with C_2H_5MgCl? Describe its structure. 10

(f) What are actinides? Why are they so called? 5

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No. 35005

CHEMISTRY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer *any* **five** questions

1. *(a)* State and explain the main points of Hückel's rule. With the help of this rule, how can aromaticity of organic compounds be explained? 10

(b) What are aromatic, anti-aromatic and non-aromatic compounds? Give examples. 10

(c) Explain the electrophilic substitution in benzene with mechanism taking nitration as example. 10

(d) Explain why the electrophilic substitution takes place preferably at alpha position in furan, thiophene and pyrrole. 10

(e) Discuss viscosity method for the determination of molecular weight of a polymer. 10

2. *(a)* What are free radicals? How are they classified? Give one method for generation of free radicals. Which species in each of the following is more stable and why?

(i) Phenyl cation and cyclohexyl cation

(ii) Phenyl anion and cyclohexyl anion 15

(b) Which S_N1 reaction of each pair is expected to take place at a faster rate and why?

(i) $(CH_3)_3C—Br + H_2O \xrightarrow{\Delta} (CH_3)_3COH + HBr$

$(CH_3)_2CH—Br + H_2O \xrightarrow{\Delta} (CH_3)_2CHOH + HBr$

(ii) $(CH_3)_3C—Br + H_2O \longrightarrow (CH_3)_3C—OH + HBr$

$(CH_3)_3C—Br + C_2H_5OH \longrightarrow (CH_3)_3C—OC_2H_5 + HBr$ 10

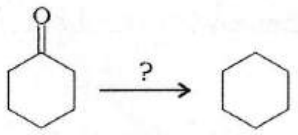
(c) Explain why the triple bonds are less susceptible to electrophilic attack than double bonds, although the concentration of electrons in a triple bond is higher than that in a double bond. 5

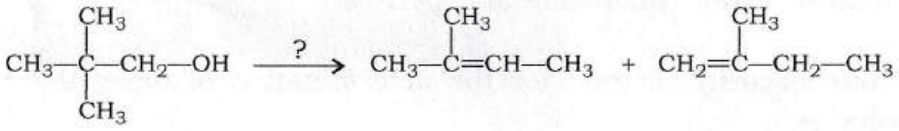
(d) Predict the major products of the following reactions. Give your reasoning : 5

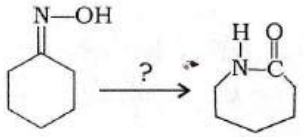
(i) $CH_3—CH=CHCH_2CH_3 + HI \longrightarrow$

(ii) $CH_3—C\equiv C—H + 2HBr \longrightarrow$

(e) How are the following transformations carried out? Give the mechanisms : 15

(i) 

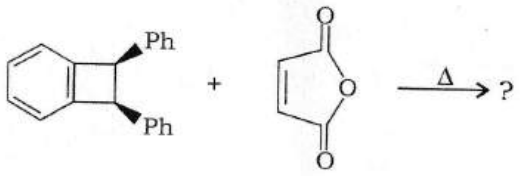
(ii) 

(iii) 

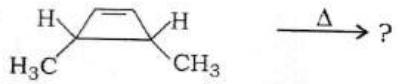
3. (a) What are pericyclic reactions? How are they classified? Briefly explain the FMO approach of pericyclic reactions. 2½+2½+5=10

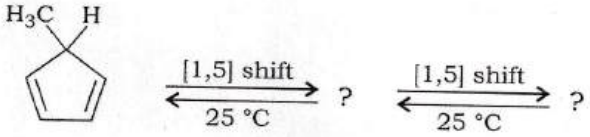
(b) Complete the following reactions with proper stereochemistry : 3×5=15

(i) 

(ii) 

(iii) 

(iv) 

(v) 

(c) What are polymers? List out the differences between organic polymers and inorganic polymers. 5

(d) Equal number of polymer samples each having molecular weight of 10^3 and 10^4 are mixed. Calculate the number average and weight average molecular weights of the sample. 5

(e) Give one method of preparation and one use of each of the following polymers : 3×5=15

(i) $(NPCl_2)_n$

(ii) Polyvinyl chloride

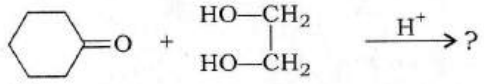
(iii) Terylene

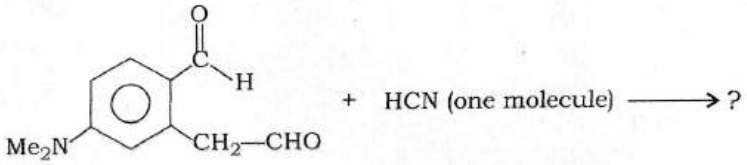
(iv) Silicates

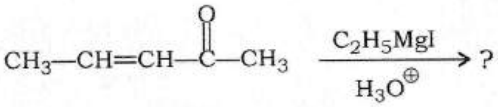
(v) Polystyrene

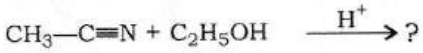
4. *(a)* Compare an E1 with an S_N1 process. 10

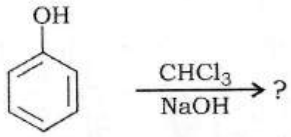
(b) Predict the products of the following reactions and also propose a reasonable mechanism (any *four*) : 10×4=40

(i) 

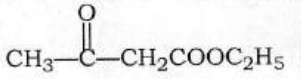
(ii) 

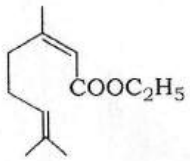
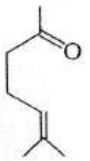
(iii) 

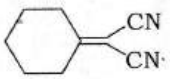
(iv) 

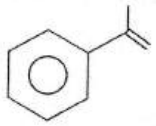
(v) 

5. How would you synthesize the following using the type of reaction mentioned? Give the mechanisms (any *five*) : 10×5=50

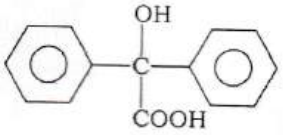
(a)  (by Claisen condensation)

(b)  from  (by Reformatsky reaction)

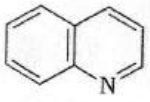
(c)  (by Knoevenagel reaction)

(d)  (by Wittig reaction)

(e) $C_6H_5CH{=}CH{-}COOH$ (by Perkin reaction)

(f) 

(by Benzoin condensation)

(g) 

(by Skraup synthesis)

6. (a) Explain number average and weight average molecular weights of polymers. 10

(b) How will you synthesize the following polymers from the indicated starting materials? 10

(i) Polyvinyl chloride (PVC) from acetylene

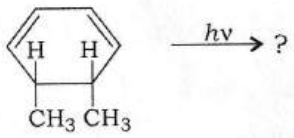
(ii) Nylon-6,6 from 1,3 butadiene

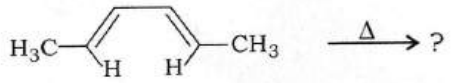
(c) What is peptide linkage? How does it form a chain of proteins? Discuss the important characteristics of proteins. 10

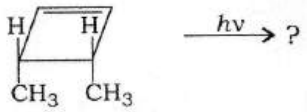
(d) What function does protein perform in human body? What is meant by denaturation of protein? 10

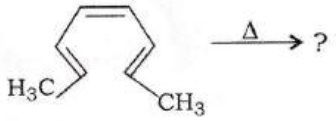
(e) What are nucleic acids? Describe the structures of DNA and RNA. 10

7. *(a)* Complete the following reactions and mention the kind of rotation and stereochemistry of the products (any *two*) : 10

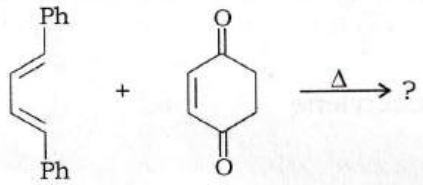
(i) 

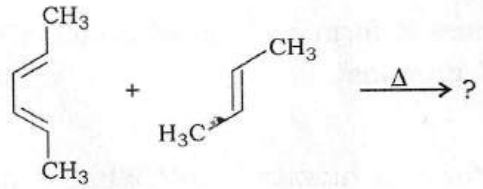
(ii) 

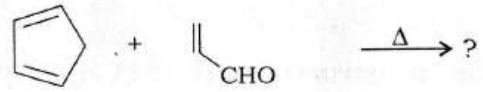
(iii) 

(iv) 

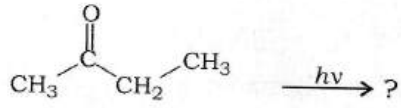
(b) Write down the products with proper stereochemistry (any *two*) : 10

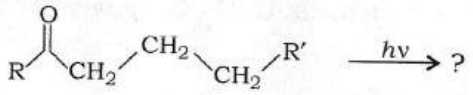
(i) 

(ii) 

(iii) 

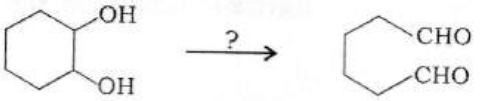
(c) Predict the products and suggest the mechanisms for the following photochemical reactions and also name the reactions : 10

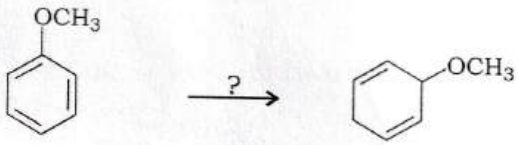
(i) 

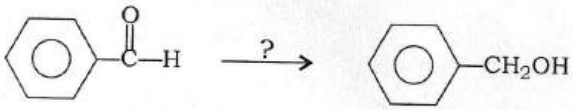
(ii) 

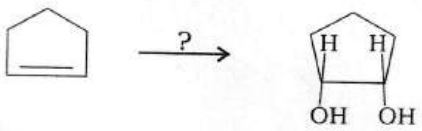
(d) Explain the terms 'singlet state' and 'triplet state'. 5

(e) Give an appropriate reagent in each of the following conversions and suggest their mechanisms (any *three*) : 5×3=15

(i) 

(ii) 

(iii) 

(iv) 

8. (a) Discuss the effects of polar solvents on the $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ transitions. 10

(b) Explain McLafferty rearrangement with an example. 5

(c) What is a chemical shift? Why do we use tetramethylsilane (TMS) as a standard substance for recording chemical shift? 5

(d) How will you distinguish between the following pair of compounds by IR spectroscopy? 10

(i) $CH_3CH_2COCH_3$ and $CH_3OCH=CH_2$

(ii) *o*-hydroxybenzoic acid and *m*-hydroxybenzoic acid

(e) An organic compound with molecular formula $C_9H_{10}O_2$ gives the following spectral data :

IR : 1740 cm^{-1}, 1220 cm^{-1}

^1H NMR : 7·2 (5H, singlet), 5·0 (2H, singlet), 1·96 (3H, singlet)

m/z : 150 (M), 91, 43 besides other peaks

Determine the structure of the compound. 5

(f) Show that on the rigid rotor model the energy difference between the adjacent lines in a rotational spectrum of a diatomic molecule is constant. 15

* * *

No. 36009

ENGLISH—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question No. **1** and **four** of the remaining questions, selecting **two** from each Section

1. Write briefly on any *two* of the following : 25×2=50

(a) Highlight the impact of the Renaissance on the development of English drama with special reference to the works of two major dramatists of the period.

(b) Discuss the main features of metaphysical poetry.

(c) What are the major characteristics of Romantic poetry?

(d) Discuss, in brief, the factors leading to the rise of the English novel in the 19th century.

SECTION—A

Answer any *two* of the following questions : 50×2=100

2. Analyze the character of King Lear in the light of classic tragic hero.

Or

Attempt a detailed character study of Miranda in William Shakespeare's famous play, *The Tempest.*

3. Examine Pope's *The Rape of the Lock* as a mock epic.

Or

Bring out the central idea of the poem, *Resolution and Independence* by William Wordsworth.

4. How does Alfred Lord Tennyson explore the theme of grief and loss in his poem, *In Memoriam*?

Or

Discuss Nora as a tragic heroine in Henrik Ibsen's play *A Doll's House*.

SECTION—B

Answer any *two* of the following questions : 50×2=100

5. Swift's satire is "a spontaneous overflow of powerful indignation and his target is Man himself". Discuss this charge with reference to *Gulliver's Travels*.

6. How does Charles Dickens critique the social and economic conditions of the 19th century England in the *Hard Times*?

7. The title of Hardy's novel describes Tess as 'a pure woman'. Examine Tess as a pure woman.

8. Analyze the theme of freedom in Mark Twain's *Adventures of Huckleberry Finn* exploring how the characters like Huck and Jim seek freedom in different ways.

★ ★ ★

No. 37013

ENGLISH—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question No. **1** and **four** of the remaining questions, selecting **two** from each Section

1. Write briefly on any *two* of the following in not more than *250* words each : 25×2=50

(a) Write an essay on the contribution of the Poets of the Thirties to English Literature with special reference to W. H. Auden.

(b) How does the stream-of-consciousness contribute to the reader's understanding of a character's thoughts and emotions?

(c) Write an essay on the new drama in the early twentieth century.

(d) In what ways do post-colonial writers explore the complexities of identity, hybridity and cultural conflict in their works?

SECTION—A

Answer any *two* of the following questions : 50×2=100

2. Why is Yeats described as 'The Seed of Modernism'? Elucidate with reference to the prescribed poems.

3. Analyze the essential themes related to modernism and the human experience that T. S. Eliot presented in *The Love Song of J. Alfred Prufrock.*

4. Explore Philip Larkin's portrayal of time in the poem, *Next, Please.*

Or

Discuss the theme of anger in *Look Back in Anger.* How does it manifest differently in each character?

SECTION—B

Answer any *two* of the following questions : 50×2=100

5. Discuss the narrative style of Joseph Conrad in *Lord Jim* and its impact on the reader's experience.

6. Bring out the significance of the title *Sons and Lovers* and its relationship to the main character's journeys and relationship.

7. Discuss the themes of E. M. Forster's novel *A Passage to India.*

8. Critically analyze Naipaul's *A House for Mr. Biswas* as a colonial novel.

Or

Discuss *Kanthapura* as a Gandhian novel dealing with Gandhi's ideology and the fight for India's freedom.

★ ★ ★

No. 38006

MANAGEMENT—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should answer Question Nos. **1** and **5** which are compulsory and **three** of the remaining questions, selecting at least **one** from each Section

SECTION—A

1. *(a)* List the managerial skills advocated by Robert L. Katz. Briefly describe each one. 25

(b) "Decision making is the most important function of management." Explain this statement and describe the decision-making process. 25

2. *(a)* Elaborate on the contributions made by F. W. Taylor and Henri Fayol to the evolution of management ideas. 25

(b) Make a clear distinction between conflicts that are interpersonal and intrapersonal. Cite relevant examples. In what ways does it undermine teamwork within the company? 25

3. *(a)* Examine and contrast the numerous contemporary theories of motivation with the early theories. Which ones, in your opinion, are more relevant to the situation of today? 25

(b) Are managers and leaders distinct from one another? Analyze the leadership styles that still apply in contemporary businesses. 10+15=25

4. *(a)* Determine the origins of PERT and CPM. Evaluate their applications. Additionally, distinguish between the two. 10+5+10=25

(b) A firm manufactures two types of products, type *A* and type *B*. They both go through a folding machine and a stapling machine. Type *A* requires 4 minutes on the folding machine and 6 minutes on the stapling machine. Type *B* requires 6 minutes on the folding machine and 4 minutes on the stapling machine. Each machine is available for a maximum of 1 hour. There is a profit of ₹40 on type *A* and ₹30 on type *B* product.

Formulate the above as a linear programming problem and solve it using the graphical method. 25

SECTION—B

5. *(a)* What do you mean by accounting 'concepts' and 'conventions'? Describe in brief various accounting concepts and conventions. 10+15=25

(b) What is the purpose of preparing a zero-base budgeting? Discuss. 15

(c) Distinguish between 'straight-line method' and 'diminishing balance method' of providing depreciation. 10

6. *(a)* What objectives should transfer prices attempt to meet? How will you administer the transfer prices for evaluating divisional performance? 10+15=25

(b) Management control begins with planning. Do you agree? Give your views. 25

7. *(a)* Explain the concept of strategy. Discuss the BCG model and the General Electric model highlighting their usefulness in formulating business unit level strategies. 25

(b) What do you mean by activity-based costing? How is it different from other methods of costing? What type of industries do you think will use this type of costing? 10+10+5=25

8. *(a)* Discuss, in detail, the components and dynamism of business environment. 25

(b) Examine the important arguments for protection vs. liberalization of global business environment. 25

★ ★ ★

No. 39008

MANAGEMENT—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should answer Question Nos. **1** and **5** which are compulsory and **three** of the remaining questions, selecting at least **one** from each Section

SECTION—A

1. *(a)* Which should be the primary objective of financial management—maximizing profits or wealth? Discuss. 20

(b) "Capital budgeting is long-term planning for making and financing proposed capital outlays." Explain. 15

(c) Give a critical appraisal of the net operating income approach and the MM approach to the problems of capital structure. 15

2. *(a)* Using a relevant example, explain the various stages of product life cycle. 25

(b) What kinds of methods are used for conducting marketing research before a new product is released onto the market? 25

3. *(a)* What do you mean by market segmentation? What are the various bases of market segmentation? 5+10=15

(b) Define pricing. Discuss the various methods of pricing. 5+10=15

(c) Briefly explain the following : 10+10=20

(i) Nature of international business

(ii) UNCTAD

4. *(a)* Elucidate on the major incentives available to developed countries to invest in developing countries. 20

(b) Briefly explain the following : 10+10+10=30

(i) Features of FDI

(ii) International trade disputes

(iii) Need for regional economic cooperation

SECTION—B

5. *(a)* Enumerate and explain all of the factors that influence the location of a plant. Explain in greater detail the factors that could influence the decision to establish a cement plant in North-East India. 15+15=30

(b) "Operations management has close interactions with other functional areas of management." Explain the statement with relevant examples. 20

6. *(a)* What is assembly line balancing? Why is it important in production management? 5+10=15

(b) Explain the functions of inventory and discuss the objectives of inventory control. 5+5=10

(c) Describe the value and necessity of information within an organization. 25

7. *(a)* Discuss the applications and recent developments of MIS. 20

(b) What is DBMS? Explain the role and objectives of DBMS. 5+10=15

(c) What is ERP? Explain the relationship between MIS and ERP. 5+10=15

8. *(a)* What are the factors that influence human resource planning? Briefly explain. 20

(b) Discuss the procedures involved in the selection process. What distinguishes it from recruitment? 10

(c) A compensation package should be designed keeping in mind a number of factors. Explain the factors involved and their relevance. 20

★ ★ ★

No.

40012

MEDICAL SCIENCE—I

Paper—VI

(Optional)

Full Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer *any* **five** questions

1. Describe the superficial palmar arch of the hand. Describe the course and distribution of median nerve in the hand. Write a short note on carpal tunnel syndrome. 20+20+10=50

2. Classify the various tests for liver functions. Write in detail about Van den Bergh reaction. How are transaminase enzymes useful in liver function tests?

15+20+15=50

3. Describe the life cycle of *Entamoeba histolytica*. Write about the laboratory diagnosis of intestinal and hepatic amoebiasis. 25+25=50

4. Describe the mechanism of action of organophosphate poisons. What are the manifestations of organophosphate poisoning? Describe the management of organophosphate poisoning. 10+20+20=50

5. Describe the normal embryological cardiac development. What are the signs and symptoms of cardiac failure? List the various causes of cardiac failure. How will you treat a patient with features of heart failure? 20+10+20=50

6. Describe the pathophysiology of pleural effusion. How will you approach a case of pleural effusion? What are the different causes of pleural effusion?
10+20+20=50

7. What are the hormones produced normally by the pituitary gland? Describe the pathophysiological changes in the body caused by hyperthyroidism. What are the signs and symptoms of hyperthyroidism? Write its management.
10+15+15+10=50

8. Discuss in detail the injuries caused by a blast. Write short notes on any *two* of the following : 30+(10×2)=50

   (a) Incised wound vs. lacerated wound

   (b) Hanging wound vs. strangulation wound

   (c) Healing by primary vs. secondary intention

   (d) Feature of opioid poisoning

★ ★ ★

No. 41010

MEDICAL SCIENCE—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer *any* **five** questions

1. What are the viruses causing hepatitis? Describe the etiology, epidemiology and clinical features of viral hepatitis A and B. Discuss on hepatitis B prevention. 10+20+20=50

2. What is Nadas criteria? Describe the components, clinical features and management of Tetralogy of Fallot. 10+10+15+15=50

3. Describe the risk factors for breast cancers. Describe inflammatory breast carcinoma. Write a short note on mammography and BI-RADS score. 15+10+25=50

4. Define gestational hypertension. What is HELLP syndrome? Describe the management of eclampsia. 10+10+30=50

5. What are the goals and objectives of the National Programme for Control of Blindness and Visual Impairment (NPCBVI)? Describe the organizational structure of NPCBVI. 25+25=50

6. Discuss generalized anxiety disorder and its management. 25+25=50

7. What are the different causes of meningitis? What are the signs and symptoms of meningitis? How will you manage a case of bacterial meningitis? 15+15+20=50

8. Enumerate the various causes of lymphadenopathy. How will you manage a case of inguinal adenopathy? 25+25=50

★ ★ ★

No. 42030

ANTHROPOLOGY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question No. **1** which is compulsory and **four** of the remaining questions, selecting at least **two/one** from each Section

SECTION—A

1. Write short notes on any *two* of the following in about *200* words each : 25×2=50

(a) *Australopithecus africanus*

(b) ABO blood and Rh factor

(c) Forensic Anthropology

(d) Kinship terminology

2. Elaborate on the main branches of Anthropology with their scope and relevance. Explain its relationship with Sociology, History and Life Science. 25+25=50

3. Narrate the relation between human growth and development. Explain the factors that affect human growth and development. 25+25=50

4. Define family and elaborate on the typology of family. Assess on the impact of urbanization and industrialization on the traditional family. 30+20=50

SECTION—B

5. Write short notes on any *two* of the following in about *200* words each : 25×2=50

(a) Autosomal aberrations

(b) Concept and patterns of culture

(c) Law and justice in tribal society

(d) Genetic counselling and eugenics

6. Explain the concepts of social change and cultural change. Correlate the relationship among culture, society and civilization. 25+25=50

7. What is fieldwork and why is it an important aspect of research in Anthropology? Discuss. Mention the basic techniques of data collection and how data is presented in anthropological research. 25+12½+12½=50

8. Write on the concept, scope and major branches of human genetics. Discuss its relationship with other branches of science and medicine. 25+25=50

★ ★ ★

No. 43030

ANTHROPOLOGY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question No. **1** which is compulsory and **four** of the remaining questions, selecting at least **two/one** from each Section

SECTION—A

1. Write short notes on any *two* of the following in about *200* words each : 25×2=50

(a) Pseudo-tribalism

(b) Linguistics and religious minorities

(c) Indus Valley Civilization

(d) Impact of market economy on Indian villages

2. Discuss on the impact of Hinduism, Christianity, Islam and other religion on tribal societies. Give a comparative study of tribal communities in India and other countries. 25+25=50

3. What are the social changes that have taken place among the tribes during colonial and post-Independence India? Elucidate the role of Anthropology in tribal and rural development. 25+25=50

4. Elaborate with suitable examples on the problems of land alienation among the Indian tribal communities. 50

SECTION—B

5. Write short notes on any *two* of the following in about *200* words each : 25×2=50

(a) Role of Anthropology in tribal and rural development

(b) Impact of Buddhism on Indian society

(c) Roles of NGOs in rural development

(d) Poverty indebtedness

6. What are the constitutional safeguards for Scheduled Tribes? Write on the impact of developmental programmes on the tribals. 25+25=50

7. Illustrate on the demographic profile of India on the basis of ethnic and linguistic elements in the Indian population. What factors influence its structure and growth? 25+25=50

8. "Displacement and rehabilitation issues are glaring among the Indian tribals." Discuss. 50

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No. 44028

BOTANY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidate has to answer **five** questions in all. Question Nos. **1** and **5** are compulsory. Out of the remaining questions, attempt *any* **three** questions, choosing at least **one** from each Section.

SECTION—A

1. Write short notes on the following : 10×5=50

(a) Lytic cycle and lysogenic cycle in viruses

(b) ICBN and its principles

(c) Ultrastructure of a bacterial cell

(d) Heterotrichous habit in algae

(e) Mycotoxins

2. *(a)* Discuss various types of stellar structures in pteridophytes with the help of suitable diagrams. 20

(b) Give an illustrated account of the evolution of sporophytes in bryophytes. 20

(c) Discuss the structure of mycoplasma and its importance. 10

3. Answer the following : 12½×4=50

(a) Write explanatory note on the anomalous secondary growth in *Bignonia* and *Dracaena* stems.

(b) Describe the symptoms, causal organisms and control measures of white rust of crucifers.

(c) Write a brief account of the use of microbes in medicines.

(d) Describe different types of stomata found in plants with proper diagrams.

4. *(a)* Describe the diagnostic characters of the family Orchidaceae with special reference to the Orchid flower. Why is family Orchidaceae regarded as the most highly evolved family in monocotyledons? 20

(b) Give comparative accounts of Bentham and Hooker, and Hutchinson system of classification. Mention the merits and demerits of the classifications. 20

(c) Discuss the range of thallus structure in Chlorophyceae giving suitable examples. 10

SECTION—B

5. Write short notes on the following : 10×5=50

(a) Cellular totipotency and its significance

(b) Development of monosporic type of embryo sac

(c) Kranz anatomy of C_4 plants

(d) Pollen allergy

(e) Energy plantation

6. *(a)* What is the significance of ethnobotanical knowledge in the welfare of mankind? Give the botanical classification and uses of five plants used by the people of North-East India. 20

(b) Give an account of Vavilov's concept of centres of origin of cultivated plants. 20

(c) Discuss the role of pollen morphology in plant taxonomy. 10

7. *(a)* Describe the process of protoplast isolation and mention the applications of protoplast culture. 20

(b) Give a brief account of polyembryony. 15

(c) Give a detailed account of the development and types of endosperm. Mention its functions. 15

8. Answer the following : 10×5=50

(a) What are haploids? Discuss their production and importance in plant improvement.

(b) Give a brief account of apomixis.

(c) What is somaclonal variation? Discuss its potential in crop improvement.

(d) Write an explanatory note on micropropagation and its utility towards *ex situ* conservation of rare and endangered plants.

(e) Explain 'cybridization'. Write example of economically useful cybrid. Describe the methods to produce cybrids.

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No. 45030

BOTANY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidate has to answer **five** questions in all. Question Nos. **1** and **5** are compulsory. Out of the remaining questions, attempt **three** questions, choosing at least **one** from each Section.

SECTION—A

1. Write short notes on the following : 10×5=50

(a) Chi-square test and its significance

(b) Prophase–I of meiosis

(c) Structural chromosomal aberrations and their genetic effects

(d) Genetic code

(e) Plant succession on a rock (xerosere)

2. Answer the following : 12½×4=50

(a) Describe the mechanism of CO_2 fixation in CAM plants.

(b) Describe the cellular function of mitochondria with required diagrams.

(c) Discuss biological nitrogen fixation.

(d) Discuss the analytical characters of a plant community.

3. Answer the following : 12½×4=50

(a) Give an account of the mechanism of protein synthesis in prokaryotic organisms.

(b) Describe the process of hybridization in self-pollinated plants. What is the importance of hybridization in crop improvement?

(c) What is extra-nuclear inheritance? Explain the phenomenon with the help of an example.

(d) Describe the salient features of Watson and Crick model of DNA double helix. How did it prove that DNA replication is semi-conservative?

4. Answer the following : 12½×4=50

(a) Describe the light reaction of photosynthesis in C3 plants. Differentiate between C3 and C4 pathways of photosynthesis.

(b) Define global warming. Explain its causes and suggest its preventive measures.

(c) Differentiate between heterosis and in-breeding depression. Explain the significance of heterosis in plant breeding.

(d) What is a phytogeographical region? Discuss Eastern and Western Himalayan floristic regions of India.

SECTION—B

5. Write short notes on the following : 10×5=50

(a) Chemical mutagens

(b) Secondary metabolites

(c) Intellectual property rights

(d) Phytoremediation

(e) Structure and significance of polytene chromosome

6. Answer the following : $12\frac{1}{2} \times 4 = 50$

(a) Discuss various steps involved in DNA recombinant technology.

(b) Describe the electron transport chain and explain the mechanism of oxidase phosphorylation.

(c) What is cell cycle? Discuss the molecular mechanism that controls various steps of cell cycle.

(d) Describe the genetic code and its significance in living system.

7. Answer the following :

(a) What is seed dormancy? Mention the causes of seed dormancy and describe how it can be regulated in seeds. 15

(b) Classify enzymes. Discuss the theories pertaining to the mechanism of action of enzymes. 15

(c) Discuss various ecological factors that govern the distribution of plants. 20

8. Answer the following :

(a) Explain how different greenhouse gases contribute to the raising global temperature causing global warming and how to mitigate. 20

(b) What is IPR? Explain different types of IPR and mention its importance. 15

(c) Write a brief account on plant endemism and Red Data Book. 15

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No. 46014

ZOOLOGY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** and *any* **four** from the rest

1. Write brief notes on any *four* of the following : 12½×4=50

(a) Skeletal system in Porifera

(b) Principle and applications of spectrophotometer

(c) Dentition in mammals

(d) Electron Microscopy

(e) General features of Branchiostoma

(f) Migration in birds

2. *(a)* With the help of illustrations, describe the life cycles of *Obelia* and *Aurelia*. Give the major difference between the two. 25

(b) Give a detailed account on the parental care in amphibians with suitable examples. 25

3. *(a)* What are hormones? What are the characteristics of endocrine glands? Describe the structure and functions of adrenal gland. 25

(b) Give a comparative account of the hearts of reptiles, birds and mammals. 25

4. *(a)* Define biogeochemical cycle. Discuss in detail the nitrogen cycle with the help of a suitable diagram. 25

(b) Give an account of the general features of *Ascaris*. Describe the life cycle of *Ascaris*. Mention its pathogenicity and preventive measures. 25

5. *(a)* Define apiculture. Describe in detail the scientific method of beekeeping with a suitable diagram of a modern hive. Enumerate the economic importance of apiculture. 25

(b) What are pheromones? Describe the role of pheromones in alarm spreading and predator detection with examples. Enumerate social behaviour in insects with examples. 25

6. *(a)* Give an account of the types of respiration in *Pila* with labelled diagrams. Explain the phenomenon of torsion in gastropods with examples. 25

(b) Describe the general features and life history of *Asterias*. How are respiration and locomotion carried out in *Asterias*? 25

7. *(a)* Give an account of the various modifications of mouthparts in insects with examples and suitable diagrams. 25

(b) Define metamorphosis. Differentiate between complete and incomplete metamorphosis in insects. Describe the metamorphosis in insects with special emphasis on the role of hormones in regulating metamorphosis. 25

8. *(a)* What are the principles of experimental design? What are the steps involved in designing of an experiment? Give an account of chi-square test. 25

(b) What is correlation? Calculate the coefficient of correlation between X and Y : 25

X :	10	9	8	7	6	5	4	3	2	1
Y :	6	7	8	4	9	2	1	5	10	3

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No. 47030

ZOOLOGY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Questions No. **1** and *any* **four** from the rest

1. Write brief notes on any *four* of the following : 12½×4=50

(a) Human genome mapping

(b) Watson and Crick model of DNA

(c) Synaptic transmission

(d) Teratogenesis

(e) Structure and functions of Golgi bodies

(f) International Code of Zoological Nomenclature

2. *(a)* Differentiate between mitosis and meiosis. Give an account of the different stages of mitosis with suitable diagrams. 25

(b) What is linkage? Explain in detail the complete linkage and incomplete linkage. Give an account of multiple alleles with reference to ABO blood group. 25

3. *(a)* What are fossils? Explain how fossils are formed with examples. Explain the importance of 'cladistics' in evolution. 25

(b) Give an account of Darwin's theory of natural selection. 25

4. *(a)* With the help of a diagram, describe the structure of haemoglobin. Explain the mechanism involved in blood coagulation mentioning the various coagulation factors required for this process. 25

(b) What are carbohydrates? Write down their classification. Add a note on the biological significance of carbohydrates. 25

5. *(a)* What are stem cells? Describe the various types of stem cells and their therapeutic applications in human welfare. 25

(b) Give the structure of cAMP. Discuss the role played by this molecule in the mechanism of action of protein/peptide hormones with illustrations. 25

6. *(a)* What is the EMP pathway? Where does it take place? Explain the steps involved in this pathway mentioning the various enzymes involved. Add a note on the number of ATP produced in this pathway. 25

(b) Define immunity. What are acquired and innate immunities? Describe the different classes of immunoglobulins and add a note on their biological functions. 25

7. *(a)* What is fertilization? Give a detailed account of the process of fertilization and mention the roles of fertilizin and antifertilizin during fertilization. 25

(b) Give a detailed account of the steps involved in DNA replication in prokaryote with suitable diagrams. 25

8. *(a)* What is DNA fingerprinting? Write the principle involved in this method. Describe in detail the steps involved in DNA fingerprinting. 25

(b) What is gastrulation? Describe the process of gastrulation in frog with the help of labelled diagrams. 25

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No. 48007

PHILOSOPHY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, selecting at least **two/one** from each Section.
Question No. **1** is compulsory.

SECTION—A

1. How would you distinguish between analytic and synthetic judgement? Is synthetic a priori judgement possible? Discuss with special reference to Kant. 25+25=50

2. What is Wittgenstein's picture theory of meaning? What are his reasons for giving up this theory and suggesting the use theory of meaning? 25+25=50

3. Write an essay on the origin of the logical positivism. Critically discuss the verification principle of logical positivism and their rejection of metaphysics. 20+30=50

4. Is it possible to have indubitable knowledge? Discuss with special reference to Descartes' scepticism. 50

5. Write short notes on any *two* of the following : 25×2=50

(a) Spinoza's substance and attributes

(b) Husserl's phenomenology

(c) Hegel's dialectical method

(d) Strawson's theory of person

SECTION—B

6. What is the literal meaning of Padārtha? How many Padārthas are there in Vaiśeṣika Philosophy? Explain in detail the Vaiśeṣika categories (Padārthas). 50

7. What is the literal meaning of Yoga? What are the various stages of the Eight-fold Path (Aṣṭāṅga Yoga) in the Philosophy of Yoga? 50

8. Write short notes on any *two* of the following : 25×2=50

   (a) Sāṁkhya theory of evolution

   (b) Śankara's concept of Mokṣa

   (c) Cārvāka theory of materialism

   (d) Buddhist theory of Kṣaṇikavāda

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No. 49010

PHILOSOPHY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, selecting at least **two/one** from each Section.
Question No. **1** is compulsory

SECTION—A

1. "Democracy is the best form of government in the present-day world." Do you agree with this statement? Give reasons for your answer. 50

2. Is caste discrimination a result of the superiority complex of a privileged class of the society or of religious rituals? Discuss with reference to the views propounded by Dr. B. R. Ambedkar. 50

3. Describe socialism as a political and philosophical ideology. Is anarchism a variety of socialism? Discuss. 25+25=50

4. Write short notes on any *two* of the following : 25×2=50

(a) Sarvodaya (Gandhi)

(b) Pluralistic theory of sovereignty

(c) Theocracy

(d) Philosophy of ecology

SECTION—B

5. What are the traditional arguments for the existence of God? Bring out the distinction between ontological and cosmological arguments for the existence of God. Explain critically. 50

6. What is the problem of evil? Discuss the theistic solution to this problem. 50

7. Can there be a religion without the concept of God? Discuss with reference to Buddhism. 50

8. Write short notes on any *two* of the following : 25×2=50

   (a) Christian doctrine of Liberation

   (b) Distinction between Reason and Faith

   (c) Personalistic and Impersonalistic notion of God

   (d) Immortality of Soul

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No. 50009

ELECTRICAL ENGINEERING—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer *any* **five** questions

1. *(a)* Draw a vector diagram for the circuit shown in Fig. 1, indicating the resistance and reactance drops, the terminal voltages V_1, V_2 and the current I. Find the values of *(i)* current I, *(ii)* V_1, V_2 and *(iii)* power factor : 15

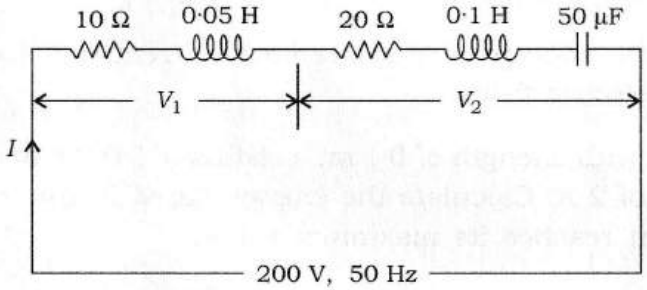

Fig. 1

(b) Write down the superposition theorem. 10

(c) For an *R-L* series circuit with d.c. voltage supply, derive the inductor voltage and current equation for transient condition. 15

(d) Derive S-parameters in terms of hybrid parameters in a two-port network. 10

2. *(a)* What is convolution? Explain the properties of convolution. 10

(b) A step voltage of 10 V is applied at $t = 0$ in a series R-C circuit where $R = 1\ \Omega$ and $C = 2$ F. The initial charge of the capacitor is nil (zero). Using Laplace transformation, find the current $i(t)$ in the circuit. 15

(c) Find the Fourier series of the waveform shown in Fig. 2 : 15

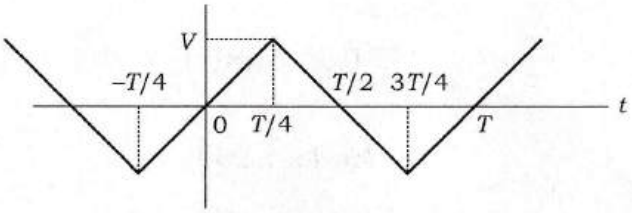

Fig. 2

(d) What does it mean for a system to be linear and time-invariant? Discuss the significance of these properties in the context of system response and stability. 10

3. *(a)* Discuss Coulomb's law and its application in determining electric field intensity. 10

(b) Explain the different types of microwave resonators and their applications in microwave circuits. 10

(c) Describe the concept of displacement current and its relationship with changing electric fields. 10

(d) A solenoid with a length of 0·1 m, a radius of 0·02 m and 500 turns carries a current of 2 A. Calculate the energy stored in the magnetic field when the current reaches its maximum value. 10

(e) A conducting sphere of radius 10 cm has a charge of 5 μC distributed uniformly. Calculate the surface charge density. 10

4. *(a)* Draw the drain and transfer characteristics of a MOSFET and explain. 15

(b) Draw the schematic diagram of JFET and explain its operation. 10

(c) Draw a summing amplifier circuit using OPAMP and explain its working. 15

(d) Discuss the operation of class A amplifier circuit with proper circuit diagram. 10

5. *(a)* Construct a *J-K* flip-flop using *D* flip-flop. 10

(b) Design a type *D* synchronous counter that goes through states 0, 3, 4, 6, 0, ... 15

(c) Draw a 4-bit bidirectional shift register and explain its operation. 15

(d) Design an 8 : 1 multiplexer circuit with the help of truth table. 10

6. *(a)* Prove that the e.m.f. induced in the windings of a transformer will lag the alternating flux producing that e.m.f. 10

(b) Explain how the speed of a d.c. motor can be controlled. 8

(c) From the equivalent circuit of induction motor, derive the speed-torque characteristics of induction motor for different operating regions and draw the diagram. 10

(d) With proper voltage, current and power waveform, explain the operation of BLDC motor. 15

(e) For a leading p.f. load, derive the voltage regulation of a synchronous generator using the phasor diagram. 7

7. *(a)* Draw the schematics of step-up chopper and derive an expression for output voltage in terms of duty cycle. 10

(b) For the ideal type *A* chopper circuit, the following conditions are given :

$E_{dc} = 220$ V, Chopping frequency $f = 500$ Hz, Duty cycle $\alpha = 0 \cdot 3$ and $R = 1$ ohm, $L = 3$ mH, $E_b = 23$ V

(i) Check whether the load current is continuous or not.

(ii) Find the average output current. 10

(c) Draw a three-phase full-wave controlled rectifier with resistive load. Draw the output voltage and current waveform for 60° firing angle, and explain its operation. 15

(d) With the help of neat circuit diagram and waveforms (phase voltage and line voltage), explain briefly the operation of transistorized three-phase bridge inverter with resistive load in 120° conduction mode. Derive the r.m.s. value of output phase voltage and line voltage. 15

8. *(a)* What is the role of a carrier signal in analog modulation techniques? 10

(b) Describe the frequency modulation technique and write down its application. 15

(c) How is signal-to-noise ratio (SNR) measured in analog communication system? 15

(d) Explain the signal bandwidth in analog communication system. 10

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No. 51012

ELECTRICAL ENGINEERING—II

Paper—VII

(Optional)

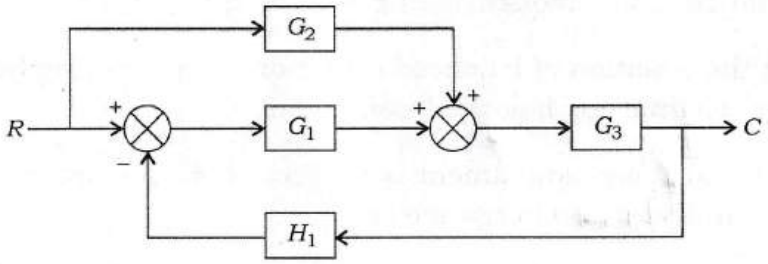
Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer *any* **five** questions

1. *(a)* For the block diagram shown in the figure below, determine the overall transfer function : 10



(b) A unity feedback control system has an open-loop transfer function

$$G(s) = \frac{K}{s(s+4)}$$

Draw the root locus and determine the value of K, if the damping ratio is 0·707. 15

(c) A closed-loop control system has the characteristic equation given by $s^3 + 4 \cdot 5s^2 + 3 \cdot 5s + 1 \cdot 5 = 0$. Investigate the stability using Routh-Hurwitz criterion. 15

(d) For a separately excited d.c. generator, draw the block diagram and derive its transfer function. 10

2. *(a)* How does a *P-N* junction diode work? Draw and explain *V-I* characteristics of *P-N* diode with neat diagrams. 15

(b) Explain how Zener diode works as a voltage regulator. 10

(c) Explain how solar photovoltaic cell generates electricity. 15

(d) What do you understand by energy levels and energy bands? Explain energy bands in solids. 10

3. *(a)* Define instruction cycle and machine cycle. 15

(b) Draw the pin diagram of 8085 microprocessor and explain the operation of different pins. 15

(c) Draw the flowchart for the seven-segment LED interface and explain. 10

(d) What is stack pointer? How does stack work in assembly language? 10

4. *(a)* Derive the expression for capacitance to be connected across the multiplier of a moving-iron voltmeter so as to make its circuit non-inductive for frequencies up to 125 Hz. 15

(b) Derive the equation of balanced condition for a Schering bridge. Draw the phasor diagram for balanced conditions. 15

(c) Explain how lag adjustment and friction compensation are made in induction disc-type energy meter. 10

(d) Describe the different parts of a CRT. Describe how the phase angle measurement can be made with the use of a CRO. 10

5. *(a)* Describe the principle of operation for a differential relay. 10

(b) Discuss the principle of operation for an SF6 circuit breaker. What are the advantages and disadvantages of using SF6 gas as the arc quenching medium? 15

(c) Explain the terms 'load factor' and 'diversity factor'. How do these factors influence the cost of generation? 15

(d) Explain the causes of low power factor of the supply system. Discuss the various methods for power factor improvement. 10

6. *(a)* What are the grid integration technologies essential for connecting wind power to electrical systems? 10

(b) Describe the main steps involved in conducting a typical energy audit. 15

(c) What distinguishes non-conventional energy resources from conventional ones? 10

(d) What are the key economic factors that influence energy prices in global markets? 15

7. *(a)* What is pulse code modulation (PCM) and how does it work in digital communication systems? 15

(b) State sampling theorem. 10

(c) What is meant by adaptive delta modulation? 10

(d) Mention the use of adaptive quantizer in adaptive digital waveform coding schemes. 15

8. *(a)* State Kepler's third law. 10

(b) Derive the simple radar range equation in terms of minimum detectable signal to noise ratio $(S/N)_{min}$ and explain why $(S/N)_{min}$ is a better measure of a radar detection than the minimum detectable signal (S_{min}). 15

(c) Explain the dispersion mechanism in optical fibres. 10

(d) Differentiate between step index and graded index fibre. How do the rays propagate in graded index fibre? 15

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No. 52004

MATHEMATICS—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and **four** of the remaining questions, selecting **two** from each Section

Assume suitable data if considered necessary and indicate the same clearly

1. Answer any *five* of the following questions : 10×5=50

(a) Verify Cayley-Hamilton theorem for the matrix

$$A = \begin{bmatrix} 0 & 0 & 1 \\ 3 & 1 & 0 \\ -2 & 1 & 4 \end{bmatrix}$$

Hence find A^{-1}.

(b) Solve :

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = 10\sin x$$

(c) How are the three vectors $\vec{a} \times \vec{b}$, $\vec{b} \times \vec{c}$ and $\vec{c} \times \vec{a}$ related when it is known that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$?

(d) A function $f(x)$ is defined as follows :

$$f(x) = \begin{cases} x\sin\dfrac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

Show that $f(x)$ is continuous at $x = 0$.

(e) Reduce the equation

$$2x^2+3y^2-4x+5y+4=0$$

to the standard form and find its focii and eccentricity.

(f) A particle is moving with simple harmonic motion and while making an excursion from one position of rest to the other, its distances from the middle point of its paths at three consecutive seconds are observed to be x_1, x_2, x_3. Prove that the time of a complete oscillation is

$$\frac{2\pi}{\cos^{-1}\left(\frac{x_1+x_3}{2x_2}\right)}$$

(g) Find the nature of the quadratic surface given by the equation

$$2x^2+5y^2+3z^2-4x+20y-6z-5=0$$

SECTION—A

2. (a) Find the eigenvector of the matrix

$$A=\begin{bmatrix}1 & 1 & 0\\ 0 & 2 & 2\\ 0 & 0 & 3\end{bmatrix}$$ 15

(b) (i) Show that a set of vectors which contains the zero vector is necessarily linearly dependent. 5

(ii) In $V=\mathbb{R}^3$, where $\mathbb{R}$ is the set of real numbers, examine each of the following sets of vectors for linear dependence : 5

$S=\{(2, 1, 2), (8, 4, 8)\}$

$S=\{(1, 2, 0), (0, 3, 1), (-1, 0, 1)\}$

(c) State whether the following is True or False with justification : 10

There exists a 3×3 real matrix C such that

$$C^{-1}\begin{bmatrix}1 & 1 & 1\\ 0 & 1 & 1\\ 0 & 0 & 0\end{bmatrix}C=\begin{bmatrix}1 & 4 & 6\\ 0 & 2 & 5\\ 0 & 0 & 3\end{bmatrix}$$

(d) Let f be the bilinear form on $\mathbb{R}^3$ defined by

$f\{(x_1, x_2, x_3), (y_1, y_2, y_3)\} = 3x_1y_1 - 2x_1y_2 + 5x_2y_1 + 7x_2y_2 - 8x_2y_3 + 4x_3y_2 - x_3y_3$

Find the matrix of f relative to the basis

$$\{e_1 = (1, 0, 0), e_2 = (0, 1, 0), e_3 = (0, 0, 1)\}$$ 15

3. (a) If $f(x) = (x-a)^m (x-b)^n$, where m and n are positive integers, show that c in Rolle's theorem divides the segment $a \le x \le b$ in the ratio $m : n$. 10

(b) Show that the maximum rectangle with a given perimeter is a square. 10

(c) Show that the function

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

is continuous, possesses partial derivative but is not differentiable at the origin. 15

(d) What is the area of the entire surface formed when the cardioid $r = a(1+\cos\theta)$ is revolved about the initial line? Find it in the case of cardioid $r = a(1-\cos\theta)$. 15

4. (a) Let V be a finite dimensional vector space. Then show that *(i)* for the identity linear map $I : V \to V$, Rank I = dim V and Nullity $I = 0$ and *(ii)* for the zero linear map $O : V \to V$, Rank $O = 0$ and Nullity $O = 0$. 10

(b) A conical tent of a given capacity has to be constructed. Find the ratio of the height to the radius of the base for the minimum amount of canvas required for the tent. 15

(c) Evaluate

$$\iint \frac{\sqrt{a^2b^2 - b^2x^2 - a^2y^2}}{\sqrt{a^2b^2 + b^2x^2 + a^2y^2}}\, dx\, dy$$

where the field of integration being the positive quadrant of the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$. 15

(d) Examine $f(x, y, z) = 2xyz - 4zx - 2yz + x^2 + y^2 + z^2 - 2x - 4y + 4z$ for extreme values. 10

5. *(a)* Find the equation of the plane through the intersection of the planes $x+y+z=1$ and $2x+3y-z+4=0$ which is parallel to the x-axis. 10

(b) Find the equation of the sphere through the circle $x^2+y^2=a^2$, $z=0$ and through the centre of the sphere $(x-\alpha)^2+(y-\beta)^2+(z-\gamma)^2=r^2$. 10

(c) Prove that the enveloping cylinder of the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ whose generators are parallel to the line $\frac{x}{0}=\frac{y}{\pm\sqrt{a^2-b^2}}=\frac{z}{c}$ meet the plane $z=0$ in circles. 15

(d) Prove that the straight lines represented by the equation

$$ax^2+2hxy+by^2+2gx+2fy+c=0$$

will be equidistant from the origin if $f^4-g^4=c(bf^2-ag^2)$. 15

SECTION—B

6. *(a)* Show that the equation

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

is exact and find the solution if $y=1$ when $x=1$. 10

(b) Solve : 10

$$p^3-p(x^2+xy+y^2)+xy(x+y)=0,\ p=\frac{dy}{dx}$$

(c) By using variation of parameter method, solve

$$\frac{d^2y}{dx^2}+y=\sec x$$ 15

(d) Reduce to Clairaut's form by putting $x^2=u$ and $y^2=v$, solve the equation

$$(px-y)(x-py)=2p$$ 15

7. *(a)* A uniform ladder is in equilibrium with one end resting on the ground and the other against a vertical wall; if the ground and the wall be both rough, the coefficients of friction be μ and μ' respectively; and if the ladder be on the point of slipping at both ends, show that the inclination of the ladder to the horizon is given by

$$\tan\theta=\frac{1-\mu\mu'}{2\mu}$$ 10

(b) A cannon ball has a range R on the horizontal plane. If h and h' are the greatest heights in the two paths for which this is possible, prove that

$$R = 4\sqrt{hh'}$$

10

(c) Show that the depth of the centre of pressure of a rhombus totally immersed with one diagonal vertical and its centre at a depth h is

$$\frac{\left(h^2 + \frac{a^2}{2h}\right)}{h}$$

where a is the length of the vertical diagonal. 15

(d) Two smooth spheres of masses m_1 and m_2 moving with velocities u_1 and u_2 along the line of centres. Find the velocity after impact and show that loss of kinetic energy is

$$\frac{1}{2}\frac{m_1 m_2}{m_1 + m_2}(u_1 - u_2)^2(1 - e^2)$$

15

8. (a) Prove that a proper vector $\vec{u}$ always remains parallel to a fixed line if and only if $\vec{u} \times \frac{d\vec{u}}{dt} = 0$. 10

(b) Prove that if $\vec{F}$ is a vector point function

$$\nabla \times (\nabla \times \vec{F}) = \nabla(\nabla \cdot \vec{F}) - \nabla^2 \vec{F}$$

where $\nabla = \hat{i}\frac{\partial}{\partial x} + \hat{j}\frac{\partial}{\partial y} + \hat{k}\frac{\partial}{\partial z}$. 15

(c) Evaluate $\oint_\Gamma (e^x dx + 2y dy - dz)$ by using Stokes' theorem where Γ is the curve $x^2 + y^2 = 4,\ z = 2$. 10

(d) Verify Green's theorem in the plane for $\oint_\Gamma (x^2 dx + xy dy)$ where Γ is a square in the xy-plane given by $x = 0,\ y = 0,\ x = a,\ y = a (a > 0)$ described in the anti-clockwise sense. 15

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No. 53004

MATHEMATICS—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and **four** questions, selecting **two** from each Section

Assume suitable data if considered necessary and indicate the same clearly

1. Answer any *five* of the following questions : 10×5=50

(a) Prove that any two right (left) cosets of a subgroup H of a group G are either disjoint or identical.

(b) Prove that every convergent sequence in $\mathbb{R}$ is a Cauchy sequence.

(c) Evaluate $\int_C \frac{e^{2z}}{(z+1)^4} dz$, where C is the circle $|z|=2$.

(d) Form a partial differential equation by eliminating a, b and c from

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

(e) Find all basic solutions of the following system :

$$x+2y+z=4$$
$$2x+y+5z=5$$

(f) Convert the following number systems to another :

(i) 11001_2 to decimal number system

(ii) 47068_8 to decimal number system

(iii) $1AC_{16}$ to decimal number system

(iv) 428_{10} to hexadecimal number system

(v) 42_{10} to binary number system

(g) Define degrees of freedom. How many degrees of freedom does a rigid body moving in space with one point fixed has?

SECTION—A

2. (a) Prove that any group of prime order can have no proper subgroups. 10

(b) Find all non-Abelian groups of order 6. 15

(c) Does the following ring have any proper ideals? If not, why? 10

$$[\{0, 1, 2, 3, 4, 5\}, +_5, \times_5]$$

(d) Prove that every field is an integral domain. Is it true that every integral domain is a field? Justify your answer. 15

3. (a) Prove that a function which is uniformly continuous on an interval is continuous on that interval. Is the converse true? Justify your answer. 15

(b) Compute $\int_1^2 (3x+1)\,dx$, using Riemann sums. 10

(c) Test for uniform convergence, the sequence $\{f_n\}$, where

$$f_n(x) = \frac{nx}{1+n^2x^2}$$

for all real x. 10

(d) If $|a| \leq 1$, then show that

$$\int_0^{\pi} \log(1+a\cos x)\,dx = \pi \log\left[\frac{1}{2}+\frac{1}{2}\sqrt{1+a^2}\right]$$ 15

4. *(a)* Find the radius of convergence of the following power series : 15

(i) $\sum_{n=0}^{\infty} \left(1+\frac{1}{n}\right)^{n^2} z^n$

(ii) $\sum_{n=0}^{\infty} 2^{-n} z^{2n}$

(b) If $f(z)$ is analytic at z_0, then prove that it must be continuous at z_0. Give an example to show that the converse is not necessarily true. 10

(c) Expand $\frac{1}{z(z^2-3z+2)}$ in Laurent's series for the following regions : 15

(i) $0 < |z| < 1$

(ii) $1 < |z| < 2$

(iii) $|z| > 2$

(d) Find a bilinear transformation which maps the upper half of the z-plane into the unit circle in the w-plane in such a way that $z = i$ is mapped into $w = 0$ while the point at infinity is mapped into $w = -1$. 10

5. *(a)* Using simplex method, solve the following : 20

$$Z = 5x_1 + 3x_2$$

subject to the constraints

$$x_1 + x_2 \leq 2$$
$$5x_1 + 2x_2 \leq 10$$
$$3x_1 + 8x_2 \leq 12$$
$$x_1, x_2 \geq 0$$

(b) Find the dual of the following problem : 10

Minimize $Z = 2y + 5z$

subject to the constraints

$$x + y \geq 2$$
$$2x + y + 6z \leq 6$$
$$x - y + 3z = 4$$
$$x, y, z \geq 0$$

(c) An agriculturist has a farm with 125 acres. He produces radish, mutter and potato. Whatever he raises is fully sold in the market. He gets ₹ 5 for radish per kg, ₹ 4 for mutter per kg and ₹ 5 for potato per kg. The average yield is 1500 kg of radish per acre, 1800 kg of mutter per acre and 1200 kg of potato per acre. To produce each 100 kg of radish and mutter, and to produce each 80 kg of potato, a sum of ₹ 12·50 has to be used for manure. Labour for each acre to raise the crop is 6 man-days for radish and potato each and 5 man-days for mutter. A total of 500 man-days labour at the rate of ₹ 40 per man-day is available. Formulate this as a linear programming problem to maximize the agriculturist's total profit. 20

SECTION—B

6. (a) Apply Charpit's method to solve

$$(p^2+q^2)y = qz$$ 15

(b) By using the method of separation of variables, solve two-dimensional Laplace's equation

$$\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$$ 15

(c) Solve : 10

$$(z^2-2yz-y^2)p+(xy+zx)q = xy-zx$$

(d) Form a partial differential equation by eliminating the function f from

$$z = y^2+2f\left(\frac{1}{x}+\log y\right)$$ 10

7. (a) Calculate by Simpson's one-third rule an approximate value of $\int_{-3}^{3} x^4 dx$ by taking seven equidistant ordinates. Compare it with the exact value and the value obtained by using the trapezoidal rule. 15

(b) Use Newton's backward interpolation formula to find $f(7\cdot5)$, given

x	:	1	2	3	4	5	6	7	8
$f(x)$	:	1	8	27	64	125	216	343	512

15

(c) What do you mean by logic gates? Describe OR, AND and NOT gates. 10

(d) Let $(B, +, \cdot, ')$ be a Boolean algebra. Show that $a' + b = 1$ if and only if $a + b = b$, $\forall\ a, b \in B$. Also show that if for $a, b, c \in B$, $a + b = a + c$ and $a \cdot b = a \cdot c$, then $b = c$. 10

8. (a) Find the equation of motion of a particle of mass m moving in a straight line in simple harmonic motion using Hamilton's equations. 15

(b) Find the image of a line source in a circular cylinder. 10

(c) Show that the velocity potential

$$\phi = \frac{1}{2} a(x^2 + y^2 - 2z^2)$$

satisfies the Laplace equation, and determine the streamlines. 10

(d) A mass of fluid is in motion so that the lines of motion lie on the surface of coaxial cylinders. Show that the equation of continuity is

$$\frac{\partial \rho}{\partial t} + \frac{1}{r}\frac{\partial}{\partial \theta}(\rho q_r) + \frac{\partial}{\partial z}(\rho q_z) = 0$$

where q_r and q_z are the velocities perpendicular and parallel to z. 15

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No. 54010

PHYSICS—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and **four** from the rest, selecting at least **one** from each Section

Assume suitable data, if considered necessary and indicate the same clearly.

Use the following values of physical constants, if necessary :

Velocity of light, $c = 3 \times 10^8$ m s^{-1}

Planck constant, $h = 6 \cdot 63 \times 10^{-34}$ J-s

Electron charge, $e = 1 \cdot 6 \times 10^{-19}$ C

Permittivity of free space, $\varepsilon_0 = 8 \cdot 857 \times 10^{-12}$ C^2 N^{-1} m^{-2}

Permeability of free space, $\mu_0 = 4\pi \times 10^{-7}$ T mA^{-1}

Mass of electron, $m_e = 9 \cdot 1 \times 10^{-31}$ kg

Boltzmann constant, $k_B = 1 \cdot 38 \times 10^{-23}$ J K^{-1}

Avogadro's number, $N_A = 6 \cdot 023 \times 10^{23}$/mole

Stefan's constant, $\sigma = 5 \cdot 67 \times 10^{-8}$ W m^{-2} K^{-4}

1. Answer any *five* questions : 10×5=50

(a) At a point above the surface of the earth, the gravitational potential is $-5{\cdot}12\times10^{7}\ \text{J kg}^{-1}$ and the acceleration due to gravity is $6{\cdot}4\ \text{m s}^{-2}$. Assuming the mean radius of the earth to be $6{\cdot}4\times10^{6}$ m, calculate the height of the point above the earth's surface.

(b) A particle is dropped from a height of 200 m above the earth surface. Calculate the eastward deflection of the particle due to Coriolis force when it hits the ground if the particle is dropped at *(i)* 30° N, *(ii)* 45° N and *(iii)* at the north pole.

(c) A particle is moving with simple harmonic motion along a straight line. Its velocities when passing through the points 3 cm and 4 cm from the centre of its path are 16 cm/s and 12 cm/s respectively. Find the amplitude, period of motion and maximum velocity of the particle.

(d) Two particles of mass 2 kg each are moving with velocities $3\hat{i}+4\hat{j}$ m/s and $5\hat{i}+6\hat{j}$ m/s. Find the kinetic energy of the system relative to the centre of mass.

(e) In a Newton's ring setup placed in air, the diameters of 5th and 10th dark rings are found to be 0·336 cm and 0·590 cm respectively. When a small quantity of liquid is added between the glass plate and the lens, the diameters of 5th and 10th dark rings are found to be 0·218 cm and 0·451 cm respectively. Calculate the refractive index of the liquid.

(f) Assuming the sun to be a blackbody at a temperature of 5800 K, use Stefan's law to show that the total radiant energy emitted by the sun per second is $3{\cdot}95\times10^{26}$ joules. Given, radius of the sun is 7×10^{8} m.

(g) Calculate the change of entropy when 10 g of ice at −10 °C is converted into steam at 100 °C. Given, specific heat of ice is 0·5 cal/g/°C, latent heat of fusion is 80 cal/g and latent heat of vaporization is 540 cal/g.

SECTION—A

2. *(a)* State the law of conservation of angular momentum. Show that the angular momentum of a particle under the influence of a central force always remains constant. 5+15=20

(b) Derive expressions for the gravitational potential and field due to a solid sphere of uniform density at an external and an internal point. 20

(c) Calculate the total force experienced by a particle in motion in a rotating frame. Name the various components of the force. 10

3. (a) State the theorem of parallel and perpendicular axes for moment of inertia. Calculate the moment of inertia of a thin spherical shell about its diameter and a tangent. 5+15=20

(b) Define centre of mass of a system of particles. Show that when no external force acts on a body, the acceleration of the centre of mass is zero and its velocity is constant. 5+10=15

(c) Show that the angular momentum $\vec{J}$ of a system of particles can be expressed in the form of $\vec{J} = \vec{J}_{cm} + \vec{R} \times \vec{P}$, where $\vec{J}_{cm}$ is the angular momentum in centre of mass frame, $\vec{R}$ is the position vector of the centre of mass and $\vec{P}$ is the total linear momentum of the system. 15

4. (a) Discuss Michelson-Morley experiment and the implications of the results of their experiment. 15+5=20

(b) Define the terms 'group velocity' and 'phase velocity'. Obtain a relation between them. 5+5=10

(c) A particle is executing a damped harmonic motion. Form the differential equation of the motion for the particle and find the solution. Discuss the solution in detail for all possible cases. 2+3+15=20

5. (a) Describe the construction and working principle of Michelson's interferometer with a neat diagram. How is it used to measure the wavelength of monochromatic light? 5+10+5=20

(b) Apply Huygen principle to obtain the laws of reflection and refraction of a plane wave at a plane surface. 15

(c) What is zone plate? Derive an expression for its focal length and compare its working with that of a convex lens. 15

SECTION—B

6. *(a)* Explain the three electric vectors $\vec{P}$, $\vec{E}$ and $\vec{D}$. Show that $\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$. 15+5=20

(b) Write down Maxwell's electromagnetic equations. From these equations, obtain electromagnetic wave equations in free space and hence show that electromagnetic waves propagate with the speed of light. 4+8+3=15

(c) What do you mean by the method of electrical images? Use the method of electrical images to find the electric potential and field due to a point charge placed near a grounded conducting sphere. 5+10=15

7. *(a)* Establish Planck's black-body radiation formula. 15

(b) State and prove Poynting theorem relating the flow of energy at a point in a space in an electromagnetic field. 15

(c) Derive and discuss Einstein's theory of specific heat of solid. 20

8. *(a)* Define critical constants for van der Waals' equation of state and obtain expressions for the critical temperature, pressure, and volume in terms of the constants of van der Waals' equation. 5+10=15

(b) Define entropy and state its physical significance. Show that entropy always increases in a physical process. 5+10=15

(c) Explain the terms 'adiabatic change' and 'isothermal change'. Show that for an adiabatic change in a perfect gas, PV^{γ} = constant, where γ is the ratio of specific heats at constant pressure and volume respectively. 6+14=20

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No.

55010

PHYSICS—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and **four** from the rest, selecting at least **one** from each Section

Assume suitable data, if considered necessary and indicate the same clearly.

Use the following values of physical constants, if necessary :

Velocity of light, $c = 3 \times 10^8$ m s^{-1}

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Permeability of free space, $\mu_0 = 4\pi \times 10^{-7}$ T mA^{-1}

Mass of electron, $m_e = 9 \cdot 1 \times 10^{-31}$ kg

Boltzmann constant, $k_B = 1 \cdot 38 \times 10^{-23}$ J K^{-1}

Avogadro's number, $N_A = 6 \cdot 023 \times 10^{23}$/mole

Stefan's constant, $\sigma = 5 \cdot 67 \times 10^{-8}$ W m^{-2} K^{-4}

1. Answer any *five* questions : 10×5=50

(a) Show by mass-energy calculations, whether the reactions $^{14}N(\alpha, p)^{17}O$ and $^{7}Li(p, \alpha)\ ^{4}He$ are exothermic or endothermic. Given, atomic masses of

$_7N^{14} = 14{\cdot}00753$ a.m.u., $_8O^{17} = 17{\cdot}00450$ a.m.u.

$_2He^4 = 4{\cdot}00260$ a.m.u., $_1H^1 = 1{\cdot}00814$ a.m.u.

$_3Li^7 = 7{\cdot}01822$ a.m.u.

(b) Compute the mass of the neutron in a.m.u. from the following reaction :

$$^1_0n + {}^1_1H \rightarrow {}^2_1H + \gamma$$

Given, masses of $^1_1H = 1{\cdot}007825$ a.m.u., $^2_1H = 2{\cdot}014102$ a.m.u. and energy of the photon $E_\gamma = 2{\cdot}23$ MeV. [Use 1 a.m.u. = 931 MeV]

(c) A nucleon (neutron or proton) is confined to a nucleus of radius 5×10^{-15} m. Calculate the minimum uncertainty in the momentum of the nucleon. Also calculate the minimum kinetic energy of the nucleon. 5+5=10

(d) Calculate I_E in a transistor for which $\beta = 50$ and $I_B = 20\ \mu A$.

(e) For a cubic lattice, calculate the distance of (1 2 3) and (2 3 4) planes from a plane passing through the origin.

(f) The exciting line in a Raman scattering experiment is 5460 Å and the Stokes' line is observed to be 5520 Å. Find the wavelength of the anti-Stokes' line.

(g) Let A, B and C are three Boolean variables. Prove the following identities : 5×2=10

(i) $ABC + A\bar{B}C + AB\bar{C} = A(B + C)$

(ii) $AB + ABC + \bar{A}B + A\bar{B}C = B + AC$

SECTION—A

2. *(a)* State Heisenberg's uncertainty principle. Starting from de Broglie wave concept, obtain Heisenberg's uncertainty principle $\Delta x \Delta p_x \geq \hbar$. Discuss its significance. 3+8+4=15

(b) Write down Schrödinger equation for a particle in a 1-D box. Solve it to obtain energy eigenvalues and energy eigenfunctions. 15

(c) Develop Schrödinger equation for a linear harmonic oscillator and solve it to obtain the energy eigenvalues and eigenfunctions. 3+17=20

3. (a) What is normal Zeeman effect? Explain this phenomenon on the basis of quantum theory. 5+10=15

(b) What is Raman effect? Give quantum mechanical theory of Raman effect. 5+10=15

(c) Describe Stern-Gerlach experiment and discuss how it verifies the principal features of the vector atom model. 10+10=20

4. (a) Calculate the transmission and reflection coefficient for a particle of energy E incident on a rectangular potential barrier of heigh $V (E \ll V)$. 20

(b) L_x, L_y and L_z are the components of the angular momentum operator L in Cartesian coordinate system. Prove that *(i)* $[L_x, L_y] = i\hbar L_z$ and *(ii)* $[L^2, L_x] = 0$. Explain the physical significance of these relations. 5+5+5=15

(c) Describe and explain *L-S* and *J-J* coupling schemes in case of two-electron system with the help of vector diagram. 15

5. (a) Obtain an expression for the rotational energy levels of a diatomic molecule taking it as a rigid rotator. Discuss its spectrum and relevant selection rules. 10+10=20

(b) Write short notes on the following : 10×2=20

(i) Franck-Condon principle

(ii) Fluorescence and phosphorescence

(c) Discuss the properties of metals that could be explained by free electron theory. 10

SECTION—B

6. *(a)* What do you mean by the binding energy of a nucleus? Plot the variation of binding energy per nucleon of nuclei with their mass numbers and discuss the features of this variation. Explain the energy released in fission and fusion with the help of this graph. 5+5+5+5+5=25

(b) Briefly describe shell model of nucleus. How does this model account for the existence of magic number? List two successes and two failures of shell model. 10+10+5=25

7. *(a)* What are elementary particles? Give examples. Describe how they are classified. 5+10=15

(b) Discuss the conservation laws obeyed in elementary particle interactions. 15

(c) What are quarks? Mention their types. Give the quark structures of *(i)* proton, *(ii)* neutron, *(iii)* π^+, π^0 and π^- mesons and *(iv)* Σ^+, Σ^0 and Σ^- particles. 2+2+16=20

8. *(a)* Explain the crystal structure of diamond. Calculate its packing fraction and show how it has a comparatively loose packing. 7+8=15

(b) Write the main characteristic properties of a superconductor. Distinguish between type-I and type-II superconductors. 10+10=20

(c) What is Josephson junction? Explain some of its important applications. 7+8=15

9. *(a)* Discuss the operation of a transistor. Define α and β of a transistor and find a relationship between them. 10+5=15

(b) What is a MOSFET? Discuss the construction, operation and characteristics of MOSFETs. 5+15=20

(c) State and prove de Morgan's laws. 15

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No. 56030

HISTORY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question Nos. **1** and **5** which are compulsory and **three** of the remaining questions, selecting at least **one** from each Section

SECTION—A

1. Write a critical note on the importance of archaeological sources for the history of ancient India. 50

Or

Discuss the distinctive features of the Harappan Civilization. Give reasons for its decline.

2. Give an account of the life and conditions of the Rigvedic people. Is it correct to call them 'an agricultural people'? Give reasons for your answer. 40+10=50

3. Examine the position of women in peninsular India during ancient period. 50

4. Write short notes on any *four* of the following in not more than *150* words each : 12½×4=50

(a) Teachings of Gautama Buddha

(b) Mahajanapadas

(c) Positions of the Brahmins in peninsular India during the post-Vedic period

(d) Nature of the Mauryan administration

(e) Sangam literature

(f) Bhaskaravarman

(g) Al-Biruni

(h) Proliferation of castes in the Gupta period

SECTION—B

5. Examine the political conditions of India on the eve of Turkish conquest. Enumerate the factors responsible for the success of the Turks. 30+20=50

Or

Discuss the salient features of the Vaishnava Bhakti Movement in northern India. What were its impact on society and culture? 50

6. Is it correct to describe Akbar as a nation-builder? Give reason for your answer. 50

7. Give an account of the administration of the Ahoms. 50

8. Write short notes on any *four* of the following in not more than *150* words each : 12½×4=50

(a) Ziauddin Barani

(b) Sher Shah as an administrator

(c) Abul Fazl

(d) Mughal-Ahom relations

(e) Dara Shukoh and his syncretism

(f) Mughal paintings

(g) Shivaji's rise to power

(h) Condition of women in 17th century India

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No. 57043

HISTORY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates should attempt Question Nos. **1** and **6** which are compulsory and any **three** from the rest

1. Write short essays on any *two* of the following : 25×2=50

(a) Subsidiary Alliance

(b) Queen's Proclamation, 1858

(c) Orientalist-Anglicist Controversy

(d) Mahalwari Settlement

(e) Drain of Wealth Theory

(f) Home Rule Movement

2. Examine the factors behind British success against the Maratha Confederacy. 50

3. Describe the process of deindustrialization in India during British rule. 50

4. Highlight the participation of women in the Indian National Movement. 50

5. Attempt a note on the consequences of the Partition of India. 50

6. Discuss any *two* of the following : 25×2=50

(a) Causes of the Renaissance

(b) Effects of the American Revolution

(c) Industrialization in Japan

(d) Role of Cavour in Italian Unification

(e) Chinese Revolution of 1949

7. Critically evaluate the causes of the French Revolution. 50

8. To what extent was colonial rivalry responsible for the outbreak of the First World War? 50

9. Account for the end of the Cold War and US ascendancy in the world. 50

10. Discuss the process of the formation of the European Union. 50

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No. 58010

GARO—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Sing·ani No. **1**-ko aganchake, jekoba **mingbriko (4)** aganchakbo

1. Sing·anirangna mingsako seoke aganchakbo : 50×1=50

(a) Harendra W. Marakni segipa 'Mande aro Chatchi Dea' poedoo maimai ong·a obostarangko janape seaha poedoo pangchake che·eme talatbo.

(b) 'Jumang Matpu Nika' poedoo A·chikrang maidakgipa ong·a obostarangni gimin aganritingbaaniarangko mesoka poedoo pangchake che·eme dokbadale talatbo.

(c) 'Churugala aro Sa·sat So·a' maikai ong·baaha aro 'Matdoka ba Matchu Den·na' kritani maikai A·chikrangni bebera·ani japang ong·baaha aro maina krita uarangni dingtanggrikaniko poedoo pangchake che·eme ku·pebo.

2. Mingsako seoke aganchakbo : 50×1=50

(a) Couplane G. Momin 'Angni Gisik' poedoo maidakgipa gisikni gimin janapaha, talatbo. Ua ia poedoo maikai ka·satangni kakketgijani aro bebe ong·gijani gimin saknabee seaha segimin poedoko ong·a ba ong·ja ingen nang·ni chanchianiko sakkirang baksa talatbo.

(b) 'Gitanjali' ki·tapni pod–35-o Tagore mai gunrangko an·tangni a·songna nangnikaha aro pod–90-o 'siani' gimin maiko janape seaha poedoo pangchake dokbadale talatbo.

(c) B. K. Sangmani Ku·bisring 1-o 'Gunni Gopram' aro 'Sinteka Gri Gitrang'-ko poedoo pangchake che·eme ku·pebo.

3. Mingsana aganchakbo : 50×1=50

(a) Rhetoric aro Grammar maikai nangrimgrika mesokaniko on·ne sebo. Allegory, Parable aro Fable maikai dingtanggrika mesokani baksa talatbo.

(b) Innuendo, Irony, Periphrasis aro Euphemism badia kattani bimango ga·aka mingprakkon mesokani baksa talate sebo.

4. Mingsana aganchakbo : 50×1=50

(a) Tragedy maia? Ua maikai ong·baaha? Uni rokom bewalrangko sebo. Comedy aro Tragedy maio dingtanggrika talatbo.

(b) Literature maiko minga? Literature-ko seanio maidakgipa gunrang dongna nanga mesokanirang baksa talatbo.

5. Mingsako seoke aganchakbo : 50×1=50

(a) D. S. Rongmuthu 'Apasong Agana' ki·tapo 'Wangalako Dakchengani' poedoo maidakgipa a·sel aro obosta ong·ani gimin janape seaha? Uano maiba A·chikrangni bebera·ani nangchapani japang gnangma? Poedoo pangchake talatbo.

(b) Man·e cha·gipa manderangni Jaksil ganna maniani somoio mai dingtang dingtang kam aro bewalrangni gimin A. Ch. Momin-ni segipa ki·tap 'A·chikni Ku·andik'-o pangchake che·eme talatbo.

(c) Dhoronsing K. Sangmani A·chik Golporang Bak–1-o 'Do·kuamung Mese' aro 'Mongmamung Okgipu'-ni golpoo pangchake ong·a obostarangko skidapani gnang dokbadale talatbo.

6. Mingsana aganchakbo : 50×1=50

(a) Maiko Punctuation minga? Punctuation-ko ka·ani niamrangko mesokanirang baksa talatbo.

(b) Maiko Clause minga? Clause ma·prakko mesokanirang baksa talatbo.

7. *(a)* Mingbriko seoke, A·chikrango ba A·chik a·songo ong·rongbewal obostarango ba dakrong bewalo pangchake ku·pebo : 10×4=40

(i) Achakore chamanjok
Wal·ja gatinggelmanjok.

(ii) A·gitoko gongsotsaa
Sakchenasa chek pina.

(iii) Do·gep bitchi ringa
Matpu de minoka.

(iv) Misi oko nanga
Saljong dong knapa.

(v) Chiru agata
Dilneng do·mika.

(b) Ortorangko see sentenceprak rikbo : 2×5=10

(i) Bila jaka udare

(ii) Do·kana chri mesoka

(iii) Ba·nang chi·nanga

(iv) Rama ja·kol talpila
Ja·ku chitangpila

(v) Medong pe·a

8. *(a)* Mingsani gimin rochona (Essay) sebo : 25×1=25

(i) ICC Men's Cricket World Cup 2023

(ii) Chengoni ma·gitcham pagitchamrangni ripingbaengipa mingnamgipa gun aro bewalrang

(iii) 100 Drums Wangala

(b) Comprehension :

Ahaia A·chikrangni maniani gitade A·brengni miko akmano jamadalko wilwile ge·gipa aro jamadal mikkangni kimindamo ge·gipa miteni miko rate Rokimemako a·bagitalna jamap kalbong gitalna manchiatani sal ba a·jri galbaani sal ong·a. A·breng ra·gijagipa biaprango a·dalko a·jri galbaani salo ahaia. 'Angni kalbong rika gitalna re·chanade' ine agane medong danggittam kaako Matgipa Bidaweni Nokmana maatchenga donchenga. 'Angni chu·simraana angni maljurina re·chaanade' ine agane botolo

akomko sike donne medongko sindape donbaa. Ia manianikon sindepa ine agana. Medong ra·onbamitingo a·ba, jamap aro kalbong busruko galbaako nipilode Kiri Rokkime jamap busrukon galnapjaenga, kalbong busrunan re·napjaenga ine a·baon dongrikpilana aro bilsi gipin kari gipino a·dalo mi misi namjana ine A·chikrang bebera·a. Nokona sokbaae medong ra·baako dunku·tetangna pakma natengtangna pote chu rugale maniako daka.

(i) Sing·anirangko aganchakbo : 5×3=15

1. A·chikrang ahaiako maikai mania?
2. Maiko sindepa minga?
3. Medong ra·onbamitingo nipilode mai ong·a ine A·chikrang beberaa?

(ii) Ortorangko sebo : 2×5=10

1. A·breng
2. Jamadal
3. A·jri
4. Kimindam
5. Kalbong

* * *

No. 59010

GARO—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Singanirangni No. **1** na aganchake, jekoba **ming 4** basee aganchakbo

1. Mingsako seoke aganchakbo : 50×1=50

(a) M. S. Sangmani 'History of Garo Literature' ki·tapo A·chikrangni aganriting baani gita A·chikrang bano songdongachabaachim? Uamang maidakgipa nengnikarangko chagronge da·o songdongenggipa A·chik a·songona sokbaaha talate sebo.

(b) A·chikrangoni sako 'Gital Chasongni A·chik Sea-Jotani Pagipa' ba 'Father of Modern Garo Literature' ine mingna man·a? Uni janggi tangani aro mai a·selrangni gimin uko indake mingna kraa, a·selrangko on·e sebo.

(c) Modhunath G. Momin-ni janggi tangani aro A·chiku sea-jotani barianina maikai on·gilanirangko dakaha, sebo.

2. Mingsako sebo : 50×1=50

(a) Dikki Dakmesokani Bak–l-o L. R. Marak poedooni gunrangko maikai jakkale seaha, sakkirang baksa talatbo.

(b) Gitingpani sian-bonan ja·mano Giting ma·ningsa maidakgipa nengnikanirangko chagrongna nangaha Dikki Bak-II Chapdilmong-II o pangchake ong·a obostarangko sebo.

3. Mingsako seoke aganchakbo : 50×1=50

(a) 'Skul Master' dakmesokao L. D. Shira namgipa skigipachi maikai songkonokko aro manderangni janggi tanganiko dingtangatna man·na mesokanirang baksa ki·tapo pangchake talatbo.

(b) 'Metongbolni Gittim' ki·tapo Dikki aro Bandini bilakaniko maikai talata? Gitingko Dikkina aro Soreko Bandina maikai Dosi Dodoke on·na man·aha?

(c) K. M. Momin 'Nokdang' dakmesokao A·chikrang maimai kamrangko ka·e janggi tangna chol man·na ine dakmesokao talataha? Gritangko nokrom rimani namgipa bewal aro chu·sokgipa ong·a ba ong·ja nang·ni chanchianiko sakkirang baksa talatbo.

4. Mingsakosan aganchakbo : 50×1=50

(a) "Maina an·ching damchi bregimin ong·a." Sawa sako maidakgipa damchi breaha 'Anchichi Bregimin' ki·tapo pangchake sakkirang baksa sebo.

(b) 'Dombe Wari' maikai ong·baaha nang·ni poraigimin 'Dombe Rani' golpo o pangchake onga obostarangko che·eme talatbo.

(c) Macbeth sawa? Sawarang una maidakgipa dakmajoani kattarangko aganaha? Uamangni agansoani chu·sokahama? Sakkirang baksa talatbo.

5. Mingsako seoke aganchakbo : 50×1=50

(a) Mai a·selrangni gimin British-ni chasongko 'Sonani Chasong' ine aganna man·gen, sakkirangko mesoke M. S. Sangma-ni 'History of Garo Language' ki·tapo pangchake talatbo.

(b) Babelo mai obosta ong·anichi a·gilsakni ku·sikko jelbra-jelsuataha che·eme sebo.

(c) A·chiku sea-jotanirang maidakgipa gadangona sokaha, da·ororo seanirangko nigope che·eme talatbo.

6. Mingsakosan aganchakbo : 50×1=50

(a) M. N. Sangma-ni 'Maniani Bidik' ki·tapo Amua ba Krita aro Asi Malja manianirangko maina aro maikai daka dingtanggrikanirangko mesokanirang baksa talatbo.

(b) 'Nokpante' maia? Uko maikai rika aro uni niamrang aro gamchatanini gimin ki·tapo pangchake talatbo.

7. Mingsana aganchakbo : 50×1=50

(a) A·chikrangni bebera·ani gita mi janggini gimin talate uno nangchapgipa bewalrangni gimin K. D. Sangma 'Katta Wal·tim' ki·tapo pangchake mesokanirang baksa talatbo.

(b) Garo manderangna Pandu o songdongmitingo uamangni wankaduaniko talate, uamangna mai dal·bea gisik ra·ani ong·aha Moniram R. Marak-ni ki·tap 'A·chikni Ma·biding' o pangchake mesokanirang baksa sebo.

(c) Raja Behari Nokma Tobani maina garo manderangko dingaha aro maikai an·tangna gimaaniko ra·baaha sakkirangko on·e talatbo.

8. Mingsakosan aganchakbo : 50×1=50

(a) Sengban Americachi poraie sokbapilon songni manderangna maikai dakchakaniko on·an baksa Nama Kattakoba agan-parakna cholko man·aha, sakkirang baksa Bluwin Ch. Sangma-ni segipa ki·tap 'Dugalgreni Me·chik' ki·tapo pangchake sebo.

(b) Maini gimin Dugalgre songko Sengba Nokat ine mingjitaha? A·selrangko sebo.

(c) 'Gamseng' dakmesoka ki·tapo mongsonggipa bakragipa (Hero of the play) sawa? Ki·tapo pangchake talatbo.

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No. 60008

ANIMAL HUSBANDRY AND VETERINARY SCIENCE—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

Note : (1) There are **Eight** questions divided into **Two Sections**.

(2) Candidates has to attempt **Five** questions in all.

(3) Question Nos. **1** and **5** are compulsory and out of the remaining, **Three** are to be attempted choosing at least **One** question from each Section.

(4) The number of marks carried by a question/part is indicated against it.

(5) Word limit in questions, wherever specified, should be adhered to.

SECTION—A

1. Answer the following questions in about *150* words each : 10×5=50

(a) What are the feeding habits of goats? Enlist the common feeds and fodders for goats.

(b) Define Artificial Insemination (AI) and mention the advantages and disadvantages of AI.

(c) Give diagrammatic representation of kidney and narrate its functions.

(d) Write BIS specifications of nutrient requirements for chicken.

(e) Write in brief about the stages of spermatogenesis in bulls.

2. *(a)* Enlist various feed additives and describe the merits of use of probiotics in animal ration. 20

(b) Describe different methods of hay-making. What are the nutrient losses occurred during hay-making and how to prevent these losses? 20

(c) Write the causes and management of repeat breeding cases in cows. 10

3. *(a)* Mention the general functions of minerals in animals. Justify the importance of vitamin D in optimum calcium and phosphorus nutrition in animals. 10+10=20

(b) Explain the care and managemental practices to be taken up during pregnancy and farrowing in sow. What care needs to be taken to improve survival rate of piglets born? 20

(c) Write in detail the factors affecting water requirements of animals. 10

4. *(a)* Name the hormones secreted from pituitary glands. Discuss the role of pituitary gland in regulation of oestrous cycle in bovine. 20

(b) Define balanced ration. Write desirable characteristics of a balanced ration for a milch cow. 15

(c) Discuss the different basis of selection of animals for milk production. 15

SECTION—B

5. Explain/Answer the following in about *150* words each : 10×5=50

(a) Traits of economic importance

(b) Chromosomal aberrations

(c) Discuss about modified Mendelian ratio in monohybrid cross with examples.

(d) Explain the strategies adopted during disaster for livestock management.

(e) Enlist the indigenous breeds of milch cattle and write in brief on their habitat and main characteristics.

6. *(a)* Describe the scientific management of a dairy cow after parturition in a dairy farm. 15

(b) Describe the feeding of ewe flock during gestation and suckling period. 15

(c) Explain sex-linked inheritance and sex-influenced inheritance with suitable example. 20

7. *(a)* What feeding practices are suggested for adult female pigs? 15

(b) Enlist various accessory sex glands of bulls and describe the contribution of seminal vesicle to semen. 15

(c) What is breeding efficiency and how can it be measured? 20

8. *(a)* What different systems of brooding are being practised in poultry? How would you prepare a brooder house to introduce day old chicks? 20

(b) Discuss genetic and phenotypic effects of inbreeding. 15

(c) Define herd recording and explain the significance of herd recording for efficient dairy farm management. 15

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No. 61007

ANIMAL HUSBANDRY AND VETERINARY SCIENCE—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

Note : (1) There are **Eight** questions divided in **Two Sections**.

(2) Candidate has to attempt **Five** questions in all.

(3) Question Nos. **1** and **5** are compulsory and out of the remaining, any **Three** are to be attempted choosing at least **One** question from each Section.

(4) The number of marks carried by a question/part is indicated against it.

(5) Word limit in questions, wherever specified, should be adhered to.

SECTION—A

1. Discuss/Answer the following in about *150* words each : 10×5=50

(a) Management of Monday Morning Sickness in horses

(b) Anatomical structures and formation of egg in hen

(c) Scalding technique in poultry and pig slaughtering

(d) How does heat stress affect the performance of dairy cows?

(e) Compare spermatogenesis and oogenesis.

2. *(a)* Write about major air pollutants in the vicinity of industrial areas and their effects on animal health and production. 20

(b) Explain in detail the mechanism, clinical symptoms and treatment of cyanide poisoning. 20

(c) Discuss about air sacs in fowl and its significance. 10

3. *(a)* Explain zoonoses. Discuss the routes of transmission of various zoonotic diseases. 20

(b) Write in detail the ante-mortem inspection procedure in a slaughter-house. 20

(c) Describe the strategies in vaccine production. 10

4. *(a)* Write in detail the etiology, pathogenesis, clinical symptoms, diagnosis and control of Rabies in dogs. 20

(b) Discuss the methods for preservation of meat and meat products. 20

(c) Discuss the different housing systems for poultry and their merits and demerits. 10

SECTION—B

5. Discuss/Answer the following in about *150* words each : 10×5=50

(a) Etiology and treatment of haemoprotozoan diseases in cattle

(b) Classification of placenta in domestic animals

(c) Discuss in detail the role of cooperative societies and Operation Flood in the development of dairy industry in India.

(d) Vitamin B complex deficiency in poultry

(e) Immunization schedule for the protection against layer bird diseases

6. *(a)* Write in detail the etiology, symptoms, diagnosis and treatment of milk fever in cattle. 20

(b) Explain with the help of flow diagrams, the manufacture of sterilized, homogenized and flavoured milk. 20

(c) Discuss the role of SPCA in animal welfare. 10

7. *(a)* Write down the methods of stunning and explain electrical stunning in small and large animals. 20

(b) What are the advantages of canning of meat products? Detail the various steps in traditional canning. 20

(c) Explain the role of public health veterinarian in relation to meat hygiene. 10

8. *(a)* Define sausage. Describe the processing steps in the preparation of ready-to-cook sausages. 20

(b) Classify diuretics with examples on the basis of efficacy and also write down their mechanism of action. 20

(c) Give a brief outline of the chemical composition and nutritional content of poultry meat. 10

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No. 62014

PSYCHOLOGY—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

This question paper comprises of two Sections. From Section—A is compulsory, two part need to be attempted and from Section—B *any* **four** questions need to be attempted

SECTION—A

1. Answer any *two* of the following questions (each answer should not exceed *250* words) : 25×2=50

(a) Discuss the usage of interdisciplinary approaches to understand human behaviour.

(b) Compare and contrast between fundamental versus applied research.

(c) Explain the role of genetic and environmental factors in determining human behaviour.

SECTION—B

2. Answer any *four* of the following questions (each answer should not exceed *750* words) : 50×4=200

(a) Discuss the theories of emotion.

(b) Describe the various projective techniques. Critically evaluate the application of projective techniques.

(c) Briefly point out the types of problem-solving. Discuss the obstacles and aids to problem-solving.

(d) What are some of the strategies that guide human decision-making? What are some of the forms of deductive reasoning that people may use, and what factors facilitate or impede decision-making?

(e) How does the language affect the way we think? Explain the basic components of words and sentences.

(f) Explain the process of concept formation. Discuss the influence of cultural factors on decision-making and judgement.

(g) Explain the formation and maintenance of attitudes. Elaborate on the measurements of attitudes, values and interest.

(h) Define Artificial Intelligence. Describe the simulation studies.

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No. 63014

PSYCHOLOGY—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

This question paper comprises of two sections. Section—A is compulsory, out of which **two** parts need to be attempted and from Section—B, *any* **four** questions need to be attempted

SECTION—A

1. Answer any *two* of the following (each answer should not exceed *250* words) : 25×2=50

(a) Highlight the ethical issues in the use of psychological tests.

(b) Discuss the factors influencing positive health and well-being.

(c) Explain the techniques used in behaviour therapy.

SECTION—B

2. Answer any *four* of the following questions (each answer should not exceed *750* words) : 50×4=200

(a) What is the difference between deprivation and social exclusion? Discuss the social, physical, cultural and economic consequences of deprived groups.

(b) Explain the causal factors of conflicts and prejudices in ingroup and outgroup. Suggest some psychological measures for handling the conflicts and prejudices.

(c) Comment on the psychological consequences of recent developments in Information Technology. What is the role of psychologists in the present scenario of Information Technology and Mass Media boom?

(d) Describe the psychological disorders that develop due to war. Discuss the role of counselling in facilitating the process of adjustment of personnel to military life.

(e) Explain the characteristics of entrepreneurial behaviour. Comment on the role and status of women entrepreneurs in India citing suitable examples.

(f) Discuss the psychological effects of noise, pollution and crowding. Suggest some techniques of motivation for small family rooms.

(g) Explain the concept of psychology of corruption. Suggest some strategies to deal with psychology of terrorism.

(h) Discuss the strategies for promoting positive mental health among defence personnel.

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No. 64020

EDUCATION—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **8** which is compulsory and *any* **four** from the rest

1. *(a)* *(i)* What is meant by educational psychology?

(ii) Explain the scope of educational psychology.

(iii) Discuss observation as a method of educational psychology.

(iv) Explain how the knowledge of educational psychology helps in teaching-learning process. 4+5+8+8=25

(b) *(i)* Discuss the concept and characteristics of creativity.

(ii) Bring out the relationship between creativity and intelligence.

(iii) Explain the role of education in promoting creativity. Support your answer with suitable examples. 5+10+10=25

2. *(a)* *(i)* Define intelligence.

(ii) Discuss Spearman's two-factor theory of intelligence.

(iii) Bring out its educational significance. 3+12+10=25

(b) *(i)* Discuss type and trait approaches to personality.

(ii) What are the characteristics of personality?

(iii) Discuss the Thematic Apperception Test (TAT) as a technique of assessing personality. 10+5+10=25

3. *(a)* *(i)* Bring out clearly the relationship between Philosophy and Education.

(ii) Differentiate between the individual and social aims of education. 10+15=25

(b) *(i)* Explain the concept of naturalism.

(ii) Discuss the principles of naturalism.

(iii) What are the contributions of naturalism to the field of education? 5+8+12=25

4. *(a)* *(i)* Explain the concept of social system.

(ii) Describe the role of education as an instrument of social change.

(iii) Discuss the role of school as a social sub-system. 5+10+10=25

(b) *(i)* Explain the meaning of freedom and discipline.

(ii) Examine the relative importance of freedom and discipline in the classroom.

(iii) Describe the role of education in democracy. 8+10+7=25

5. *(a)* *(i)* What were the aims of education in post-Vedic period?

(ii) Explain the student-teacher relationship and methods of teaching during the post-Vedic period.

(iii) Discuss the main features of educational thought and practices in ancient Rome. 10+10+5=25

(b) *(i)* Discuss the contribution of J. Krishnamurti to modern Indian education.

(ii) Explain the relevance of Gandhi's basic education in the present-day educational context.

(iii) Briefly discuss the modern educational thought of Paulo Freire. 5+10+10=25

6. *(a)* *(i)* Explain the meaning of Logical Atomism of Bertrand Russell.

(ii) Write the contribution of Swami Vivekananda to modern Indian education.

(iii) Examine briefly the contribution of John Dewey to educational thought and practice. 5+10+10=25

(b) (i) What is meant by inclusive education?

(ii) Describe its needs and importance.

(iii) Discuss the different types of inclusion as per their classification.

3+10+12=25

7. (a) (i) Differentiate between measurement and evaluation.

(ii) Explain the concept of reliability and validity of a test.

(iii) Describe the methods of determining reliability and content validity.

5+10+10=25

(b) (i) What are educational objectives?

(ii) Explain Bloom's taxonomy of educational objectives under cognitive domain. Cite appropriate examples.

(iii) Explain the meaning and types of correlation. 5+12+8=25

8. Write short notes on the following : 10×5=50

(a) Trial and error theory of learning

(b) Likert's attitude scale

(c) Spearman's rank difference method of correlation

(d) Non-formal and continuing education

(e) Steps and techniques of counselling

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No. 65020

EDUCATION—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **8** which is compulsory and *any* **four** from the rest

1. *(a)* *(i)* Describe the salient features of Vedic education.

(ii) Examine the relevance of Vedic education to present-day system of education in India.

(iii) Briefly describe the main features of Muslim system of education. 8+9+8=25

(b) *(i)* What are the main recommendations of the Secondary Education Commission (1952–1953)?

(ii) Explain the features of the Charter Act (1813).

(iii) Enumerate the main recommendations of Hunter Commission (1882) and discuss its influence on the development of education in India. 10+5+10=25

2. *(a)* *(i)* Discuss the various provisions implemented for the universalization of elementary education in contemporary Indian education.

(ii) How far has the implementation of SSA been successful in the universalization of elementary education? Discuss. 12+13=25

(b) *(i)* Discuss briefly the major recommendations of Hartog Committee.

(ii) Discuss the recommendations of Programme of Action of Secondary Education. 10+15=25

3. *(a)* *(i)* Elucidate the important features of Knowledge Commission Report, 2007 with reference to higher education.

(ii) Briefly describe the globalization of higher education. 10+15=25

(b) Discuss the role of DIET, CTE, DERT and NCTE in teacher education. 25

4. *(a)* *(i)* Discuss the present status of vocationalization of secondary education in India.

(ii) Discuss the problems and issues of higher education in Meghalaya. 15+10=25

(b) *(i)* Describe the Rashtriya Madhyamik Shiksha Abhiyan (RMSA).

(ii) Discuss the features and strategies of implementation of the Rashtriya Madhyamik Shiksha Abhiyan. 10+15=25

5. *(a)* *(i)* Briefly describe the various types of educational technology and the role of ICT in classroom instruction.

(ii) Explain the meaning, types and uses of teaching aids. 10+15=25

(b) *(i)* Describe the process of communication in the classroom.

(ii) Briefly analyse the core teaching skills. 10+15=25

6. *(a)* *(i)* Give the concept and scope of school management.

(ii) Differentiate between centralized and decentralized types of school management.

(iii) Discuss the principles of school management. 8+8+9=25

(b) *(i)* Explain the concept of institutional planning.

(ii) Discuss the needs and steps of school supervision.

(iii) Briefly examine the importance of teacher's diary. 8+10+7=25

7. *(a)* *(i)* What are co-curricular activities?

(ii) Discuss the role of teacher in management and organization of co-curricular activities.

(iii) Explain the benefits of co-curricular activities to the school and students. 5+10+10=25

(b) (i) What is time management?

(ii) Explain the principles of time-table construction.

(iii) Discuss the democratic type of school management. 5+10+10=25

8. Write short notes on the following : 10×5=50

(a) Human rights education

(b) Programmed instruction

(c) System approach to instruction

(d) Role of Integrated Child Development Services (ICDS)

(e) Problem solving and discussion as methods of teaching

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No. 66006

MECHANICAL ENGINEERING—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer *any* **five** questions

1. A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If at a temperature of 10 °C, there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised to 200 °C. Take E for steel and copper as $2{\cdot}1\times10^5$ N/mm^2 and 1×10^5 N/mm^2 respectively. The value of coefficient of linear expansion for steel and copper is given as 11×10^{-6} per °C and 18×10^{-6} per °C respectively. 50

2. A beam 12 m long is supported at one end at a point 10 m away from first support. It carries a u.d.l. of 100 N/mm over the entire length. Draw the SF and BM diagrams. 50

3. *(a)* What do you mean by eutectic temperature? Draw an iron-carbon equilibrium diagram and show all the phases, eutectoid boundaries, etc. 20

(b) With neat sketches, discuss gray cast iron and nodular (ductile) iron. 10

(c) What are the advantages of aluminium over steel? What are the structures formed during the aging of precipitation hardening of Al-4 wt% Cu alloy? Discuss with sketches. With neat sketches, show the stability criteria of ceramic atoms. 20

4. In an orthogonal cutting operation, the following data have been observed :

Uncut chip thickness, $t = 0{\cdot}127$ mm

Width of cut, $b = 6{\cdot}35$ mm

Cutting speed, $V = 2$ m/s

Rake angle, $\alpha = 10°$

Cutting force, $F_c = 567$ N

Thrust force, $F_t = 227$ N

Chip thickness, $t_c = 0{\cdot}228$ mm

Determine the shear angle, friction angle, shear stress along the shear plane and the power for the cutting operation. Also, find the chip velocity, shear strain in chip and shear strain rate. 50

5. *(a)* Describe the difference between carburising and nitriding treatments. What is the purpose of each? Give one example of component for which each process is suitable.

(b) Up to what depth, components can be hardened by carburising process? 50

6. *(a)* Discuss about the criteria for a good plant layout with neat sketch. 20

(b) With proper example, discuss the KANBAN system. 15

(c) What do you mean by single sampling plans? Narrate it with proper diagram. 15

7. The following table gives the number of defects on each truck inspected every day. The inspection process continues for a period of 22 days in a month. Compute the control limit and draw the necessary control chart from this data. Also, determine the subsequent values of control limit if the process is out of control : 50

Truck Sample No.	1	2	3	4	5	6	7	8	9	10	11
Number of Defects	1	3	5	4	8	3	8	1	3	13	2
Truck Sample No.	12	13	14	15	16	17	18	19	20	21	22
Number of Defects	0	2	10	3	0	10	3	0	3	13	10

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No. 67004

MECHANICAL ENGINEERING—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer *any* **five** questions

1. 2 kg of air at 500 kPa, 80 °C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surrounding which is at 100 kPa, 5 °C. For this process, determine *(a)* the maximum work, *(b)* the change in availability and *(c)* the irreversibility. For air, take $C_v = 0{\cdot}718$ kJ/kg-K, $u = C_v T$, where C_v is constant and $PV = mRT$, where P is pressure in kPa, V is volume in m^3, m is mass in kg, R is a constant $= 0{\cdot}287$ kJ/kg-K and T is temperature in K. 50

2. *(a)* What is the main reason for the development of two-stroke engines and what are the two main types of two-stroke engines? Why are two-stroke engines banned? 25

(b) Compare four-stroke and two-stroke cycle engines. Bring out clearly their relative merits and demerits. 25

3. *(a)* Point out the salient characteristics of LPG and CNG when used as alternate fuel in automobile engine. 20

(b) Explain the functions and operation of exhaust gas recirculation (EGR) system. 15

(c) Explain the following terms : 15

(i) Octane rating

(ii) Cetane rating

(iii) Stoichiometric air

(iv) Higher calorific value

(v) Lower calorific value

4. (a) What do you understand by the word 'draught'? How are draughts classified? 10

(b) Explain the principle used in forced and induced draught. Why is balanced draught preferred over forced or induced draught? 20

(c) Explain the difference between velocity compounding and pressure compounding of steam turbine. Which is more preferred in practice and why? 20

5. (a) Differentiate between a heat engine and a refrigerator using the appropriate schematic and cycle diagrams. 25

(b) Describe the relative advantages and disadvantages of air-cooled, water-cooled and evaporative condensers. 25

6. (a) When is reheating of steam recommended in a steam power plant? How does the reheat pressure get optimized? 25

(b) What is the effect of reheat on (i) the specific output, (ii) the cycle efficiency, (iii) the steam rate and (iv) the heat rate of a steam power plant? 25

7. (a) Enumerate the desirable properties of an ideal refrigerant. 20

(b) State the properties and uses of the following refrigerants : 30

(i) R-11 (Trichloromonofluoromethane)

(ii) R-12 (Dichlorodifluoromethane)

(iii) R-22 (Monochlorodifluoromethane)

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No. 68010

CIVIL ENGINEERING—I

Paper—VI

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

There are **eight** questions in this paper. Question No. **1** is compulsory. Out of the remaining **seven** questions, attempt any **four** questions

Assume suitable data, where necessary, and indicate the same clearly. Symbols and notations have their usual standard meanings, unless otherwise mentioned. Wherever required, draw neat sketches and give examples to illustrate answers. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the answer book must be clearly struck off. Question numbers must be written in full for each and every part of a question.

1. Answer the following questions :

(a) What is a rigid body? 3

(b) Explain the concept of force and state the principle of transmissibility of force. 3+3=6

(c) State Varignon's theorem. 3

(d) Define the following : 3×2=6

(i) Modulus of elasticity

(ii) Poisson's ratio

(e) What is strain energy? 3

(f) What is bulking of sand? 3

(g) What is laminar flow? 4

(h) What is a venturi meter used for? 3

(i) What is a non-Newtonian fluid? 3

(j) What do you mean by hydrostatic pressure? 4

(k) What is fineness modulus? 3

(l) Write a note on origin of soil. 5

(m) Explain the concept of optimum moisture content. 4

2. (a) State the principle of virtual work. 4

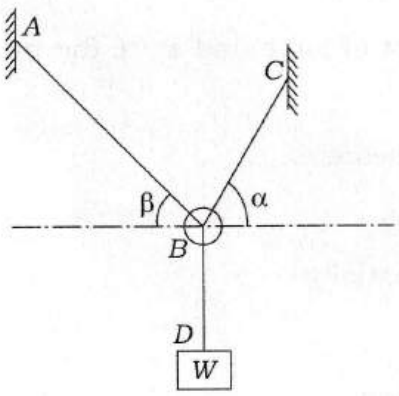
(b) Explain the parallelogram law of force. 4

(c) State Castigliano's first theorem. 4

(d) State and explain the law of dimensional homogeneity. 4

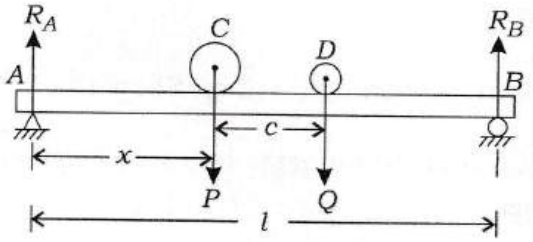
(e) With neat diagrams, explain the term 'second moment of area'. 4

(f) Draw free body diagrams for the body of weight W, the string BD and the ring B shown in the figure below : 2×3=6



(g) A round bar of 40 mm diameter was subjected to a tensile force of 400 kN. The extension of the bar measured over a gauge length of 200 mm was found to be 0·32 mm. The decrease in the diameter was found to be 0·02 mm. Calculate the modulus of rigidity of the bar material. 4

(h) Two rollers C and D produce vertical forces P and Q on the horizontal beam AB as shown in the figure below :



Determine the distance x of the load P from the support A if the reaction $R_A = 2R_B$. The weight of the beam is negligible. Given, $P = 20$ kN, $Q = 10$ kN, $l = 4{\cdot}5$ m and $c = 0{\cdot}9$ m. 10

(i) An 8 m long beam AB is simply supported at the ends and it is subjected to a point load of 20 kN at point C at a distance of 6 m from A. Using Mohr's moment-area method, compute the deflection of the beam at C. Take $I = 6\times10^8$ mm^4 and $E = 2\times10^5$ N/mm^2. 10

3. (a) Explain the design philosophies of working stress method and limit state method. 5+5=10

(b) Design a butt joint to connect two plates 175 mm × 10 mm (Fe 410 grade) using M20 bolts. Arrange the bolts to give maximum efficiency. Take single shear capacity for M20 bolts as 45·3 kN and hole diameter as 22 mm. 15

(c) Write the factors contributing to the joint action of steel and concrete in a reinforced concrete section. 5

(d) For a balanced rectangular section (200 mm × 300 mm) of a singly reinforced beam, determine the depth of neutral axis, moment of resistance and percentage of steel using M20 concrete and Fe 415 steel. Take $\sigma_{cbc} = 7$ N/mm^2, modular ratio $m = 13{\cdot}33$ and $\sigma_{st} = 230$ N/mm^2. 4+4+4=12

(e) What is pre-stressed concrete? Explain the stress concept of pre-stressed concrete. 3+5=8

4. *(a)* Derive Bernoulli's energy equation mentioning its assumptions. 10

(b) A circular plate 1·5 m in diameter is placed vertically in water so that the centre of the plate is 3·0 m below the free surface. Determine the total pressure on the plate. 5

(c) Find the kinematic viscosity of a liquid whose specific gravity is 0·95 and viscosity is 0·011 poise. 5

(d) A stream function is given by $\psi = 2xy$. Show that the flow is irrotational. 5

(e) A jet of water 25 mm in diameter has a velocity of 20 m/s. Calculate the power of the jet. 5

(f) The head of water over an orifice of diameter 20 mm is 2·0 m. Find the discharge through the orifice. Take $C_d = 0{\cdot}6$. 5

(g) Calculate the discharge over a sharp-crested weir 5 m long if the head of water over the crest is 0·040 m. Take $C_d = 0{\cdot}62$. 5

(h) A pipe 50 mm in diameter and 1·00 km long delivers water at a velocity of 1·0 m/s. Find the loss of head due to friction. Take friction factor $f = 0{\cdot}008$. 5

(i) A rectangular channel 6 m wide conveys water at 11·50 cumec at a depth of 0·30 m. If a hydraulic jump occurs, find the depth of flow after the jump. 5

5. *(a)* Explain Atterberg's limits and their importance. 10

(b) A soil sample has a porosity of 40%. The specific gravity of solids is 2·65. Calculate the void ratio, dry density and unit weight if the soil is 60% saturated. 2+2+2=6

(c) Write and explain Darcy's law of permeability. 4

(d) What is structural water? 3

(e) A coarse-grained soil has a void ratio of 0·78 and specific gravity 2·65. Calculate the critical gradient at which quick sand condition will occur. 3

(f) What is consolidation of soil? What is its opposite process called? 3+1=4

(g) An undisturbed sample of clay 24 mm thick consolidated 50% in 25 minutes, when it was tested in the laboratory with drainage allowed at top and bottom. The clay layer from which the sample was obtained is 3 m thick in the field. How much time will it take to consolidate 50% with double drainage? Assume uniform consolidation pressure. 5

(h) Define safe bearing capacity and give its relation with net safe bearing capacity. 3+2=5

(i) Design a gravity retaining wall, 5 m high with vertical back to retain a dry cohesionless backfill of bulk density 1·8 tonne/m^3 and angle of shearing resistance 30°. Find also the factor of safety against sliding assuming angle of friction between the base of the wall and the foundation soil as 30°. The wall is to be 1 m wide at top and is to be constructed with brick masonry having density of 2·0 tonne/m^3. Use Rankine's theory. 10

6. (a) Discuss the advantages and disadvantages of fixed beams. 10

(b) Differentiate between fundamental units and derived units. 3

(c) State D'Alembert's principle. 3

(d) Draw the shear force diagram and bending moment diagram for a beam 6 m long fixed at both ends and carrying a uniformly distributed load of 5 kN/m in the middle 2 m of the beam. 5+5=10

(e) What are influence lines? A simply supported beam has a span of 20 m. A uniformly distributed load of 2 tonne/m and 5 m long crosses the span. With the help of influence lines, find the maximum BM produced at a point 8 m from the left support. 3+7=10

(f) A two-hinged parabolic arch of span 36 m and central rise of 6 m has the moment of inertia varying as the secant of slope of the rib axis. Find the horizontal thrust on the arch, if a point load of 100 kN acts at a distance of 9 m from the left end support. 10

(g) What is unsymmetrical bending? 4

7. *(a)* A laboratory compaction test on a soil having specific gravity of 2·67 gave maximum dry density of 1·82 g/cm^3 and water content 16%. Determine the degree of saturation, the percentage air voids and the theoretical maximum dry density corresponding to zero air voids at optimum moisture content. 3+3+3=9

(b) With a neat sketch, explain the concept of metacentric height. 5

(c) What is an orifice? What is vena contracta? 3+2=5

(d) What is a weir? 3

(e) Explain the concept of absolute similitude between a model and its prototype. 5

(f) Define specific energy head and critical flow in case of open channel flow. 3+3=6

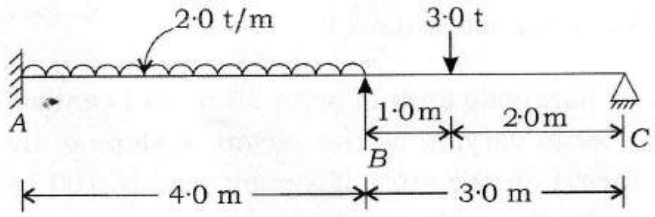
(g) A jet 150 mm in diameter moving at a speed of 25 m/s strikes a plate which remains at rest. Find the force exerted by the jet on the plate when the plate is held normal to the jet. 5

(h) A turbine running under a head of 25 m develops 7300 kW power running at 120 r.p.m. What is the specific speed of the turbine? 5

(i) The mass of an empty jar was 0·498 g. When completely filled with water, its mass was 1·528 kg. An oven-dried sample of mass 0·198 g was placed in the jar and water was added to fill the jar and its mass was found to be 1·653 kg. Determine the specific gravity of the sample. 7

8. *(a)* State Clapeyron's theorem of three moments. 4

(b) A beam, having two spans, the first of 4·0 m and the other of span 3·0 m, is fixed at one end and is simply supported at the other end and is continuous over the central support. The loading on the beam is shown in the figure below :



The beam is of uniform section. Calculate the bending moments and shear forces for design of the beam. 10

(c) Briefly describe how particle size distribution can be obtained for a soil sample consisting of both coarse-grained and fine-grained soil. 10

(d) Explain how diagonal tension develops due to shear near the supports in an RC beam. 5

(e) Explain the phenomenon of surface tension. 5

(f) Explain the function of a surge tank. 5

(g) What is meant by boundary layer? 5

(h) What is Euler's formula for load-carrying capacity of short columns? What is the effective length of a column which is fixed at the base and is free at the top? 3+3=6

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No. 69010

CIVIL ENGINEERING—II

Paper—VII

(Optional)

Marks : 250

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **all** questions

Assume suitable data when needed

1. *(a)* Describe the water absorption of stones. Discuss the general properties of tiles. 2+2=4

(b) Name the properties of lime. Define the term 'shake' in timber. Discuss cup shake. 2+1+2=5

(c) Describe single Flemish bond with diagram. How is laying of Moorum flooring carried out? 3+2=5

(d) Define Surkhi. What is the aim of good plaster? 1+1=2

(e) How is crack repairing carried out in masonry walls? 2

2. *(a)* Describe three factors affecting orientation of building. Define the term 'grouping'. How are groupings carried out in residential building and in hospital building? 3+1+1+1=6

(b) What are the advantages of energy-efficient building? 3

(c) Define the term 'independent cluster' for building. What do you understand by volume to plot area ratio? As per NBC, give the provision for community open spaces in residential building. 2+2+2=6

(d) Specify the joinery work in wooden doors and windows. How is crossing method carried out in estimate work? Define the term 'sinking fund'. 2+2+2=6

3. (a) Describe three factors affecting selection of equipments for construction projects. 3

(b) Discuss the objective of motion study. 2

(c) Name the objective of concrete transit mixer. How does it function? 1+2=3

(d) Bulldozer is suited in which type of situation? Name its usual function. 1+1=2

(e) Describe the working of sheepsfoot roller. 3

(f) Elaborate two points for the purpose of project scheduling. What do you understand by the term 'project control'? 2+2=4

(g) A project manager has obtained the following optimistic, most likely and pessimistic times (in weeks), relating to various activities related to the construction of power project :

Activity Sequence	*Optimistic Time*	*Most Likely Time*	*Pessimistic Time*
1–2	6	9	18
1–3	5	8	17
2–4	4	7	22
2–5	4	7	10
3–4	4	7	16
3–5	2	5	8
4–5	4	10	22

Estimate the estimated time and the variance for each activity. Also draw the arrow diagram. 3+1=4

(h) Describe the economies of production and economies of finance relating to the scaling of economy. 2+2=4

4. *(a)* A survey line was measured to be 60 m. It was found that there was a misalignment and the line was 1 m off the straight line at the middle. Determine the correct length. 2

(b) Describe the cross-section method adopted for contouring survey. 4

(c) Describe the advantages of plane table. 4

(d) A National Highway curve of 625 m radius is to be set out to connect two straights. The maximum speed of a moving vehicle on this curve is restricted to 90 kmph. Transition curves are to be introduced at each end of the curve. Calculate the suitable length of the transition curve and the necessary shift of the circular curve. 2+2=4

(e) Describe the criteria in triangulation for arrangement of triangles. 4

(f) During survey work, the first reading at point *A* is 0·795 m and its RL is 550·605 m which also happened to be its BM. The next reading at point *B* is 1·655 m, followed by subsequent readings. Determine the RL at *B* by rule out a page of level field book. 3

5. *(a)* Describe the requirement of good sleepers. 4

(b) How is rail fixed to the concrete sleepers? 2

(c) Draw a line diagram showing right-hand turnout with details. 2

(d) Discuss the occurrence of creep in railway track due to wave formation. 3

(e) Describe the function of home signals. 2

(f) Describe the methods for maintenance of straight tracks. 4

(g) Describe the most commonly adopted ballast in Indian Railways. 2

6. *(a)* For planning the road development of a backward district, the following data were collected :

(i) Total area = 1200 km^2

(ii) Agriculture and developed area = 4500 km^2

(iii) Existing railway track length = 150 km

(iv) Number of towns and villages in different population ranges is as below :

Population	>5000	2001–5000	1001–2000	500–1000	<500
Number of Villages and Towns	15	50	140	300	620

Calculate the total length of unmetalled roads for this road system based on Nagpur Road Plan. 3

(b) Calculate the minimum non-passing sight distance on a highway at a descending gradient of 6% from the following data : 2

Design speed = 80 kmph
Reaction time of the driver = 2·5 seconds
Coefficient of friction between tyre and road surface = 0·4

(c) Draw a superelevation when it is rotated about the centreline. Where is it mostly adopted? 2+1=3

(d) How is postcard survey conducted for traffic survey? 2

(e) Describe about the overhang and mounting height of street lighting. 3

(f) Discuss the necessity of subsurface drainage in highway. 2

(g) Define possible capacity that is being used in highway. 2

(h) How do mud pumping and corrugation occur in highway? 2+2=4

(i) Describe WBM road with diagram. 2+1=3

7. *(a)* Describe convective precipitation. Describe the flood frequency method. 2+2=4

(b) Estimate the total volume of rainfall water received in m^3 over a basin of 4444 ha for the following observations : 3

Station	*A*	*B*	*C*	*D*	*E*
Polygon Area (ha)	518	777	906	1495	748
Observed Rainfall (mm)	267	198	142	114	81

(c) How is a good irrigation method being measured? Discuss two cases of waterlogging. 2+2=4

(d) Describe three duties in irrigation system. 3

(e) A weir has 51 number of vertical gates with span of each gate 10 m, full reservoir level (u/s) 110 m, crest level 106 m, coefficient of end contraction for piers 0·02, coefficient of end contraction for abutment 0·1, coefficient of discharge (Francis method) 1·70. Determine the maximum flood discharge which can safely pass over the weir without exceeding the full reservoir level. Neglect velocity of approach. 2

(f) Why is a vertical drop fall with cistern often used? Describe the function of cross regulator. Discuss the curtain grouting. 2+3+3=8

(g) Describe silt extruder with diagram. Discuss the aggrading rivers. 2+1+2=5

(h) Describe the chute spillway. Describe the impermeable groynes with diagram. Describe the length of guide bank as per spring method. 3+2+2+2=9

(i) Describe specific yield. How is pumping in test carried out by Parker method? 2+2=4

(j) A tube well of 20 cm diameter penetrates fully an artesian aquifer of 30 m thickness. Determine the permeability of the aquifer if a steady discharge of 40 L/s is obtained from the well under a drawdown of 4 m at well face. The radius of influence is 245 m. 2

(k) Describe the seepage losses in a canal. When linings are provided, what happens to the reservoir and velocity of flow? By providing lining, derive the annual saving in value of water which is otherwise lost by seepage. 3+1+1+4=9

(l) A channel has CCA 5000 ha. Two Rabi crops are sown, one is gram and the other is wheat. The following are the details of these crops :

Crop	*Intensity of Irrigation*	*Kor Depth* (cm)	*Kor Period* (days)
Wheat	40%	13·5	15
Gram	50%	12·0	18

Determine the discharge. 2

(m) Describe the sediment loads in a reservoir. Describe Khosla's interim conclusion for permeable foundation. 3+3=6

8. (a) Elaborate four factors while deciding the site for location of impounded reservoir. 4

(b) The following were the population recorded in a village :

Year	*Population*
1960	8000
1970	12000
1980	17000
1990	22500

Determine, by geometrical increase method, the population at the end of the year 2000. 3

(c) Water has to be supplied to a town with one lakh population at the rate of 150 L/capita/day from a river 2000 m away. The difference in elevation between the lowest water level in the sump and the reservoir is 36 m. If the demand has to be supplied in 8 hours, assume the maximum demand as 1·5 times the average demand. Take $f = 0{\cdot}0075$, velocity in the pipe 2·4 m/s and the efficiency of the pump as 80%. Determine the diameter of the pipe. 3

(d) Describe the rectangular sedimentation tank used in water treatment with diagram. 3+1=4

(e) Describe the efficiency of slow sand filter. 3

(f) How is temporary hardness of water removed by addition of limewater? Show the equation. 2

(g) Discuss the necessity of laying water pipelines in parallel. How is laying of water supply pipes carried out? 3+2=5

(h) Describe *(i)* cast iron pipe, *(ii)* flange joint and *(iii)* necessity of check valve. 3+2+2=7

(i) Describe the gutter inlets with diagram. Discuss the need of inverted siphon for a sewer. 2+1+2=5

(j) Describe about the limiting velocities in a sewer. Discuss a two-pipe system of plumbing with a diagram. 3+2+2=7

(k) Describe three tests that are conducted for physical examination of sewage. How is the process of broad irrigation carried out for sewage disposal? 3+3=6

(l) Describe the operation and loading of trickling filters. How is the operation and maintenance of oxidation pond carried out? 4+3=7

(m) In thermal power plant, give the permissible limits of *(i)* condenser cooling water for pH and *(ii)* boiler blowdown suspended solids. 1+1=2

(n) State the procedure power to declare the area as air polluted area. 3

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